User's Guide for Offshore and Coastal Dispersion (OCD) Model, Version 5

Prepared for:

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

Contract No. 1435-03-96-PO-51307

Prepared by:

Joseph C. Chang
Kathy J. Hahn
Earth Tech, Inc.
196 Baker Avenue
Concord, MA 01742

Project No: 21129

November, 1997

User's Guide for Offshore and Coastal Dispersion (OCD) Model, Version 5
Table of Contents

1. Introduction

The Offshore and Coastal Dispersion (OCD) model (Hanna et al., 1985; DiCristofaro and Hanna, 1989) was first developed in the 1980s to simulate the effects of offshore emissions from point, area, or line sources on the air quality of coastal regions. The model includes special algorithms that account for overwater plume transport and dispersion, as well as changes that take place as the plume crosses the shoreline. The height of the thermal internal boundary layer (TIBL) is parameterized by the model. Plume fumigation (i.e., vertical plume dispersion after the plume passes through the TIBL) is explicitly accounted for. Parameterizations of the overwater surface boundary layer are provided. Furthermore, the OCD model also includes treatments of plume dispersion over complex terrain and platform downwash.

The original OCD model uses the traditional “input stream” approach for the specification of the input data in the user control file (see DiCristofaro and Hanna, 1989). This approach is not user-friendly because of the rigid structure for the input file. The original OCD model is also sensitive to user errors, due to the lack of adequate error-checking performed by the model on the input data. Furthermore, after being applied by many modelers in the past few years, it has become apparent that some additional technical features, such as the automatic creation of a Cartesian receptor network and the support of more meteorological data formats, should be added to the model. As a result, the Minerals Management Service (MMS) is funding a project with the objectives that a graphical user interface (GUI) program for the OCD model would be developed, that a more flexible user control file would be used, and that the FORTRAN code for the OCD model would be further enhanced. The current phase of the project does not include revisions to the basic dispersion algorithms used in the OCD model.

The GUI program makes the OCD model more user-friendly, and reduces potential user difficulties in applying the model. With the GUI, the user can prepare, execute, and analyze an OCD application in a graphical or menu-driven environment. Extensive error-checking on the input data is performed by the GUI program. On-line help system is also provided through the GUI, so that the user rarely would have to consult the user’s guide for further instructions. However, it is noted that the user is not required to use the GUI program in order to run the OCD model, which is sometimes desirable if, for example, many production runs are to be made.

A flexible format similar to that for the CALPUFF model (Scire et al., 1995) is used in the new OCD user control file. The exact placement for the input data is no longer required, and the user can include an unlimited amount of comments in the file. In addition to the automatic creation of a Cartesian receptor network and the support of more meteorological data formats, other enhancements made to the OCD code include the removal of hardwired array limits and legacy FORTRAN statements, better error-checking, and the correction of some minor programming errors.

Furthermore, existing processor programs for OCD are improved, and new processor programs for OCD are developed. These processors streamline the data preparation and analysis procedures. Currently, a total of five processors are available, including:

OCD4TO5	A conversion utility that converts the original OCD control files to the new format
OCDPRO	A processor that fills in missing overwater meteorological data, if any
MAKEGEO	A processor that automates the preparation of shoreline data
MAKEUTM	A processor that converts source and receptor locations in latitudes and longitudes to user coordinates
ANALYSIS	A postprocessor that tabulates the results predicted by OCD, and creates various data files that can be subsequently plotted

OCDPRO and ANALYSIS are existing programs. OCD4TO5 and MAKEUTM are newly developed programs. MAKEGEO is largely adapted from the TOPO-MAP utility program that was previously developed by the MMS. Figure 1-1 shows the order of application for the processor programs and the OCD model. All programs can be executed on the command line manually, or through the GUI program in a menu-driven environment. Note that the applications of the OCDPRO, OCD4TO5, MAKEGEO, and MAKEUTM programs are not required if the user already has a set of adequate input files for the OCD model; and the application of the ANALYSIS postprocessor is not required if the user is satisfied with the results summarized by the OCD model, or wants to use his own program to further analyze the results.

In the following, the terms "OCD/4" and "the original version of OCD" are used to refer to the OCD model (Version 4) described in DiCristofaro and Hanna (1989), and the terms "OCD/5" and "the new version of OCD" are used to refer to the OCD model (Version 5) described in this report.

Section 2 describes the system requirements and installation for the OCD model, the GUI program, and the processor programs. User's instructions for the OCD model and the processors are given in Section 3. User's instructions for the GUI program are given in Section 4. The enhancements for the OCD model and the processors are described in Section 5. The programmer's notes, including instructions on how to recompile the codes, are provided in Section 6. A summary is given in Section 7. Finally, Section 8 contains the references.

As described above, since the basic dispersion algorithms in OCD were not altered, the user should still refer to DiCristofaro and Hanna (1989) for the technical descriptions of the model. The current report is mainly served as a User's Guide.

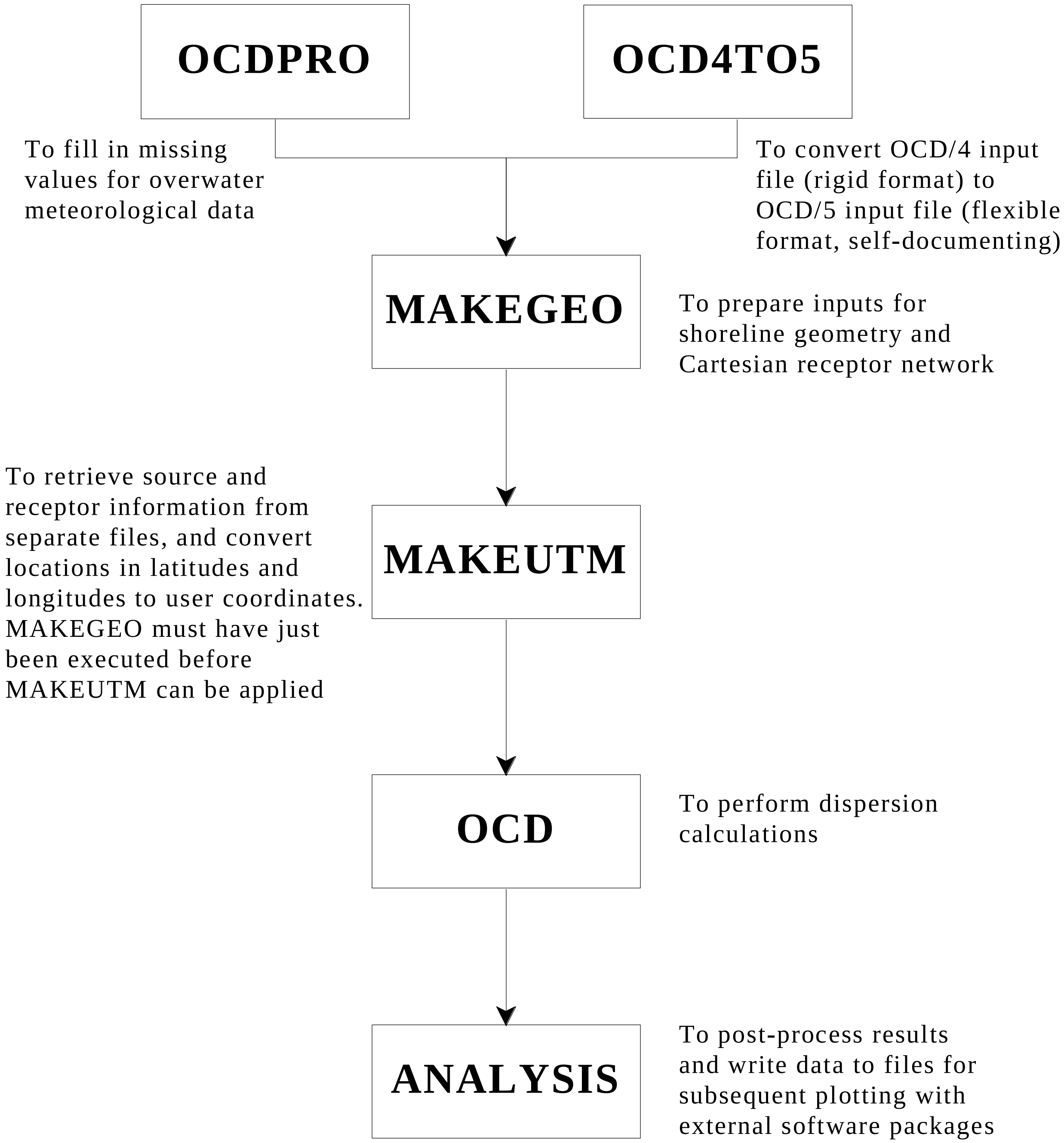


Figure 1-1. Flow diagram showing the order of application for the OCD model and the processor programs. The applications of the OCDPRO, OCD4TO5, MAKEGEO, and MAKEUTM programs are not required if the user already has a set of adequate input files for the OCD model.

2. System Requirements and Installation

The OCD model, the supporting processors, and the graphical user interface (GUI) program were designed to run on a personal computer (PC). The minimum hardware requirement is a 486DX PC with 8 MB of memory and 20 MB of free disk space. It is certainly more desirable to have a faster PC (e.g., a Pentium or Pentium Pro) with more memory and disk space, especially when making large-scale production runs with many sources and receptors is required.

The GUI program, developed using Microsoft Visual Basic (version 4), runs only under the Windows 3.1, Windows 95, and Windows NT (versions 3.51 and 4.0) environments. The OCD model and the processors are FORTRAN programs that would run in the DOS and Windows environments. They can also run on other computer platforms, such as UNIX, as long as the FORTRAN codes are recompiled.

Note that in order to be compatible with all computer display modes, the GUI screens are designed to be full screen in 640 x 480 VGA mode and will be smaller, but centered on the screen, in higher resolution modes.

Take the following steps to install the OCD software package, including (1) the executable codes for the OCD model, the processor programs, and the GUI program, (2) the library routines, and (3) a set of test case files:

1. Insert the setup disk in floppy drive a: or b:.

2. Use the appropriate command in your operating environment to run the setup program from the floppy disk. For example, assume a: is the floppy drive, then under the Windows 95 environment, click on Start/Run..., type a:\setup.exe, and hit <ENTER>; under the Windows 3.1 environment, click on Program Manager/File/Run..., type a:\setup.exe, and hit <ENTER>.

3. Follow the instructions provided in the setup program.

4. The setup program will inform the user when the model is installed correctly. If any errors occur, repeat the installation procedure. It is possible that sometimes the library routines (i.e., the DLL files) that the setup program is trying to install already exist on the machine. If the existing files are older, the setup program will simply overwrite those files. If the existing files are newer, then the setup program will ask the user whether to overwrite the files. In this case, the newer existing files should be kept. When installing the package to a machine running Windows 95, the setup program will sometimes warn the user that the *ddeml.dll* file is currently in use. In this case, the user can simply ignore the warning message and instruct the setup program to continue.

5. When setup is complete, click on the OCD icon to start the graphical user interface (GUI) program for OCD.

The above software package does not include the FORTRAN source codes for various programs. To install source codes, create a directory, e.g., *\ocdfor,* on the machine, copy the file *ocdfor.exe* from the diskette labeled “OCDFOR” to the directory, at the directory type “ocdfor”, then list the file *readme.lst* for more details.

3. User's Instructions for OCD and Supporting Processors, without GUI

User's instructions for the OCD model and the supporting processor programs, without the GUI program, are given in this section. There is a total of five processors: OCD4TO5, OCDPRO, MAKEGEO, and MAKEUTM are preprocessors, and ANALYSIS is postprocessor (see Figure 1-1). OCD4TO5, OCDPRO, MAKEGEO, and ANALYSIS can be independently applied. However, MAKEUTM can only be run after MAKEGEO has just been run. The use of the GUI is not required in order to apply the OCD model and the processors.

Instructions for the preprocessor programs, the OCD model, and the postprocessor are given in Sections 3.1, 3.2, and 3.3, respectively. A brief summary is given in Section 3.4.

3.1 Preprocessor Programs

The OCD4TO5, OCDPRO, MAKEGEO, and MAKEUTM preprocessor programs are described below in detail. Each processor program requires a set of input and output files. <u>In order to simplify the interaction between the GUI program and the processor programs, the names for all input and output files are hardwired in the code. Therefore, it is strongly recommended that the user prepare the data files using different names, and then let the file management feature of the GUI copy the files, or manually copy the files, before running the preprocessors.</u>

3.1.1 OCD4TO5 Conversion Utility

As described in Section 3.2.1, the control file for the new OCD model has been completely changed. The traditional "input-stream" approach (see DiCristofaro and Hanna, 1989) is replaced with the state-of-the-art "self-documenting" approach, where the specifications of model inputs are embedded in a file that looks like an abbreviated version of the user's guide. There are no rigid limits on the exact locations of the input data in the control file, and an unlimited amount of comments can be included.

In order to facilitate the transition from the old OCD control file to the new format, a conversion utility called OCD4TO5 was developed, by which a control file for the old OCD model (OCD/4) can be converted to a control file acceptable to the new OCD model (OCD/5). Since only limited error-checking is implemented in OCD4TO5, it is important that the user starts with a *valid* control file for OCD/4 before running OCD4TO5.

In OCD/4, due to a rigid file structure, the user can include in the control file only the input data that are relevant to the current run. For example, if polar receptors are not required in the current run, then the data for polar receptors are not allowed in the OCD/4 control file. OCD/5, on the other hand, allows for an unlimited amount of comments in the control file. Therefore, when creating a new control file for OCD/5 from an existing control file for OCD/4, the OCD4TO5 utility also includes those data that are not relevant to the current run. These irrelevant data are clearly marked (see Section 3.2.1 for more detail), and are simply treated as comments by OCD/5. The purpose for including these data is such that OCD4TO5 always generates a "complete" control file for OCD/5. As a consequence, any control file created by OCD4TO5 can be treated as a standard template control file. The user does not have to consult the user's guide in order to find out what additional data are required in case different modeling options are selected.

The OCD4TO5 processor requires one input file, *ocd4inpt.dat*, and generates one output file, *ocd5inpt.dat*. The o*cd4inpt.dat* file is a valid OCD/4 control file (see DiCristofaro and Hanna, 1989 for a description of the file format), and the *ocd5inpt.dat* is a control file acceptable to OCD/5 (see Section 3.2.1).

3.1.2 OCDPRO Overwater Meteorological Data Processor

The OCD model requires the user to provide overwater meteorological data (see Section 3.2.3), where the overwater mixing height, the overwater humidity (relative humidity, web bulb temperature, or dew point temperature), the overwater air temperature, and the water surface temperature (or air minus water temperature) must be available. No defaults are assumed for these four variables in the OCD model.

The OCDPRO processor is designed to assist the user in creating the overwater meteorological input file to the OCD model without missing data for the above four parameters by the following procedures:

- Persist for short time periods (less than six hours)
- Prepare a report notifying the user to manually edit the data for time periods greater than five hours but less than two days. It is the responsibility of the user to replace the missing data from previous days that are representative.
- For longer time periods (greater than two days), the missing overwater values of relative humidity, air temperature, air minus water temperature, and mixing height are replaced with the following default values:

Parameter	Default
relative humidity	80 %
air temperature	overland air temperature
air minus water temperature	0 C
mixing height	500 m

Note that the OCDPRO processor should only be used if all sources of overwater and representative overland data have been exhausted, mainly because of the potential use of the above arbitrary default values.

OCDPRO requires the following three input files:

ocdpro.dat User control file

wmetin.dat Overwater meteorological data file, possibly with missing data, in the same format as the *wmet.dat* file described in Section 3.2.3

lmetpro.dat Overland meteorological data file, in same format as the *lmet.dat* file described in Section 3.2.2, or the data included as Input Group 17 in the OCD control file described in Section 3.2.1. The only variable in *lmetpro.dat* that will be used by OCDPRO is the overland air temperature.

OCDPRO generates the following two output files:

ocdpro.out Output listing file

wmetout.dat Overwater meteorological data file, with no missing data, in the same format as the wmet.dat file described in Section 3.2.3

The *ocdpro.dat* file (free-format, ASCII) contains only one parameter, IOPT5, which has the same meaning as IOPT(5), one of the main program options for the OCD model described in Section 3.2.1.

IOPT5 = 0 The overland meteorological data file, *lmetpro.dat*, is a binary (unformatted) PCRAMMET data file (see Table 3-12)

IOPT5 = 1 The overland meteorological data file, *lmetpro.dat*, is in the OCD format (see Table 3-11, Input Group 17)

IOPT5 = 2 The overland meteorological data file, *lmetpro.dat*, is an ASCII (formatted) PCRAMMET data file (see Table 3-13)

3.1.3 MAKEGEO Shoreline Data Processor

The OCD model requires the specification of the shoreline geometry, or the land-sea interface. The information is used to determine the change in plume dispersion as the plume crosses the internal boundary layer generated at the shoreline. The traditional approach to preparing the shoreline data required the user to overlay a grid on the area of interest, and then provide digitized information on the distribution of land versus water. Figure 3-1 shows a sample digitized shoreline map required by the OCD model. Manual preparation of such information is obviously a laborious task, and prone to user errors. Furthermore, the results are not easily reproducible.

In order to address the above difficulties, the Minerals Management Service developed a utility program called TOPO-MAP that automates the generation of the shoreline data required by the OCD model, based on the data obtained from the U.S. Geological Survey (USGS). The MAKEGEO shoreline data processor is largely adapted from TOPO-MAP, but with minor modifications so that the program interface is consistent with the OCD model. The MAKEGEO processor can be applied only if the model domain is in the continental U.S., and cannot be applied to other regions of the world (e.g., the South China Sea), since the corresponding binary databases (see below) have not been prepared.

MAKEGEO requires the following five input files:

makegeo.dat	User control file
west.bin	Binary shoreline database for the Pacific Coast
gom.bin	Binary shoreline database for the Gulf of Mexico
east.bin	Binary shoreline database for the Atlantic Coast
alaska.bin	Binary shoreline database for the Alaska Coast

MAKEGEO generates the following three output files:

makegeo.shr	Shoreline data file for the model domain, to be directly included as Input Group 16 in the OCD/5 control file (see Section 3.2.1)
makegeo.ref	UTM coordinates and zone for the origin of the model domain (to be used by the MAKEUTM processor, described later, to convert receptor and source locations in latitudes and longitudes to user coordinates)
makegeo.car	Cartesian receptor network information for the model domain (a 20×20 Cartesian receptor network will be set up to cover the entire model domain), to be directly included as Input Group 11 in the OCD/5 control file (see Section 3.2.1)

The format of the *makegeo.dat* file is described in Table 3-1. A sample *makegeo.dat* file is shown in Table 3-2. The user is required to enter the two latitudes and the two longitudes that define the model domain, and the resolution for the digitized shoreline data. The four binary shoreline databases, *west.bin, gom.bin, east.bin,* and *alaska.bin* are derived from the USGS data, and are not to be modified by the user. Note that the following limits on latitudes and longitudes apply:

```
! LWFLAG =
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLWWLLLLLLLLLLLLLLLLLLWLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLWWWLLLLLLLLLLLLLLLWWWWLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLWWWLLLLLLLLLLLLLWWWWWWWWLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLWWLLLLLLLLLLLWWWWWWWWWLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLWWLLLLLLLLLLWWWWWWWWWWLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWLLLLLLWWWWWWWWWWWLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWLLLLWWWWWWWWWWLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWLLLLWWWWWWWWWWLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWLWWWWWWWWWWWWWWWLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWLLLLLLLLLLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWLLLLLLLLLWLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWLLLLLLLLWWWWWLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWLLLLWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWWWWWWWWWLWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWWWWWLLLLL,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWWLLLLWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWLLLLLWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWLLLLWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWLLLWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWLWWWWWWWWWWLLLWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWLLLWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWLLLWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWLLWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWLWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWLWLLWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWLLWWWWWLLLWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWLWWWLLLLLWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWWWWWLLWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWLLLLWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWLLLLWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLLLLLLLLWWWWWWLLWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLWWLLLLLLLLWWWWLLWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLWWWLLLLWWWWLLLWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLWWWWWWWWLLWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLWWWWWWWLLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLLWWWWWWWLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLLWWWWWLLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLLWLWWWLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLWLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLWWWWLLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLWWLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLWWLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW,
LLLLLLLLLLLLLLLLLLWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW!
```

Figure 3-1. Sample digitized shoreline data required by the OCD model. The mapped area is bound by 29°N and 30°N latitudes, and 94.5°W and 95.5°W longitudes, including the Houston and Galveston Bay areas. The letters “W” and “L” are used to indicate water and land. Refer to Section 3.2.1 for a description of the file format.

Table 3-1.
Control file for MAKEGEO Shoreline Data Processor (*makegeo.dat*) [1]

Record no.	Variable no.	Variable	Type	Description
1	1	SLAT1	real	The first latitude limit that defines the model domain (> 0 for the northern hemisphere), decimal notation (e.g., 35.2583 = 35°15'30"), see below for the allowed ranges for SLAT1. SLAT1 ≠ SLAT2
2	1	SLAT2	real	The second latitude limit that defines the model domain (> 0 for the northern hemisphere), decimal notation, see below for the allowed ranges for SLAT2. SLAT1 ≠ SLAT2
3	1	SLON1	real	The first longitude that defines the model domain (> 0 for the western hemisphere), decimal notation, see below for the allowed ranges for SLON1. SLON1 ≠ SLON2
4	1	SLON2	real	The first longitude that defines the model domain (> 0 for the western hemisphere), decimal notation, see below for the allowed ranges for SLON2. SLON1 ≠ SLON2
5	1	IXG	integer	Number of grid rectangles desired along the x-axis for the shoreline data (60 to 120, in increments of 10)
6	1	IYG	integer	Number of grid rectangles desired along the y-axis for the shoreline data (60 to 120, in increments of 10)

[1] The File is ASCII and is read with free-format.

For the Pacific coast: 31 ≤ latitude ≤ 49, and 116 ≤ longitude ≤ 128

For the Gulf of Mexico coast: 23 ≤ latitude ≤ 32, and 80 ≤ longitude ≤ 98

For the Atlantic coast: 23 ≤ latitude ≤ 47, and 65 ≤ longitude ≤ 83

For the Alaska coast: 50 ≤ latitude ≤ 72, and 128 ≤ longitude ≤ 188

Table 3-2.
Sample *makegeo.dat* file

```
29.
30.
94.5
95.5
 60
 60
```

Region	Allowed range for latitudes	Allowed range for longitudes
Pacific Coast	31°N - 49°N	116°W - 128°W
Gulf of Mexico Coast	23°N - 32°N	80°W - 98°W
Atlantic Coast	23°N - 47°N	65°W - 83°W
Alaska Coast	50°N - 72°N	128°W - 188°W

A sample *makegeo.shr* file (partial listing) created by the MAKEGEO processor is shown in Figure 3-1. In addition to the creation of the shoreline data required by the OCD model, MAKEGEO also (1) sets the origin, i.e., (0., 0.), of the user coordinate system at the southwest corner of the model domain, to which the source and receptor locations will be referenced, and (2) prepares the necessary information to define a 20×20 Cartesian receptor network that covers the entire model domain

Table 3-3 shows the format of the *makegeo.ref* file created by the MAKEGEO processor. The file contains the information on the origin for the current model domain, and is to be used by the MAKEUTM processor (see Section 3.1.4) to convert source or receptor locations that are in latitudes and longitudes to user coordinates.

Table 3-4 shows a sample *makegeo.car* file generated by MAKEGEO, where a 20×20 Cartesian receptor network covering the entire model domain is defined. The *makegeo.car* file can be directly included in the OCD control file, *input.dat*, as Input Group 11 (see Section 3.2.1).

3.1.4 MAKEUTM Source/Receptor Data Processor

A rectilinear coordinate system referenced to an arbitrary origin is used by the OCD model. As a result, the source and receptor coordinates defined in an OCD input file are only locally valid. For example, the same coordinates (0.30, 0.45 km) that appear in two separate OCD input files do not necessarily refer to the same point. If the user wants to use the same set of sources or receptors that are fixed in space in different OCD runs with different reference points, then the source or receptor coordinates will also be different. In order to allow the user to easily use the same set of sources or receptors for different model domains, the MAKEUTM processor program was developed. It is assumed that a source or receptor data file called *makeutm.inp* (described in detail below) has already been independently prepared, where the source or receptor coordinates are in latitudes and longitudes. Furthermore, it is assumed that the MAKEGEO processor (see Section 3.1.3) has just been applied, since MAKEUTM uses the information contained in the *makegeo.ref* file created by MAKEGEO to define the reference point of the user coordinate system.

Table 3-3.
Model Domain Reference File Generated by MAKEGEO Shoreline Data Processor (*makegeo.ref*) [1]

Record no.	Variable no.	Variable	Type	Description
1	1	UTME	real	UTM easting for the *southwest* corner of the modeling domain, km
	2	UTMN	real	UTM northing for the *southwest* corner of the modeling domain, km
	3	IZONE	integer	UTM zone for the *southwest* corner of the modeling domain
2	1	SLAT	real	The latitude for the *southwest* corner of the modeling domain, decimal notation (> 0 for northern hemisphere)
	2	SLON	real	The longitude for the *southwest* corner of the modeling domain, decimal notation (> 0 for western hemisphere)

[1] The file is ASCII and is read with free-format. The file is used as input to the MAKEUTM source and receptor data processor, and is normally not to be edited by the user.

Table 3-4.

Sample *makegeo.car* file generated by the MAKEGEO processor. The file defines a 20×20 Cartesian receptor network covering the entire model domain, and can be directly included in the OCD control file, *input.dat*, as Input Group 11 (see Section 3.2.1).

```
INPUT GROUP 11 -- Cartesian coordinate receptors (conditional)
(Only necessary if IOPT(8)=2, 3, 5, or 6)
Any combination of receptors located at sea or on land is allowed.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! X0_C     =    0.000000     !
          X0_C     -- X-coord of the NORTHWEST corner of the Cartesian
                      receptor network, user units
                      The NORTHWEST corner of the domain corresponds to:
                      N. latitude =     30.0000
                      W. latitude =     95.5000
                      or,
                      UTM-E (km)  =     256.454
                      UTM-N (km)  =     3319.55
                      UTM zone    =           15
          No default
! Y0_C      =     109.166     !
          Y0_C     -- Y-coord of the NORTHWEST corner of the Cartesian
                      receptor network, user units
          No default
! NX_C     =           20 !
          NX_C     -- Number of receptors along the x-axis
                      (1 to MAXCAR specified in PARAMS.CMN)
          Default = 20
! NY_C      =          20 !
          NY_C     -- Number of receptors along the y-axis
                      (1 to MAXCAR specified in PARAMS.CMN)
                      The total number of Cartesian receptors is NX_C*NY_C.
                      The sum of polar, Cartesian, and discrete receptors
                      cannot > MAXREC specified in PARAMS.CMN.
          Default = 20
! DELX_C   =     5.20332     !
          DELX_C   -- The distance between successive Cartesian receptors
                      along the x-axis, user units (>0)
          No default
! DELY_C   =     5.74557     !
          DELY_C   -- The distance between successive Cartesian receptors
                      along the y-axis, user units (>0)
          No default
! END !
```

The *makeutm.inp* file contains either source or receptor information, but not the combination of both. The file is ASCII and is read with free-format. One line is used to define each source or receptor. For source information, there should be 12 data items per line for point and area sources, and 14 data items per line for line sources. For receptor information, there should be six data items per line. The format for the *makeutm.inp* file is described in Table 3-5 for source information, and in Table 3-6 for receptor information. A sample *makeutm.inp* file is shown in Table 3-7, where the information for two point sources is defined.

The MAKEUTM processor generates one output file, *makeutm.out*. A sample *makeutm.out* file is shown in Table 3-8. The *makeutm.out* file is intended to be directly included in the OCD control file, *input.dat*, as Input Group 6 for source information, or Input Group 13 for discrete receptor information (see Section 3.2.1).

Table 3-5.
Input File, *makeutm.inp*, for the MAKEUTM Processor - Source Information Version [1]

Variable no.	Type	Description
1	character	Source name (at most 12 characters, no space)
2	real	Latitude of point source; latitude of the circle center for area source; or latitude of the starting point for line source; positive for the northern hemisphere
3	real	Longitude of point source; longitude of the circle center for area source; or longitude of the starting point for line source; positive for the western hemisphere
4	real	Pollutant emission rate (g/s, ≥0)
5	real	Height of the building or obstacle at or near the stack location (m, ≥0) relative to platform or ground level, depending upon base elevation specified below
6	real	Height of stack-top (m, >0.1) above ground (if on land), or above platform level (if at sea on "stilts"), or above sea level (if floating on water)
7	real	Stack gas temperature (K) (must be at least as high as the ambient temperature)
8	real	Stack-top inside diameter (m, >0) for point or line sources, circle diameter (m, >0) for area sources
9	real	Stack gas exit velocity (m/s, >0)
10	real	Deviation of stack angle from the vertical (deg, 0 to 180); 0 means the stack is vertical, <90 means the stack has an upward pointing component, >90 means the stack has a downward pointing component
11	real	Elevation of ground or platform base at stack location relative to the water surface, user units
12	real	Building width used to computer platform downwash (m, ≥0); =0 means no downwash
The following two variables are required only for line source		
13	real	Latitude of ending point for line source, positive for northern hemisphere
14	real	Longitude of ending point for line source, positive for western hemisphere

[1] The file is ASCII and is read with free-format. The file includes either source or receptor information, but not the combination of both. One line of data should be used to define each source or receptor. For source information, there should be 12 data items per line for point and area sources, or 14 data items per line for line source. For receptor information, there should be six data items per line. Blank lines are not allowed in the file.

Table 3-6.
Input File, *makeutm.inp*, for the MAKEUTM Processor - Receptor Information Version [1]

Variable no.	Type	Description
1	character	Receptor name (at most 8 characters, no space)
2	real	Latitude of receptor; postiive for northern hemisphere
3	real	Longitude of receptor; positive for western hemisphere
4	real	Receptor height above local ground level (m) ($\geq$0)
5	real	Ground elevation relative to the water surface at the receptor location, user units
6	real	Terrain elevation toward which source to receptor is aligned (used for Hc calculation) (m)

[1] The file is ASCII and is read with free-format. The file includes either source or receptor information, but not the combination of both. One line of data should be used to define each source or receptor. For source information, there should be 12 data items per line for point and area sources, or 14 data items per line for line source. For receptor information, there should be six data items per line. Blank lines are not allowed in the file.

Table 3-7.
Sample *makeutm.inp* File, Where the Information for Two Point Sources is Defined.

```
STACK_1 29.50 90.50  1.0    0.   36.580  290.   0.01    1.0    0.    0.    0.
STACK_2 29.52 90.54  1.0    0.   24.380  292.   0.01    1.0    0.    0.    0.
```

Table 3-8.

Sample *makeutm.out* File Created by the MAKEUTM Processor Program Based on the *makegeo.ref* File Listed in Table 3-3, and the *makeutm.inp* File Listed in Table 3-7.

```
INPUT GROUP 6a -- Source description, no. of sources (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! NPT       =            2 !
          NPT      -- No. of sources (>0)
                      For point sources, NPT cannot > MAXP specified
                      in PARAMS.CMN
                      For area  sources, NPT cannot > 5
                      For line  sources, NPT must = 1
          No default
! END !
INPUT GROUP 6b -- Source description, source parameters (mandatory)
Any combination of stationary sources located offshore or on land near the
coast (with coastline resolution limitations taken into account) is allowed.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
          In the following, sets of source description records
          are repeated NPT times, one set for each source.
          Each set of source description records contains at least
          two records, SRCNAM and SRCPAR.  A third record, containing
          variables XSTOP and YSTOP, is required for line source.
          SRCNAM   -- Source name (at most 12 characters, no space)
          SRCPAR   -- Contains the following 11 parameters:
                 (1 ) X-coord of point source, user units,
                      X-coord of circle center for area source, user units,
                      X-coord of starting point for line source,  user units,
                 (2 ) Y-coord of point source, user units,
                      Y-coord of circle center for area source, user units,
                      Y-coord of starting point for line source,  user units,
                 (3 ) Pollutant emission rate (g/s) (>=0),
                      will not be used if IOPT(6)=1
                 (4 ) Height of building or obstacle at or near stack
                      location (m, >=0) relative to platform or water
                      level, depending upon base elevation specified below
                 (5 ) Height of stack-top (m, >0.1) above ground (if on land),
                      or above platform level (if at sea on "stilts"),
                      or above sea level (if floating on water)
                 (6 ) Stack gas temperature (K) (must be at least as high as
                      the ambient temperature)
                 (7 ) Stack-top inside diameter (m, >0) for point or line
                      sources, circle diameter (m, >0) for area sources
                 (8 ) Stack gas exit velocity (m/s) (>0)
                 (9 ) Deviation of stack angle from the vertical (deg)
                      (0 to 180)
                      0 means the stack is vertical, <90 means the stack
                      has an upward pointing component, >90 means the stack
                      has a downward pointing component.
                 (10) Elevation of ground, water, or platform base at stack
                      location relative to the water surface, user units
                 (11) Building width used to computer platform downwash
                      (m) (>=0)
                      (=0 means no downwash)
          No default
! SRCNAM   = STACK_1      !
! SRCPAR   =     485.909,      55.420,       1.000,   0.000,  36.580,  290.000,    0.010,    1.000,    0.000,    0.000,    0.000 !
! END !
! SRCNAM   = STACK_2      !
! SRCPAR   =     481.983,      57.554,       1.000,   0.000,  24.380,  292.000,    0.010,    1.000,    0.000,    0.000,    0.000 !
! END !
```

3.2 OCD Model Files

Several input and output files may be associated with a run of the OCD model, including:

input.dat	User control file
lmet.dat	Overland meteorological data file
wmet.dat	Overwater meteorological data file
emis.dat	Hourly emission data file
ocd.out	Output listing file
error.out	Error message file
extra.out	Ancillary output listing file
conc.bin	Binary concentration file

The *input.dat, wmet.dat, ocd.out,* and *error.out* files are mandatory. The overland meteorological data are mandatory; however, the data can be included in the *input.dat* user control file, or in the separate *lmet.dat* file. The *emis.dat, extra.out,* and *conc.bin* files are optional, depending on user options.

<u>Note that as for the processor programs described in Section 3.1, in order to simplify the interaction between the GUI program and the OCD model, the names of the above eight files are all hardwired in the code. Therefore, it is strongly recommended that the user prepare the data files using different names, and then let the file management feature of the GUI copy the files, or manually copy the files, before running the OCD model.</u>

Each of the eight OCD data files is described below. When appropriate, other related topics to the data files are also discussed.

3.2.1 User Control File (*input.dat*)

The selection and control of the OCD model options are determined by user-specified inputs contained in a control file. This file, *input.dat*, contains all the information, such as starting date, run length, shoreline specifications, source data, receptor data, technical options, and output options, necessary to define a model run. As mentioned above, the rigid structure associated with the control file for the previous version of the OCD model (OCD/4) is now replaced by a flexible format, similar to that for the CALPUFF model (Scire et al., 1995), in the new model (OCD/5). The flexibility for the new control file is demonstrated later.

The OCD control file is organized into 17 Input Groups (see Table 3-9). Note that the grouping of data is slightly different between OCD/4 and OCD/5. For example, the total numbers of Input Groups are 16 and 17 in OCD/4 and OCD/5, respectively. In OCD/4, the three lines of run title occupy three Input Groups, whereas in OCD/5, the three lines of run title occupy just one Input Group. Input Groups 11 and 12 for the Cartesian receptor network are available only to OCD/5.

The Input Groups for the control file must appear in order, i.e., Input Group 1 followed by Input Group 2, etc. However, the variables within an Input Group may appear in any order. Each Input Group must end with an Input Group terminator consisting of the word END between two delimiters (i.e., !END!).

A sample control file is shown in Table 3-10. It is designed to be flexible, easy-to-use, and self-documenting. The control file is read by a set of FORTRAN text processing routines contained within the OCD code. These routines allow the user considerable flexibility in designing and customizing the input file. An unlimited amount of optional descriptive text can be inserted within the control file to make it self-documenting. For example, the definition, allowed values, units, and default value for each input variable can be included within the control file. Currently, each line in the control file should have less than 132 characters.

The control file processor searches for pairs of special delimiter characters (!). All text outside the delimiters is assumed to be user comment information, and is ignored by the input module. Only data within the delimiter characters are processed. The input data consist of a leading delimiter followed by the variable name, equals sign, input value or values, and a terminating delimiter (e.g., ! XX = 12.5 !). The variable name is not case-sensitive (i.e., XX, xx, Xx are all equivalent). The variable can be a real, integer, character, or logical array or scalar. The use of repetition factors for arrays is allowed (e.g., ! XARRAY = 3 * 1.5 ! instead of ! XARRAY = 1.5, 1.5, 1.5 !). Different values must be separated by commas. Spaces within the delimiter pair are ignored. Exponential notation (E-format) for real numbers is allowed. The data may be extended over more than one line. The line being continued must end with a comma. Each leading delimiter must be paired with a terminating delimiter. All text between the delimiters is assumed to be data, so no user comment information is allowed to appear within the delimiters.

Each OCD control file input variable is described in detail in Table 3-11, where default or recommended values are given, if applicable. The control file processor has a list of the variable names and array dimensions for each Input Group. Checks are performed to ensure that the proper variable names are entered by the user, and that no array dimensions are exceeded. Error messages result if an unrecognized variable name is encountered or too many values are entered for a variable.

Table 3-9.
OCD Control File Input Groups [1]

Input Group	Description
1	Run title (mandatory)
2	Flag for normal run vs. test run (mandatory)
3	Control parameters and constants (mandatory)
4	Main model options (mandatory)
5	Overland wind and terrain (mandatory)
6	Sources descriptions (mandatory)
7	User-specified significant sources (conditional)
8	Overland meteorological data identifiers (conditional)
9	Polar receptor network (conditional)
10	Polar receptor network elevations (conditional)
11	Cartesian receptor network (conditional)
12	Cartesian receptor network elevations (conditional)
13	Discrete receptors descriptions (conditional)
14	Special options for additional meteorological data (mandatory)
15	Chemical transformation (conditional)
16	Shoreline geometry (mandatory)
17	Overland meteorological data (conditional)

[1] Note that the Input Groups are slightly different from those for the previous version of the OCD model (OCD/4).

Table 3-10.

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the “!” Delimiter. The Data that are Not Required are Enclosed by the “#” Delimiter.

```
OCD Sample Control File (line 1 of run title)
...                     (line 2 of run title)
...                     (line 3 of run title)
---------------- Run title (first 3 lines, INPUT GROUP 1) ---------------
          (OCD takes the first three line of this file as the run title)

                    OCD MODEL CONTROL FILE
                    ----------------------

------------------------------------------------------------------------------

          Only those data that are enclosed by proper delimiters, the
          exclamation marks, will be retrieved by OCD.  All other
          information is used for comments.  For the sake of completeness,
          other data that are not required by the current run will
          still be included in the control file; however, they are
          enclosed by different delimiters, the number signs.
          Therefore the user can simply "activate" those input
          fields accordingly when the model options are changed.

          The "default values" mentioned below will only be specified by the
          Graphical User Interface (GUI) program.  OCD still requires all
          necessary inputs be explicitly specified in the control file.
          If you run OCD without the GUI, then all input variables whose
          values are not assigned in the control file will be given a value
          of zero, which is not necessarily the default.

INPUT GROUP 2 -- Flag for normal run vs. test run (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! INORMAL  =            1 !
          INORMAL -- Flag for normal run vs. test run (0 or 1)
                     = 1, Normal Run
                     = 0, Test   Run
          Default = 1
! END !

INPUT GROUP 3 -- Control parameters and constants (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! IDATE(1) =           80 !
          IDATE(1) -- Starting year for this run (2 digits)
          No default
! IDATE(2) =          268 !
          IDATE(2) -- Starting Julian day for this run (1 to 366)
                      Only effective if PCRAMMET data file is used (IOPT(5)
                      =0 or 2); if IOPT(5)=1, i.e., overland meteorological
                      data are included in the control file, then the first
                      meteorological data record determines the starting date
                      and hour
          No default
! IHSTRT   =            1 !
          IHSTRT   -- Starting hour for this run (1 to 24)
                      Only effective if PCRAMMET data file is used (IOPT(5)
                      =0 or 2); if IOPT(5)=1, i.e., overland meteorological
                      data are included in the control file, then the first
                      meteorological data record determines the starting date
                      and hour
          No default
! NPER     =           17 !
          NPER     -- Length of run in no. of averaging periods (>0)
                      NPER*NAVG is the length of run in hours.
          No default
! NAVG     =            1 !
          NAVG     -- No. of hours in an averaging period (1 to 24)
                      NAVG is only used for output purposes.  (See IOPT(10),
                      IOPT(17), and IOPT(18) below.)  OCD still performs
                      hourly dispersion calculations.
                      Note that NAVG is not to be confused with the averaging
                      times (1, 3, 8, 24 hours, and NAV5 hours if necessary)
                      used in the summary high-give tables.  With the
                      appropriate output options selected, comprehensive
                      printout for each NAVG-hour period will be generated.
                      For example, for a one-year (8760 hours) simulation,
                      then NAVG = 3 would mean that 2920 (8760/3) tables will
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
                be generated.  On the other hand, for the averaging
                times considered in the summary high-five tables,
                the same amount of information is always generated
                regardless of the length of run.
         Default = 1
! IPOL     =          3 !
         IPOL     -- Pollutant indicator (3 to 7)
                = 3, SO2
                = 4, TSP
                = 5, NOX
                = 6, CO
                = 7, Others
         Default = 7
! NSIGP    =          0 !
         NSIGP    -- No. of significant point sources (0 to 25)
                NSIGP = 0 means that no significant sources will be
                considered.  When NSIGP >0, OCD will automatically
                determine the ordering of the NSIGP significant sources.
                If necessary, the user can override this selection and
                specify a new ordering of the NSIGP significant sources
                through IOPT(7) and Input Group 7 described below.
         Default = 0
! NAV5     =          0 !
         NAV5     -- An optional fifth averaging time, in hours, to be
                included in the high five table (0 to 24, but
                excluding 1, 3, 8, and 24 already considered by OCD)
                0 means a fifth averaging time will not be added.
                Note that this averaging time is not to be confused
                with NAVG (see notes above).
         Default = 0
! CONTWO   =    1.00000000000000      !
         CONTWO   -- Conversion factor that converts user horizontal length
                units (by multiplication) to kilometers (>0)
                For example, CONTWO=0.001 if meters are used as
                user horizontal length units; CONTWO=0.0003048
                if feet are used as user horizontal length units.
         No default
! CELM     =   0.304800000000000      !
         CONTWO   -- Conversion factor that converts user height
                units (by multiplication) to meters (>0)
                For example, CELM=0.3048 if feet are used as
                user height units.
         No default
! END !

INPUT GROUP 4 -- Main model options (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! IOPT(1)  =          1 !
         IOPT(1)  -- Switch for terrain adjustment (0 or 1)
                = 0, Do not use terrain adjustment
                = 1, Use terrain adjustment
         Default = 0
! IOPT(2)  =          1 !
         IOPT(2)  -- Switch for stack-tip downwash (0 or 1)
                = 0, Use stack-tip downwash
                = 1, Do not use stack-tip downwash
         Default = 1
! IOPT(3)  =          1 !
         IOPT(3)  -- Switch for gradual plume rise (0 or 1)
                = 0, Use gradual plume rise
                = 1, Do not use gradual plume rise
         Default = 1
! IOPT(4)  =          0 !
         IOPT(4)  -- Switch for buoyancy-induced dispersion (0 or 1)
                = 0, Do not use buoyancy-induced dispersion
                = 1, Use buoyancy-induced dispersion
         Default = 0
! IOPT(5)  =          1 !
         IOPT(5)  -- Switch for overland met data (0 to 2)
                = 0, From separate binary PCRAMMET file
                = 1, ASCII met data included in the control file
                = 2, From separate ASCII PCRAMMET file
                If binary file is to be used, make sure that
                the file is compatible with the Fortran compiler
                used to compile OCD.
         No default
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
! IOPT(6)  =          0 !
         IOPT(6)  -- Switch for emission rate (0 or 1)
                     = 0, Use constant emission rate specified in the control file
                     = 1, Use hourly emissions from a file called EMIS.DAT
         No default
! IOPT(7)  =          0 !
         IOPT(7)  -- Switch for user-specified significant sources (0 or 1)
                     = 0, No significant sources specified by the user, and
                     OCD will determine significant sources if necessary
                     = 1, Significant sources specified by the user in
                     Input Group 7
                     (IOPT(7) can = 1 only if NSIGP > 0)
         Default = 0
! IOPT(8)  =          0 !
         IOPT(8)  -- Switch for receptor type (0 to 6)
                     = 0, Discrete receptors only
                     = 1, Discrete and polar receptors
                     = 2, Discrete and Cartesian receptors
                     = 3, Discrete, polar, and Cartesian receptors
                     = 4, Polar receptors only
                     = 5, Cartesian receptors only
                     = 6, Polar and Cartesian receptors
         No default
! IOPT(9)  =          1 !
         IOPT(9)  -- Switch for printout of emissions with height table
                     (0 or 1)
                     = 0, Generate output
                     = 1, Do not generate output
         Default = 1
! IOPT(10) =          1 !
         IOPT(10) -- Switch for printout of resultant met data summary
                     for averaging period (0 or 1)
                     = 0, Generate output
                     = 1, Do not generate output
         Default = 1
! IOPT(11) =          1 !
         IOPT(11) -- Switch for printout of hourly contributions of
                     significant sources (0 or 1)
                     The printout lists the hourly contribution from EACH
                     significant source for each receptor.  It also lists
                     the hourly concentration at each receptor due to
                     (1) ALL significant sources, and (2) ALL sources.
                     = 0, Generate output
                     = 1, Do not generate output
                     (IOPT(11) can = 0 only if NSIGP > 0)
         Default = 1
! IOPT(12) =          1 !
         IOPT(12) -- Switch for printout of met data on hourly contributions
                     (0 or 1)
                     = 0, Generate output
                     = 1, Do not generate output
         Default = 1
! IOPT(13) =          1 !
         IOPT(13) -- Switch for case-study printout of plume transport and
                     dispersion on hourly contributions (0 or 1)
                     = 0, Generate output
                     = 1, Do not generate output
         Default = 1
! IOPT(14) =          1 !
         IOPT(14) -- Switch for printout of hourly summary of receptor
                     concentrations (0 or 1)
                     The printout lists the hourly concentration at each
                     receptor due to (1) ALL significant sources, and
                     (2) ALL sources.  Individual source contributions are
                     not listed.  The receptor location, height, and
                     elevation are also printed.
                     = 0, Generate output
                     = 1, Do not generate output
         Default = 1
! IOPT(15) =          1 !
         IOPT(15) -- Switch for printout of met data on hourly summary
                     (0 or 1)
                     = 0, Generate output
                     = 1, Do not generate output
                     (This option currently has the same effects as IOPT(12).
                     Thus, for consistence, IOPT(15) should equal IOPT(12).)
         Default = 1
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
! IOPT(16) =            1 !
          IOPT(16) -- Switch for case-study printout of plume transport and
                      dispersion on hourly summary (0 or 1)
                      = 0, Generate output
                      = 1, Do not generate output
                      (This option currently has the same effects as IOPT(13).
                      Thus, for consistence, IOPT(16) should equal IOPT(13).)
          Default = 1
! IOPT(17) =            1 !
          IOPT(17) -- Switch for printout of averaging period contributions
                      (0 or 1)
                      The printout is similar to the one generated by
                      IOPT(11), but is for each averaging period (NAVG hours).
                      = 0, Generate output
                      = 1, Do not generate output
                      (IOPT(11) and IOPT(17) both = 0 is meaningful only if
                      NAVG > 1.)
          Default = 1
! IOPT(18) =            1 !
          IOPT(18) -- Switch for printout of averaging period summary (0 or 1)
                      The printout is similar to the one generated by
                      IOPT(14), but is for each averaging period (NAVG hours).
                      = 0, Generate output
                      = 1, Do not generate output
                      (IOPT(14) and IOPT(18) both = 0 is meaningful only if
                      NAVG > 1.)
          Default = 1
! IOPT(19) =            1 !
          IOPT(19) -- Switch for printout of average concentrations and
                      high-five table for the entire run (0 or 1)
                      = 0, Generate output
                      = 1, Do not generate output
          Default = 0
! IOPT(20) =            0 !
          IOPT(20) -- Switch for source type (0 to 2)
                      = 0, Point source
                      = 1, Area  source
                      = 2, Line  source
          Default = 0
! IOPT(21) =            1 !
          IOPT(21) -- Switch for summary output file EXTRA.OUT (0 or 1)
                      There is one line of output in the extra.out file for
                      each receptor/source pair and each hour when nonzero
                      concentration was predicted
                      = 0, Do not create the file
                      = 1, Create the file
          Default = 0
! IOPT(22) =            1 !
          IOPT(22) -- Switch for hourly binary concentration file
                      CONC.BIN (0 or 1)
                      = 0, Do not create the file
                      = 1, Create the file
          Default = 1
! IOPT(23) =            1 !
          IOPT(23) -- Switch for printout of table of annual impact
                      assessment from non-permanent activities (0 or 1)
                      For example, assume a facility operates only 30 days
                      a year, and OCD is applied for that 30-day period.
                      Then the annual impact due to that facility will be
                      30/365 of the averaging concentration for the entire
                      run (run length = 30 days).
                      = 0, Do not generate output
                      = 1, Generate output
          Default = 0
! IOPT(24) =            0 !
          IOPT(24) -- Switch for land source (do not modify wind speed)
                      (0 or 1)
                      = 0, Modify wind speed
                      = 1, Do not modify wind speed
                      IOPT(24) should = 1 for land source.
          No default
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
! IOPT(25) =           0 !
          IOPT(25) -- Switch for pollutant decay rate via chemical
                      transformation (0 or 1)
                      = 0, Do not specify decay rate (i.e., no decay)
                      = 1, Specify decay rate
          Default = 0
! END !

INPUT GROUP 5 -- Overland wind and terrain (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! HANE     =    10.0000000000000      !
          HANE     -- Overland anemometer height (m) (>0)
          No default
! ZOL      =   0.100000000000000      !
          ZOL      -- Overland surface roughness length (m) (>0)
          No default
! ZMIN     =    10.0000000000000      !
          ZMIN     -- Minimum miss distance for a plume above the ground at the
                      receptor location (m) (>0)
                      Currently, EPA recommends setting ZMIN = 10 m.  However,
                      before running OCD in complex terrain, the local MMS
                      agency should be contacted for guidance in setting a
                      value for ZMIN.
          No default
! SLAT     =    34.3000000000000      !
          SLAT     -- Latitude of the source region (deg) (-90 to 90)
                      (decimal notation; e.g., 25.675 deg =
                      25 deg 40 min 30 sec)
                      (>0 for northern hemisphere)
          No default
! END !

INPUT GROUP 6a -- Source description, no. of sources (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! NPT      =           3 !
          NPT      -- No. of sources (>0)
                      For point sources, NPT cannot > MAXP specified
                      in PARAMS.CMN
                      For area  sources, NPT cannot > 5
                      For line  sources, NPT must = 1
          No default
! END !

INPUT GROUP 6b -- Source description, source parameters (mandatory)
Any combination of stationary sources located offshore or on land near the
coast (with coastline resolution limitations taken into account) is allowed.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
          In the following, sets of source description records
          are repeated NPT times, one set for each source.
          Each set of source description records contains at least
          two records, SRCNAM and SRCPAR.  A third record, containing
          variables XSTOP and YSTOP, is required for line source.
          SRCNAM   -- Source name (at most 12 characters, no space)
          SRCPAR   -- Contains the following 11 parameters:
                 (1 ) X-coord of point source, user units,
                      X-coord of circle center for area source, user units,
                      X-coord of starting point for line source,  user units,
                 (2 ) Y-coord of point source, user units,
                      Y-coord of circle center for area source, user units,
                      Y-coord of starting point for line source,  user units,
                 (3 ) Pollutant emission rate (g/s) (>=0),
                      will not be used if IOPT(6)=1
                 (4 ) Height of building or obstacle at or near stack
                      location (m, >=0) relative to platform or ground
                      level, depending upon base elevation specified below
                 (5 ) Height of stack-top (m, >0.1) above ground (if on land),
                      or above platform level (if at sea on "stilts"),
                      or above sea level (if floating on water)
                 (6 ) Stack gas temperature (K) (must be at least as high as
                      the ambient temperature)
                 (7 ) Stack-top inside diameter (m, >0) for point or line
                      sources, circle diameter (m, >0) for area sources
                 (8 ) Stack gas exit velocity (m/s) (>0)
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
               (9 ) Deviation of stack angle from the vertical (deg)
                    (0 to 180)
                    0 means the stack is vertical, <90 means the stack
                    has an upward pointing component, >90 means the stack
                    has a downward pointing component.
               (10) Elevation of ground or platform base at stack
                    location relative to the water surface, user units
               (11) Building width used to computer platform downwash
                    (m) (>=0)
                    (=0 means no downwash)
          No default

! SRCNAM   = Source_1 !
! SRCPAR   =      -0.303,       9.634,       1.000,   7.000,   8.100,  300.000,   0.200,   0.000,   0.000,   0.000,  20.000 !
! END !

! SRCNAM   = Source_2 !
! SRCPAR   =      -0.156,      10.746,       1.000,   7.000,   8.100,  300.000,   0.200,   0.000,   0.000,   0.000,  20.000 !
! END !

! SRCNAM   = Source_3 !
! SRCPAR   =      -0.156,       9.634,       1.000,   7.000,   8.100,  300.000,   0.200,   0.000,   0.000,   0.000,  20.000 !
! END !


INPUT GROUP 6c -- Source description, line source parameters (conditional)
(Only necessary if IOPT(20)=2)
Modeling of line sources is limited to screening type analyses of 24 hours
or less.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
# XSTOP    =    0.000000000000000      #
          XSTOP    -- X-coord of ending point for line source, user units
          No default
# YSTOP    =    0.000000000000000      #
          YSTOP    -- Y-coord of ending point for line source, user units
          No default
# END #

INPUT GROUP 7 -- User-specified significant sources (conditional)
(Only necessary if IOPT(7)=1 and NSIGP > 0)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
# SRCNUM   = 1  #
          SRCNUM   -- Source numbers for the NSIGP significant sources, where
                      NSIGP was previously specified in the control file.
                      For example, SRCNUM = 2, 1, 5 means that source
                      number 2 is the first significant source, source
                      number 1 is the second significant source, and
                      source number 5 is the third significant source.
# END #

INPUT GROUP 8 -- Overland meteorological data identifiers (conditional)
(Only necessary if IOPT(5)=0 or 2)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
# ISFCD    =        99999 #
          ISFCD    -- surface station identifier code (5 digit)
          No default
# ISFCYR   =           97 #
          ISFCYR   -- year of surface data (2 digit)
          No default
# IMXD     =        99999 #
          IMXD     -- upper air station identifier code (5 digit)
          No default
# IMXYR    =           97 #
          IMXYR    -- year of upper air data (2 digit)
          No default
# END #

INPUT GROUP 9 -- Polar coordinate receptors, no. of rings (conditional)
(Only necessary if IOPT(8)=1, 3, 4, or 6)
Any combination of receptors located at sea or on land is allowed.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
# NRING    =           5 #
         NRING    -- No. of rings for polar receptors
                     (1 to MAXRING specified in PARAMS.CMN)
                     The total number of polar receptors is NRING*36.
                     The sum of polar, Cartesian, and discrete receptors
                     cannot > MAXREC specified in PARAMS.CMN.
         Default = 5
# CENTX    =    0.000000000000000      #
         CENTX    -- X-coord of the center of rings, user units
         No default
# CENTY    =    0.000000000000000      #
         CENTY    -- Y-coord of the center of rings, user units
         No default
# RADII    =        1.000,        2.000,        3.000,        4.000,
      5.000 #
         RADII    -- Radial distances for the NRING rings, user units (>0)
         No default
# END #

INPUT GROUP 10 -- Polar coordinate receptor elevations (conditional)
(Only necessary if IOPT(8)=1, 3, 4, or 6; and IOPT(1)=1)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
         In the following, for each azimuth (sector), the ground elevations
         for the receptors along that azimuth are specified in user height
         units in the order that the ring distances are specified above.
         ISECTOR  -- Azimuth indicator (1 to 36)
                     1 = the 10-degree sector,
                     2 = the 20-degree sector,
                     3 = the 30-degree sector, etc.
                     Must be in the order of 1 to 36.
         ELEV     -- Ground elevations relative to the water surface for the
                     NRING receptors along the ISECTOR-th radial,
                     user height units
         No default

# ISECTOR  =           1 #
# ELEV     = 0.          , 0.          , 0.          , 0.          ,
0.          #
# END #

# ISECTOR  =           2 #
# ELEV     = 0.          , 0.          , 0.          , 0.          ,
0.          #
# END #


... (Sections for ISECTOR = 3 through 34 omitted here to save space)


# ISECTOR  =          35 #
# ELEV     = 0.          , 0.          , 0.          , 0.          ,
0.          #
# END #

# ISECTOR  =          36 #
# ELEV     = 0.          , 0.          , 0.          , 0.          ,
0.          #
# END #

INPUT GROUP 11 -- Cartesian coordinate receptors (conditional)
(Only necessary if IOPT(8)=2, 3, 5, or 6)
Any combination of receptors located at sea or on land is allowed.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
# X0_C     =    0.000000     #
         X0_C     -- X-coord of the NORTHWEST corner of the Cartesian
                     receptor network, user units
         No default
# Y0_C     =    0.000000     #
         Y0_C     -- Y-coord of the NORTHWEST corner of the Cartesian
                     receptor network, user units
         No default
# NX_C     =          20 #
         NX_C     -- Number of receptors along the x-axis
                     (1 to MAXCAR specified in PARAMS.CMN)
         Default = 20
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
# NY_C     =          5 #
         NY_C     -- Number of receptors along the y-axis
                     (1 to MAXCAR specified in PARAMS.CMN)
                     The total number of Cartesian receptors is NX_C*NY_C.
                     The sum of polar, Cartesian, and discrete receptors
                     cannot > MAXREC specified in PARAMS.CMN.
         Default = 20
# DELX_C   =    1.00000    #
         DELX_C   -- The distance between successive Cartesian receptors
                     along the x-axis, user units (>0)
         No default
# DELY_C   =    1.00000    #
         DELY_C   -- The distance between successive Cartesian receptors
                     along the y-axis, user units (>0)
         No default
# END #

INPUT GROUP 12 -- Cartesian coordinate receptors elevations (conditional)
(Only necessary if IOPT(8)=2, 3, 5, or 6; and IOPT(1)=1)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
         In the following, for each row (from north to south, NY_C rows
         in total) of receptors, a row indicator and NX_C values, representing
         elevations of the receptors along that row (from west to east),
         are specified.
         IROW     -- Row indicator (1 to NY_C, must be in that order)
         ELEV     -- Ground elevations relative to the water surface for the
                     NX_C receptors along the IROW-th row, user height units
         No default

# IROW     =          1 #
# ELEV     = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 #
# END #

# IROW     =          2 #
# ELEV     = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 #
# END #

# IROW     =          3 #
# ELEV     = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 #
# END #

# IROW     =          4 #
# ELEV     = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 #
# END #

# IROW     =          5 #
# ELEV     = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 #
# END #

INPUT GROUP 13a -- Discrete receptors (conditional)
(Only necessary if IOPT(8)=0, 1, 2, or 3)
Any combination of receptors located at sea or on land is allowed.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! NDISC    =          2 !
         NDISC    -- No. of discrete receptors (>0)
                     The sum of discrete, polar, and Cartesian receptors
                     cannot > MAXREC specified in PARAMS.CMN
         No default
! END !

INPUT GROUP 13b -- Discrete receptors (conditional)
(Only necessary if IOPT(8)=0, 1, 2, or 3)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
         In the following, sets of discrete receptor description records
         are repeated NDISC times, one set for each discrete receptor.
         Each set contains two records, RCPNAM and RCPPAR.
         RCPNAM   -- Receptor name (at most 8 characters, no space)
         RCPPAR   -- Contains the following 5 parameters:
                 (1) X-coord of receptor, user units
                 (2) Y-coord of receptor, user units
                 (3) Receptor height above local ground level (m) (>=0)
                 (4) Ground elevation relative to the water surface at
                     receptor location, user units
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
                (5) Terrain elevation toward which source to receptor
                    is aligned (used for Hc calculation) (m)
          No default

! RCPNAM   = Rec_1 !
! RCPPAR   =       7.198,      13.213,   0.000,  12.000,   0.000 !
! END !

! RCPNAM   = Rec_2 !
! RCPPAR   =       8.959,      10.368,   0.000,  15.000,   0.000 !
! END !


INPUT GROUP 14 -- Special options for additional met data (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! JOPT(1)  =            1 !
          JOPT(1)  -- Switch for overwater wind direction data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! JOPT(2)  =            1 !
          JOPT(2)  -- Switch for overwater wind speed data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! JOPT(3)  =            1 !
          JOPT(3)  -- Switch for overwater vertical potential temperature
                      gradient data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! JOPT(4)  =            1 !
          JOPT(4)  -- Switch for overwater humidity data (1 to 3)
                      = 1, Relative humidity (%) is provided
                      = 2, Web bulb temperature (K) is provided
                      = 3, Dew point temperature (K) is provided
          No default
! JOPT(5)  =            0 !
          JOPT(5)  -- Switch for overland horizontal and vertical turbulence
                      intensity data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! JOPT(6)  =            2 !
          JOPT(6)  -- Switch for water surface temperature data (1 or 2)
                      = 1, Water surface temperature (K) is provided
                      = 2, Air minus water surface temperature (K) is provided
          No default
! JOPT(7)  =            0 !
          JOPT(7)  -- Switch for overwater wind direction shear data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! JOPT(8)  =            0 !
          JOPT(8)  -- Switch for overwater horizontal turbulence intensity
                      data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! JOPT(9)  =            0 !
          JOPT(9)  -- Switch for overwater vertical turbulence intensity
                      data (0 or 1)
                      = 0, Not provided or do not use
                      = 1, Provided
          No default
! HWANE    =      20.5000000000000       !
          HWANE    -- Height above water level of overwater anemometer, m (>0)
          No default
! HWT      =      7.00000000000000       !
          HWT      -- Height above water level of overwater air
                      temperature sensor, m (>0)
          No default
! END !
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the “!” Delimiter. The Data that are Not Required are Enclosed by the “#” Delimiter.

```
 INPUT GROUP 15 -- Chemical transformation rates
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
(Only necessary if IOPT(25)=1)
# ALAT     =     34.3000000000000      #
          ALAT     -- Latitude of the site (deg) (-90 to 90)
                      (decimal notation)
                      (>0 for northern hemisphere)
                      (should be the same as SLAT previously defined)
          No default
# ALONG    =     75.0000000000000      #
          ALONG    -- Longitude of the site (deg) (-180 to 180)
                      (decimal notation)
                      (>0 for western hemisphere)
          No default
# TZONE    =     5.00000000000000      #
          TZONE    -- Time zone of the site
                      Time zone is defined as the number of hours behind GMT
                      (-12 to 11)
                      For example, TZONE = 5. for EST.
          No default
# DECAY    =  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000,  0.0000 #
          DECAY    -- 12 monthly values of the pollutant decay rate
                      (%/hour) (>=0)
          No default
# END #

INPUT GROUP 16a -- Shoreline geometry (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
! X0       =   -0.333300000000000      !
          X0       -- X-coord of the NORTHWEST corner of the mapped area,
                      user units
          No default
! Y0       =     16.0000000000000      !
          Y0       -- Y-coord of the NORTHWEST corner of the mapped area,
                      user units
          No default
! NX       =           60 !
          NX       -- Number of grid rectangles along the x-axis
                      (1 to MAXMAP specified in PARAMS.CMN)
          No default
! NY       =           56 !
          NY       -- Number of grid rectangles along the y-axis
                      (1 to MAXMAP specified in PARAMS.CMN)
          No default
! DELX     =    0.333300000000000      !
          DELX     -- The length of each grid delta-x, user units (>0)
          No default
! DELY     =    0.250000000000000      !
          DELY     -- The length of each grid delta-y, user units (>0)
          No default
! WMIN     =     1.00000000000000      !
          WMIN     -- The minimum along wind width for a land or water body
                      to be considered significant, user units (>0)
                      WMIN allows OCD to neglect insignificant water bodies
                      or land masses (e.g., a very narrow barrier beach or
                      a very narrow lagoon).  As a guidance value, a maximum
                      of ten times the estimated plume height is suggested
                      for WMIN.
          No default
! AVGDIST  =     7.00000000000000      !
          AVGDIST  -- The average distance from source to shoreline,
                      user units (>0)
                      AVGDIST is only used to determine the range of acceptable
                      values for DELX and DELY, and is not used in actual
                      calculations.
          No default
! END !

INPUT GROUP 16b -- Shoreline geometry (mandatory)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
          In the following, for each row (from north to south) of grid
          rectangles to be mapped, a series of L's or W's (from west to east)
          is used to represent the distribution of (L)and vs. (W)ater.

          Note that only the letters L and W are allowed.
          There should be NY rows of data, and each row should have NX letters
          of either L or W.
```

Table 3-10 (Continued).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
          Although it is not necessary for receptors or sources to be located
          on the grid, it is very important that a gridded land sector be
          included between all sources and overland receptors.  Otherwise,
          the model assumes the receptor is over water.

! LWFLAG =
WWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWLLLWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWLLLLLLLLLLLLLLLLLLLLLLLLLL!
! END !

          If overland met data are to be included in the control file,
          i.e., IOPT(5) = 1, then the following line, in its exact form with
          the proper delimiters used, must be present, and immediately
          followed (i.e., no blank lines) by the sequential overland met data.
```

Table 3-10 (Concluded).

Sample OCD Control File. All 17 Input Data Groups are Included for the Sake of Completeness, Although Not All are Necessary. The Data that are Required are Enclosed by the "!" Delimiter. The Data that are Not Required are Enclosed by the "#" Delimiter.

```
! INPUT GROUP 17 !
80 268  1   4   4.1  288.3  264.   400.
80 268  2   4   6.2  288.0  279.   400.
80 268  3   4   6.9  288.0  291.   400.
80 268  4   4   6.3  288.0  274.   400.
80 268  5   4   6.1  289.0  269.   400.
80 268  6   4   3.1  290.0  260.   250.
80 268  7   2   3.3  288.7  260.   100.
80 268  8   3   5.1  289.3  263.   100.
80 268  9   4   5.2  289.2  263.    50.
80 268 10   4   4.0  290.3  275.    50.
80 268 11   4   5.1  290.6  278.    50.
80 268 12   5   4.9  290.4  277.    50.
80 268 13   4   4.7  287.6  282.   100.
80 268 14   4   4.6  288.0  276.   100.
80 268 15   5   4.9  288.2  273.   100.
80 268 16   4   5.8  290.1  272.    50.
80 268 17   4   4.2  289.0  268.    50.
```

Table 3-11.
OCD Control File Inputs

Input Group 1 - Run title (mandatory)

Variable	Type	Description	Default Value
TITLE	character array with 3 elements	It is assumed that the *first three* lines, up to 80 characters per line, of the control file define the title of the run. Other comments included in the self-documenting control file can appear only after the third line of the file.	-

Input Group 2 - Flag for normal run vs. test run (mandatory)

Variable	Type	Description	Default Value
INORMAL	integer	Flag for normal run vs. test run (0 or 1) = 1, Normal Run; the program will stop at the first fatal error, if any = 0, Test Run; the program will go through all user inputs in the control file and generate all relevant error messages, if any; no dispersion calculations will be performed	1

Input Group 3 - Control parameters and constants (mandatory)

Variable	Type	Description	Default Value
IDATE(1)	integer	Starting year for this run (0 to 99)	-
IDATE(2)	integer	Starting Julian day for this run (1 to 366); only effective if PCRAMMET data file is used (IOPT(5) = 0 or 2); if IOPT(5) = 1, i.e., overland meteorological data are included in the control file, then the first meteorological data record determines the starting date and hour	-
IHSTRT	integer	Starting hour for this run (1 to 24), only effective if PCRAMMET data file is used (IOPT(5) = 0 or 2); if IOPT(5) = 1, i.e., overland meteorological data are included in the control file, then the first meteorological data record determines the starting date and hour	-
NPER	integer	Length of run in number of averaging periods (>0) NPER•NAVG (see below) is the length of run in hours	-

Table 3-11 (Continued).
OCD Control File Inputs

Variable	Type	Description	Default Value
NAVG	Integer	Number of hours in an averaging period (1 to 24) NAVG is only used for output purposes. (See IOPT(10), IOPT(17), and IOPT(18) below.) OCD always performs hourly dispersion calculations. Note that NAVG is not to be confused with the averaging times (1, 3, 8, 24 hours, and NAV5 hours if necessary) used in the summary high-give tables. With the appropriate output options selected, comprehensive printout for each NAVG-hour period will be generated. For example, for a one-year (8760 hours) simulation, then NAVG = 3 would mean that 2920 (8760/3) tables will be generated. On the other hand, for the averaging times considered in the summary high-five tables, the same amount of information is always generated regardless of the length of run.	1
IPOL	Integer	Pollutant indicator (3 to 7) = 3, SO_2 = 4, TSP = 5, NO_x = 6, CO = 7, Others	7
NSIGP	Integer	Number of significant point sources (0 to 25) NSIGP = 0 means that no significant sources will be considered. When NSIGP >0, OCD will automatically determine the ordering of the NSIGP significant sources. If necessary, the user can override this selection and specify a new ordering of the NSIGP significant sources through IOPT(7) and Input Group 7 described below.	0
NAV5	Integer	An optional fifth averaging time, in hours, to be included in the high-five table (0 to 24, but excluding 1, 3, 8, and 24 already considered by OCD) NAV5=0 means a fifth averaging time will not be added. Note that this averaging time is not to be confused with NAVG defined above.	0
CONTWO	real	Conversion factor that converts user horizontal length units (by multiplication) to kilometers (>0) For example, CONTWO=0.001 if meters are used as user horizontal length units; CONTWO=0.0003048 if feet are used as user horizontal length units.	-
CELM	Real	Conversion factor that converts user height units (by multiplication) to meters (>0) For example, CELM=0.3048 if feet are used as user height units	-

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 4 - Main model options (mandatory)			
Variable	Type	Description	Default Value
IOPT(1)	integer	Switch for terrain adjustment (0 or 1) = 0, Do not use terrain adjustment = 1, Use terrain adjustment	0
IOPT(2)	integer	Switch for stack-tip downwash (0 or 1) = 0, Use stack-tip downwash = 1, Do not use stack-tip downwash	1
IOPT(3)	integer	Switch for gradual plume rise (0 or 1) = 0, Use gradual plume rise = 1, Do not use gradual plume rise	1
IOPT(4)	integer	Switch for buoyancy-induced dispersion (0 or 1) = 0, Do not use buoyancy-induced dispersion = 1, Use buoyancy-induced dispersion	0
IOPT(5)	integer	Switch for overland met data (0 to 2) = 0, From separate binary PCRAMMET file (lmet.dat) = 1, ASCII met data included in the control file = 2, From separate ASCII PCRAMMET file (lmet.dat) If binary file is to be used, make sure that the file is compatible with the Fortran compiler used to compile OCD.	-
IOPT(6)	integer	Switch for emission rate (0 or 1) = 0, Use constant emission rate specified in the control file = 1, Use hourly emissions from an external file (emis.dat)	-
IOPT(7)	integer	Switch for user-specified significant sources (0 or 1) = 0, No significant sources specified by the user, and OCD will determine significant sources if necessary = 1, Significant sources specified by the user in Input Group 7 (IOPT(7) can = 1 only if NSIGP > 0)	0
IOPT(8)	integer	Switch for receptor type (0 to 6) = 0, Discrete receptors only = 1, Discrete and polar receptors = 2, Discrete and Cartesian receptors = 3, Discrete, polar, and Cartesian receptors = 4, Polar receptors only = 5, Cartesian receptors only = 6, Polar and Cartesian receptors	-

Table 3-11 (Continued).
OCD Control File Inputs

Variable	Type	Description	Default Value
IOPT(9)	integer	Switch for printout of emissions with height table (0 or 1) = 0, Generate output = 1, Do not generate output	1
IOPT(10)	integer	Switch for printout of resultant met data summary for averaging period (0 or 1) = 0, Generate output = 1, Do not generate output	1
IOPT(11)	integer	Switch for printout of hourly contributions of significant sources (0 or 1). The printout lists the hourly contribution from *each* significant source for each receptor. It also lists the hourly concentration at each receptor due to (1) *all* significant sources, and (2) *all* sources. = 0, Generate output = 1, Do not generate output (IOPT(11) can = 0 only if NSIGP > 0)	1
IOPT(12)	integer	Switch for printout of met data on hourly contributions (0 or 1) = 0, Generate output = 1, Do not generate output	1
IOPT(13)	integer	Switch for case-study printout of plume transport and dispersion on hourly contributions (0 or 1) = 0, Generate output = 1, Do not generate output	1
IOPT(14)	integer	Switch for printout of hourly summary of receptor concentrations (0 or 1). The printout lists the hourly concentration at each receptor due to (1) *all* significant sources, and (2) *all* sources. Individual source contributions are not listed. The receptor location, height, and elevation are also printed. = 0, Generate output = 1, Do not generate output	1
IOPT(15)	integer	Switch for printout of met data on hourly summary (0 or 1) = 0, Generate output = 1, Do not generate output (This option currently has the same effects as IOPT(12). Thus, for consistence, IOPT(15) should equal IOPT(12).)	1

Table 3-11 (Continued).
OCD Control File Inputs

Variable	Type	Description	Default Value
IOPT(16)	integer	Switch for case-study printout of plume transport and dispersion on hourly summary (0 or 1) = 0, Generate output = 1, Do not generate output (This option currently has the same effects as IOPT(13). Thus, for consistence, IOPT(16) should equal IOPT(13).)	1
IOPT(17)	integer	Switch for printout of averaging period contributions (0 or 1) The printout is similar to the one generated by IOPT(11), but is for each averaging period (NAVG hours). = 0, Generate output = 1, Do not generate output (IOPT(11) and IOPT(17) both = 0 is meaningful only if NAVG > 1.)	1
IOPT(18)	Integer	Switch for printout of averaging period summary (0 or 1) The printout is similar to the one generated by IOPT(14), but is for each averaging period (NAVG hours). = 0, Generate output = 1, Do not generate output (IOPT(14) and IOPT(18) both = 0 is meaningful only if NAVG > 1.)	1
IOPT(19)	Integer	Switch for printout of average concentrations and high-five table for the entire run (0 or 1) = 0, Generate output = 1, Do not generate output	0
IOPT(20)	Integer	Switch for source type (0 to 2) = 0, Point source = 1, Area source = 2, Line source	0
IOPT(21)	Integer	Switch for the secondary summary output file (*extra.out*) (0 or 1) There is one line of output in the *extra.out* file for each receptor-stack pair and hour modeled = 0, Do not create the file = 1, Create the file	0
IOPT(22)	Integer	Switch for hourly binary concentration file (*conc.bin*) (0 or 1) = 0, Do not create the file = 1, Create the file	1

Table 3-11 (Continued).
OCD Control File Inputs

Variable	Type	Description	Default Value
IOPT(23)	Integer	Switch for printout of table of annual impact assessment from non-permanent activities (0 or 1) For example, assume a facility operates only 30 days a year, and OCD is applied for that 30-day period. Then, the annual impact due to that facility will be 30/365 of the averaging concentration for the entire run (run length = 30 days). = 0, Do not generate output = 1, Generate output	0
IOPT(24)	integer	Switch for land source (do not modify wind speed) (0 or 1) = 0, Modify wind speed = 1, Do not modify wind speed (IOPT(24) should = 1 for land source.)	-
IOPT(25)	integer	Switch for pollutant decay rate via chemical transformation (0 or 1) = 0, Do not specify decay rate (i.e., no decay) = 1, Specify decay rate	0

Input Group 5 - Overland wind and terrain (mandatory)

Variable	Type	Description	Default Value
HANE	real	Overland anemometer height (m) (>0)	-
Z0L	real	Overland surface roughness length (m) (>0)	-
ZMIN	real	Minimum miss distance for a plume above the ground at the receptor location (m) (>0) Currently, EPA recommends setting ZMIN = 10 m. However, before running OCD in complex terrain, the local MMS agency should be contacted for guidance in setting a value for ZMIN.	-
SLAT	real	Latitude of the source region (deg) (-90 to 90) Decimal notation; e.g., 25.675 deg = 25 deg 40 min 30 sec >0 for northern hemisphere	-

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 6 - Sources descriptions (mandatory)
Any combination of stationary sources located offshore or on land near the coast (with coastline resolution limitations taken into account) is allowed.

Variable	Type	Description	Default Value
NPT	integer	For point sources (IOPT(20)=0), NPT must ≤ MAXP specified in *params.cmn* For area sources (IOPT(20)=1), NPT must ≤ 5 For line sources (IOPT(20)=2), NPT must = 1	-
SRCNAM	character	Source name (at most 12 characters, no space)	-
SRCPAR	real array with 11 elements	Contains the following 11 parameters: (1) x-coordinate of point source; x-coordinate of circle center for area source; or x-coordinate of starting point for line source; user units (2) y-coordinate of point source; y-coordinate of circle center for area source; or y-coordinate of starting point for line source; user unit, (3) Pollutant emission rate (g/s, ≥0), not used if IOPT(6)=1 (4) Height of building or obstacle at or near stack location (m, ≥0) relative to platform or ground level, depending upon base elevation specified below (5) Height of stack-top (m, >0.1) above ground (if on land), above platform level (if at sea on "stilts"), or above sea level (if floating on water) (6) Stack gas temperature (K) (must be at least as high as the ambient temperature) (7) Stack-top inside diameter (m, >0) for point or line sources, circle diameter (m, >0) for area sources (8) Stack gas exit velocity (m/s, >0) (9) Deviation of stack angle from the vertical (deg, 0 to 180); 0 means the stack is vertical, <90 means the stack has an upward pointing component, >90 means the stack has a downward pointing component. (10) Elevation of ground or platform base at stack location relative to the water surface, user units (11) Building width used to computer platform downwash (m, ≥0); =0 means no downwash	-

Table 3-11 (Continued).
OCD Control File Inputs

Variable	Type	Description	Default Value
XSTOP	real	x-coordinate of ending point for line source, user units (Only required for line source, i.e., IOPT(20)=2)	-
YSTOP	real	y-coordinate of ending point for line source, user units (Only required for line source, i.e., IOPT(20)=2)	-

SRCNAM and SRCPAR should be repeated NPT times, one for each source

Input Group 7 - User-specified significant sources (conditional)
(Only necessary if IOPT(7)=1 and NSIGP > 0)

Variable	Type	Description	Default Value
SRCNUM	real array with NSIGP elements	Source numbers for the NSIGP significant sources, where NSIGP was previously specified in the control file. For example, SRCNUM = 2, 1, 5 means that source number 2 is the first significant source, source number 1 is the second significant source, and source number 5 is the third significant source.	-

Input Group 8 - Overland meteorological data identifiers (conditional)
(Only necessary if IOPT(5)=0 or 2)

Variable	Type	Description	Default Value
ISFCD	integer	Surface station identifier code (0 - 99999)	-
ISFCYR	integer	Year of surface data (0 - 99)	-
IMXD	integer	Upper air station identifier code (0 - 99999)	-
IMXYR	integer	Year of upper air data (0 - 99)	-

Input Group 9 - Polar receptor network (conditional)
(Only necessary if IOPT(8)=1, 3, 4, or 6)
Any combination of receptors located at sea or on land is allowed.

Variable	Type	Description	Default Value
NRING	integer	Number of rings for polar receptors (1 to MAXRING specified in *params.cmn*). The total number of polar receptors is NRING•36. The sum of polar, Cartesian, and discrete receptors must ≤ MAXREC specified in *params.cmn*.	5
CENTX	real	x-coordinate of the center of rings, user units	-
CENTY	real	y-coordinate of the center of rings, user units	-
RADII	real array with NRING elements	Radial distances for the NRING rings, user units (>0)	-

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 10 - Polar receptor network elevations (conditional)
(Only necessary if IOPT(8)=1, 3, 4, or 6; and IOPT(1)=1)

Variable	Type	Description	Default Value
ISECTOR	integer	Azimuth indicator (1 to 36; must be in that order) 1 = the 10-degree sector centered at the 10 degree azimuth 2 = the 10-degree sector centered at the 20 degree azimuth 3 = the 10-degree sector centered at the 30 degree azimuth etc.	-
ELEV	real array with NRING elements	Ground elevations relative to the water surface for the NRING receptors along the ISECTOR-th radial, user height units	-

ISECTOR and ELEV should be repeated 36 times, one for each 10-degree sector. Note that the sectors must be in the order of from 1 to 36.

Input Group 11 - Cartesian receptor network (conditional)
(Only necessary if IOPT(8)=2, 3, 5, or 6)
Any combination of receptors located at sea or on land is allowed.

Variable	Type	Description	Default Value
X0_C	real	x-coordinate of the *northwest* corner of the Cartesian receptor network, user units	-
Y0_C	real	y-coordinate of the *northwest* corner of the Cartesian receptor network, user units	-
NX_C	integer	Number of receptors along the x-axis (1 to MAXCAR specified in *params.cmn*)	20
NY_C	integer	Number of receptors along the y-axis (1 to MAXCAR specified in *params.cmn*) The total number of Cartesian receptors is NX_C•NY_C. The sum of polar, Cartesian, and discrete receptors must ≤ MAXREC specified in *params.cmn*.	20
DELX_C	real	The distance between successive Cartesian receptors along the x-axis, user units (>0)	-
DELY_C	real	The distance between successive Cartesian receptors along the y-axis, user units (>0)	-

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 12 - Cartesian receptor network elevations (conditional)
(Only necessary if IOPT(8)=2, 3, 5, or 6; and IOPT(1)=1)

Variable	Type	Description	Default Value
IROW	integer	Row indicator (1 to NY_C; must be in that order) The rows are arranged from north to south, i.e., row 1 is the north most, and row NY_C is the southmost	-
ELEV	real array with NX_C elements	Ground elevations relative to the water surface for the NX_C receptors along the IROW-th row, user height units The columns are arranged from west to east, i.e., column 1 is the westmost; and column NX_C is the eastmost	-

IROW and ELEV should be repeated NY_C times, one for each row of Cartesian receptors. Note that the rows must be in the order of from 1 to NY_C.

Input Group 13 - Discrete receptors descriptions (conditional)
(Only necessary if IOPT(8)=0, 1, 2, or 3)
Any combination of receptors located at sea and on land is allowed.

Variable	Type	Description	Default Value
NDISC	integer	Number of discrete receptors (>0) The sum of discrete, polar, and Cartesian receptors must ≤ MAXREC specified in *params.cmn*	-
RCPNAM	character	Receptor name (at most 8 characters, no space)	-
RCPPAR	real array with 5 elements	Contains the following 5 parameters: (1) x-coordinate of receptor, user units (2) y-coordinate of receptor, user units (3) Receptor height above local ground level (m) (≥0) (4) Ground elevation relative to the water surface at the receptor location, user units (5) Terrain elevation toward which source to receptor is aligned (used for H_c calculation) (m)	-

RCPNAM and RCPPAR should be repeated NDISC times, one for each discrete receptor

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 14 - Special options for additional meteorological data (mandatory)			
Variable	Type	Description	Default Value
JOPT(1)	integer	Switch for overwater wind direction data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
JOPT(2)	integer	Switch for overwater wind speed data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
JOPT(3)	integer	Switch for overwater vertical potential temperature gradient data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
JOPT(4)	integer	Switch for overwater humidity data (1 to 3) = 1, Relative humidity (%) is provided = 2, Web bulb temperature (K) is provided = 3, Dew point temperature (K) is provided	-
JOPT(5)	integer	Switch for overland horizontal and vertical turbulence intensity data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
JOPT(6)	integer	Switch for water surface temperature data (1 or 2) = 1, Water surface temperature (K) is provided = 2, Air minus water surface temperature (K) is provided	-
JOPT(7)	integer	Switch for overwater wind direction shear data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
JOPT(8)	integer	Switch for overwater horizontal turbulence intensity data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
JOPT(9)	integer	Switch for overwater vertical turbulence intensity data (0 or 1) = 0, Not provided or do not use = 1, Provided	-
HWANE	real	Height above water level of overwater anemometer, m (>0)	-
HWT	real	Height above water level of overwater air temperature sensor, m (>0)	-

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 15 - Chemical transformation (conditional)
(Only necessary if IOPT(25)=1)

Variable	Type	Description	Default Value
ALAT	real	Latitude of the site (deg, decimal notation, -90 to 90) >0 for northern hemisphere For consistence, ALAT should be the same as SLAT previously defined	-
ALONG	real	Longitude of the site (deg, decimal notation, -180 to 180) >0 for western hemisphere	-
TZONE	real	Time zone of the site (-12 to 11) Time zone is defined as the number of hours behind GMT. For example, TZONE = 5. for Eastern Standard Time.	-
DECAY	real array with 12 elements	12 monthly values for the pollutant decay rate during daytime hours (%/hour, ≥0) =0 means no decay (or chemical transformation) No chemical transformation is considered during nighttime hours	-

Input Group 16 - Shoreline geometry (mandatory)

Variable	Type	Description	Default Value
X0	real	x-coordinate of the *northwest* corner of the mapped area, user units	-
Y0	real	y-coordinate of the *northwest* corner of the mapped area, user units	-
NX[1]	integer	Number of grid rectangles along the x-axis (1 to MAXMAP specified in *params.cmn*)	-
NY[1]	integer	Number of grid rectangles along the y-axis (1 to MAXMAP specified in *params.cmn*)	-
DELX	real	The length of each grid along the x-axis, user units (>0)	-
DELY	real	The length of each grid along the y-axis, user units (>0)	-
WMIN	real	The minimum alongwind width for a land or water body to be considered significant, user units (>0) WMIN allows OCD to neglect insignificant water bodies or land masses (e.g., a very narrow barrier beach or a very narrow lagoon). As a guidance value, a maximum of ten times the estimated plume height is suggested for WMIN.	-

Table 3-11 (Continued).
OCD Control File Inputs

Variable	Type	Description	Default Value
AVGDIST	real	The average distance from source to shoreline, user units (>0) AVGDIST is only used to determine the range of acceptable values for DELX and DELY, and is not used in actual calculations.	-
LWFLAG	character arrays with NX•NY elements	For each row (from north to south) of grid rectangles to be mapped, a series of L's or W's (from west to east) is used to represent the distribution of (L)and vs. (W)ater. Note that only the letters L and W are allowed. There should be NY rows of data, and each row should have NX letters of either L or W. The example below demonstrates how the LWFLAG array is used to define the shoreline geometry, where there are 26 (NX) grid rectangles along the x-axis, and 9 (NY) grid rectangles along the y-axis.	-

```
! LWFLAG =
LLLLLLLLLLLLLLLLLLLLLLLLLL,
LLWWLLLLLLLLLLLLLLLLLLLLLL,
WWWWWWWWLLLLLLLLLLLLLLLLLL,
WWWWWWWWWLLLLLLLLLLLLLLLLL,
WWWWWWWWWWLLLLLLLLLLLLLLLL,
WWWWWWWWWWWLLLLLLLLLLLLLLL,
WWWWWWWWWWWWLLLLLLLLLLLLLL,
WWWWWWWWWWWWWLLLLLLLLLLLLL,
WWWWWWWWWWWWWWLLLLLLLLLLLL!
```

Although it is not necessary for receptors or sources to be located on the grid, it is very important that a gridded land sector be included between all sources and overland receptors. Otherwise, the model assumes the receptor is over water.

Input Group 16 can be directly prepared by the MAKEGEO processor described previously, where it is required that NX and NY be between 60 and 120, and in increments of 10.

Table 3-11 (Continued).
OCD Control File Inputs

Input Group 17 - Overland meteorological data (conditional)
(Only necessary if IOPT(5)=1)

Variable	Type	Description	Default Value
JYR	integer	Year (0 - 99)	-
DAY1	integer	Julian day (1 - 366)	-
KHR	integer	Hour (1 - 24)	-
IKST	integer	Overland stability class (1 - 6)	-
QU	real	Overland wind speed (m/s, > 0)	-
QTEMP	real	Overland ambient air temperature (K, 200 - 330)	-
QTHETA	real	Overland wind direction (deg, 1 - 360; from which the wind blows)	-
QHL	real	Overland mixing height (m, 1 - 10000)	-

Input Group 17, the hourly overland meteorological data included at the end of the control file, is treated by the OCD control file processor as *regular* ASCII data records, i.e., comments should no be added, and variable names and record delimiters should not be used. There is one line for each hourly record, including the above eight variables. The data are read with free-format. The sequential tabulation of the hourly data must appear immediately after the following header record, in its exact form:

```
! INPUT GROUP 17 !
```

The location of the above header record within a line is flexible. That is, the header record can start from any column in the line. However, as just mentioned, there should not be any blank lines between the header record and the ensuing overland meteorological data. The meteorological data records can be repeated as many as 8784 times. The end of the control file also indicates the end of meteorological data records. Thus, there should not be any blank lines in the control file after the last meteorological data record.

The file must be synchronized in time with the overwater meteorological data.

Default or recommended values will be assigned to applicable variables only when the graphical user interface (GUI) program is used to create the OCD control file. <u>Regardless of whether the OCD control file is created by the GUI program or manually prepared, all variables for each Input Group must explicitly appear in the control file.</u>

Previously, the user had to manually prepare the shoreline geometry information (Input Group 16) required by the OCD model (DiCristofaro and Hanna, 1989). It is a tedious process, and the results are not easily reproducible. The task can now be automated by the MAKEGEO preprocessor (see Section 3.1.3), if the model domain is in the continental U.S. By specifying the two latitudes and the two longitudes that define the model domain, and the number of grid rectangles in both the x- and y-directions for the shoreline map, the MAKEGEO preprocessor will generate a file containing the shoreline geometry information. The file in turn can be directly included in the OCD control file as Input Group 16.

A standard control file is provided along with the OCD test case. Furthermore, if the user has a control file for OCD/4, then a standard control file for OCD/5 can also be generated by the OCD4TO5 preprocessor (see Section 3.1.1). It is recommended that a copy of the standard control file be permanently stored as a backup. Working copies of the control file may be made and then edited and customized by the user for a particular application.

3.2.2 Overland Meteorological Data File (*lmet.dat*)

The meteorological data representing overland conditions can be provided by the user in the same manner as for all standard EPA dispersion models. The data can be provided in one the following three forms, to be selected depending on the value of IOPT(5) in the user control file (*input.dat*):

- IOPT(5) = 1: Hourly data in the OCD format, included in the user control file (*input.dat*) as Input Group 17. The data include year, Julian day, hour, stability class, wind speed, ambient air temperature, wind direction from which the wind blows, and mixing height (see Table 3-11).

- IOPT(5) = 0: A binary (unformatted) data file prepared with the PCRAMMET preprocessor (USEPA, 1995). The format of the binary PCRAMMET data file is shown in Table 3-12. Note that the flow vector, the direction to which the wind blows, is used in PCRAMMET.

- IOPT(5) = 2: An ASCII (formatted) data file prepared with the PCRAMMET preprocessor (USEPA, 1995). The format for the binary PCRAMMET data file is shown in Table 3-13.

Table 3-12.
Format for Binary (Unformatted) PCRAMMET Data File (from USEPA, 1995)

Header Record			
	Type	Number	Description
	integer	1	Surface station number
	integer	1	Surface station year
	integer	1	Mixing height station number
	integer	1	Mixing height station year
Data records (one per day)			
	Type	Number	Description
	integer	1	Year
	integer	1	Month
	real	1	Julian day
	integer	24	Hourly values of stability class
	real	24	Hourly values of wind speed (m/s)
	real	24	Hourly values of ambient temperature (K)
	real	24	Hourly values of *flow vector* (deg) (direction to which the wind blows)
	real	24	Hourly values of randomized *flow vector* (deg) (toward which the wind blows)
	real	48	Array dimensioned (2,24) containing 24 rural mixing height values (corresponding to 1 for the first array dimension), and 24 urban mixing height values (corresponding to 2 for the first array dimension) (m)

Table 3-13.
Format for ASCII (Formatted) PCRAMMET Data File (from USEPA, 1995)

Header Record - Written with the format: (4 (I6, 1X))

Type	Variable no.	Description
integer	1	Surface station number
integer	2	Surface station year
integer	3	Mixing height station number
integer	4	Mixing height station year

Data records (one per hour) - Written with the format (4I2, 2F9.4, F6.1, I2, 2F7.1)

Type	Variable no.	Description
integer	1	Year
integer	2	Month
integer	3	Day
integer	4	Hour
real	5	Random *flow vector* (deg) (direction to which the wind blows)
real	6	Wind speed (m/s)
real	7	Ambient temperature (K)
integer	8	Stability class
real	9	Rural mixing height (m)
real	10	Urban mixing height (m)

Note that the flow vector, the direction to which the wind blows, is used in PCRAMMET. This is a new model option for OCD/5.

If an overland meteorological input file is prepared by the EPA PCRAMMET preprocessor, and the model starting time is not at the beginning of the data set, the data in the overland input file are read until the starting time is reached. At the same time, hourly data in the overwater meteorological input file and the emission file, if applicable, are read and discarded. The OCD model checks the dates and hours of all input files being used to ensure that they agree with each other.

If the overland meteorological data are not in the PCRAMMET formats, i.e., the data are included in the control file as Input Group 17, then the first data record determines the model starting date and hour. The first record of the overwater and emissions data files must start at the same hour.

The overland anemometer height above ground level and the representative surface roughness length are specified in Input Group 5. The surface roughness length should be estimated from an examination of vegetation and other obstacles to wind flow within a 3-km radius of the anemometer site. Table 3-14 lists typical surface roughness lengths for various types of environment. A composite value for the site in question can be obtained by weighting the value for each type of ground cover according to its fraction of area coverage near the site. Accuracy to within a factor of two is acceptable, since the OCD model uses the logarithm of the surface roughness length.

If turbulence intensity data representative of overland conditions are available, the user is encouraged to use the on-site data in lieu of the Briggs (1973) rural coefficients which the mode defaults to. The turbulence intensity values should be measured as close to a typical plume height level as possible. If the overland intensity values are used by OCD but are missing for a given hour, default values from the Briggs curves are substituted. Computation of σ_y and σ_z values (lateral and vertical dispersion coefficients, respectively) based on turbulence intensity data is discussed in more detail in DiCristofaro and Hanna (1989). If the overland turbulence intensity data are available, they must be input to the OCD model via the overwater meteorological data file *wmet.dat*, because the overland meteorological data file, such as the PCRAMMET data file, does not include turbulence data.

In the OCD model, overwater observations of wind direction and wind speed are assumed to apply to both overwater and overland areas. If on-site meteorological observations over the water are not available, then hourly overland values are used. If overwater measurements of wind direction and wind speed are available, then the only overland meteorological data used by the OCD model are the overland stability class, temperature, and turbulence data (optional).

Table 3-14.
Typical Surface Roughness Lengths[1] for Various Ground Covers

Ground Cover	Surface Roughness Length, m
water surface[2]	0.00001 - 0.004
snow surface	0.0005 - 0.001
fallow field or low grass	0.01 - 0.03
high grass	0.03 - 0.10
desert, sand dunes	0.05 - 0.10
flat rural, few trees[3]	0.003 - 0.03
rural, rolling terrain, few trees[3]	0.01 - 0.15
woods[3]	1.0
suburban[3]	0.5 - 1.5
urban[3]	1.5 - 4.0
dense vegetation cover	1/8 of the average canopy height[4]

[1] Reference: Counihan (1975), Priestley (1959), Hess (1959), Stull (1989)
[2] Roughness length increases with increasing wind speed
[3] Roughness length increases for taller or more closely spaced obstacles to wind flow, or for higher terrain obstacles.
[4] Reference: Brutsaert (1975)

3.2.3 Overwater Meteorological Data File (*wmet.dat*)

The OCD model requires knowledge of the overwater boundary layer. In general, wind speeds are higher, turbulence intensities are lower, and afternoon mixing depths are lower over water than over land. Stabilities are usually much closer to neutral over water and bear little relation to Pasquill-Gifford stability classes determined over land. In fact, the boundary layer is often unstable at night and stable in the daytime over water.

A complete set of overwater meteorological data includes hourly observations of the parameters listed below:

- wind direction (WD)
- wind speed (u)
- mixing height (z_i)
- humidity (RH)
- air temperature (T_a)
- surface water temperature (T_s)
- vertical wind direction shear ($\Delta WD/\Delta z$)
- vertical potential temperature gradient ($\partial\theta/\partial z$)
- horizontal and vertical components of turbulence intensities (i_y and i_z)

The overwater meteorological data listed above and the overland turbulence intensities (see Section 3.2.2) are included in a file called *wmet.dat*. Table 3-15 shows the format for *wmet.dat*. Note that although *wmet.dat* is called "overwater" meteorological data file, it also includes information on the horizonal and vertical components of turbulence intensities over land. The hourly data included in *wmet.dat* must be synchronized in time with the overland meteorological data included in the *lmet.dat* file or the *input.dat* control file.

<u>The overwater mixing height, overwater humidity (in terms of relative humidity, wet bulb temperature, or dew point temperature), overwater air temperature, and water surface temperature (or air minus water temperature) must be available for every modeled hour in order to run the OCD model.</u> The types of the overwater humidity data and the water surface temperature data are controlled by variables JOPT(4) and JOPT(6) in Input Group 14 of the OCD control file. There are no defaults for these four parameters. It is the user's responsibility to provide a complete overwater meteorological data set containing the above mandatory information. The OCDPRO processor (see Section 3.1.2) can be used if all sources of overwater meteorological data are exhausted. A discussion of available meteorological data for offshore sources is presented in Appendix C of DiCristofaro and Hanna (1989).

Table 3-15.
Format for Overwater Meteorological Data File (*wmet.dat*)[1]

Variable	Type	Description	Default Value
KYR	integer	Year (0 - 99)	-
KDAY	integer	Julian day (1 - 366)	-
KHR	integer	Hour (1 - 24)	-
WD	integer	Overwater wind direction (deg,. 1 - 360; from which the wind blows)	-
WS	real	Overwater wind speed (m/s, 1 - 99)	-
HLW	real	Overwater mixing height (m, 1 - 10000) *Must be available*	-
WHUM	real	Overwater humidity; can be relative humidity (%, 0 - 100), wet bulb temperature (K, >0), or dew point temperature (K, >0) *Must be available*	-
WTA	real	Overwater ambient air temperature (K, 200 - 330) *Must be available*	-
WTS	real	Overwater surface temperature; can be water surface temperature (K, 260 - 320), or air minus water temperature (K) *Must be available*	-
WDSHR	real	Overwater vertical wind direction shear (deg/m, 0 - 180)	-
IYW	real	Overwater horizontal turbulence intensity (nondimensional, 0.0 - 2.0; = σ_v/u)	-
IZW	real	Overwater vertical turbulence intensity (nondimensional, 0.0 - 1.0; = σ_w/u)	-
IYL	real	Overland horizontal turbulence intensity (nondimensional, 0.0 - 2.0; = σ_v/u)	-
IZL	real	Overland vertical turbulence intensity (nondimensional, 0.0 - 1.0; = σ_w/u)	-
WDTHDZ	real	Overwater vertical potential temperature gradient (K/m, 0.0 - 0.5)	-

[1]The hourly overwater meteorological data are read with free-format, with one record for each hour. The data must be synchronized in time with the hourly overland meteorological data. Note that data for HLW, WHUM, WTA, and WTS must be available. The time information (KYR, KDAY, and KHR) cannot be missing either. Other variables that are out-of-range are considered missing, and will be substituted with overland values or parameterized (see DiCristofaro and Hanna, 1989).

A 10-m measurement height for all parameters, except i_y and i_z, is desirable, but the model will accept measurements from other (usually higher) heights. The complete set of these data will be taken only during research-grade diffusion experiments, but the OCD model is sufficiently general to handle incomplete data bases, except for the four mandatory parameters mentioned in the above paragraph.

In the absence of any information on overwater stability, the OCD model will estimate the Monin-Obukhov length from hourly values of overwater T_a, RH, u, and T_s. The calculation of overwater stability is very sensitive to the air-water temperature difference, T_a - T_s. When this difference is close to zero, a one degree error in either T_a or T_s can cause the calculated stability to change from stable to unstable. For this reason, it is recommended that T_a and T_s observations to input directly to the model only if the measurements are taken at the same place and time, e.g., on an automated buoy or on an oil drilling platform. In the absence of such measurements, T_a - T_s can be estimated or can be set equal to zero as a first approximation.

If possible, the measurements of the water and air temperature difference should be obtained by a thermocouple device linking the two measurement heights, rather than by the use of two independent thermometers. This is because the error in the calibration of individual thermometers may be of the same magnitude as the temperature difference required as input to the OCD model.

If the overwater wind speed (u_{sea}) is not known, it can be estimated by default within the OCD model from on-shore measurements (u_{land}) using a simple empirical relation devised by Hsu (1981):

$$u_{sea} = 3 \times {u_{land}}^{2/3}$$

where the wind speeds are in m/s. The OCD model will adjust any final wind speeds up to 1.0 m/s if the value is less than 1.0 m/s. This formula is based on data from several outer continental shelf regions and leads to u_{sea}/u_{land} equal to about 1.75 for u_{land} equal to 5.0 m/s. In any case, the sea and land wind speeds at the coastal zone are assumed equal so as to prevent unrealistic mass convergence or divergence. For land sources, IOPT(24) in Input Group 4 of the OCD control file (see Table 3-11) should be set to 1 so that wind speeds are not altered.

The minimum onshore wind speeds input to the model should not be limited to 1.0 m/s if these data are to be used to calculate offshore wind speeds. The user is cautioned that the EPA PCRAMMET preprocessor limits wind speeds to 1.0 m/s.

There are no simple method for extrapolating wind direction offshore. The OCD model arbitrarily sets the land and sea wind directions equal to each other.

The wind, temperature, and turbulence profiles in the marine environment are used to determine overwater plume transport and dispersion. Wind speed, overwater and water surface temperatures, and overwater humidity can be used to estimate complete profiles of all variables using boundary layer theory. The difference between the air and sea temperature is of particular importance. The absolute values of these temperatures are not as critical, although they slightly affect the computations of plume buoyancy and moisture flux between the air and sea.

The development of the algorithm for computing the Monin-Obukhov length is based upon measurements of wind, temperature, and humidity at a height of 10 m above sea level. The OCD model scales measurements taken at other heights to the 10 m level. Optimum results are obtained for measurements taken as close to 10 m as possible, but satisfactory results can be obtained for measurements at heights up to 100 m.

Measurements of the horizontal component of turbulence intensity, if available, are recommended. Such measurements should be taken over the water rather at or near the shore because significant changes in the turbulence intensity can occur as air flow approaches the shoreline.

Because accurate measurements of the vertical component of turbulence intensity are difficult to obtain on a floating platform subjected to sea motion, the user is encouraged to use default values. Tests have shown that the OCD model performs better using predicted vertical turbulence intensity values rather than measured values.

The mixing height is difficult to measure and the model is relatively sensitive to its value, which can be 100 m or less over the sea. The plume from a low level source will become uniformly mixed in such a shallow layer before it has traveled more than 5 or 10 km. Measurements of mixing heights at sea or at the shoreline with an acoustic sounder or radiosonde ascents should be considered.

Hourly measurements of vertical wind direction shear ($\Delta WD/\Delta z$) or vertical potential temperature gradient ($\partial\theta /\partial z$) are usually available only for research-grade experiments, but may be feasible on the support structure of an elevated platform. The vertical wind direction shear is set to zero if it is not available. The vertical potential temperature gradient is computed from the Monin-Obukhov length if it is not measured. The measured or parameterized value of $\partial\theta /\partial z$ becomes important in very stable conditions, when the vertical plume spread is a function of $\partial\theta /\partial z$. If strong inversions are expected at a particular site, $\partial\theta /\partial z$ should be measured by instruments on the platform structure or ship.

3.2.4 Hourly Emission Data File (*emis.dat*)

Stack parameters, including the emission rate, the stack gas exit velocity, and the stack gas exit temperature, specified in Input Group 6 of the control file (see Table 3-11) do not vary with time. If at least one of the above three parameters varies with time, then the hourly emission data file *emis.dat* is required. Table 3-16 shows the format for the *emis.dat* file.

3.2.5 Output Listing File (*ocd.out*)

The OCD model always generates an output listing file, *ocd.out*, that consists of the following sections:

1. Echo of all user input options and specifications of sources, receptors, and land/sea interface.

2. Output for each hour or averaging period, which can include meteorological summaries, contributions of each significant source to total concentrations, predicted concentration at each receptor, and case-study printout of plume transport and dispersion.

3. Average concentrations and a high-five table for the entire run.

Item 1 above is mandatory, whereas Items 2 and 3 are conditional, depending on user options. Note that Item 2 above should be deleted for production runs of the OCD model, since massive output will be generated. However, Item 2 is useful for the study of model results for a short time period. The printout of hourly meteorology and the case-study of plume transport and dispersion is unique to the OCD model because of its consideration of conditions over both land and water. For each stack-receptor pair for which the plume's lateral miss distance is not extremely large (i.e., non-zero concentrations were predicted), the OCD model can print out the following information in the case-study mode:

- plume axis position relative to receptor
- plume height above the ground at receptor
- distance from source to shoreline
- components of σ_y and σ_z
- horizontal and vertical terms in the Gaussian equation
- predicted concentration at receptor
- effects of chemical transformation of the pollutant, terrain correction, and reflection adjustment
- overland mixing height
- effects of building downwash
- momentum and buoyancy rise
- stack-specific turbulence intensity values (a function of height)
- distance to final rise

Table 3-16.
Format for Hourly Emission Data File (*emis.dat*)[1]

Variable	Type	Description	Default Value
LYR	integer	Year (0 - 99)	-
LDAY	integer	Julian day (1 - 366)	-
LHR	integer	Hour (1 - 24)	-
Q	real	Pollutant emission rate (g/s, $\geq$0)	-
VS	real	Stack gas exit velocity (m/s, >0)	-
TS	real	Stack gas temperature (K) (must be at least as high as the ambient temperature)	-

[1]The hourly emission data are read with free-format, with one record per source and per hour. If there are multiple sources, then there should be N data records for each hour, where N is the number of sources. The order of source records must be consistent with that specified in the control file. The hourly emission data must be synchronized in time with the hourly overland and overwater meteorological data.

The user also has the option to print out an abbreviated listing of the OCD results using the variable IOPT(21) in OCD Input Group 4 (see Table 3-11). If IOPT(21) is set to 1, a file called *extra.out* is created which contains one line of information for each stack-receptor pair and each hour modeled (see Section 3.2.7 for more details).

3.2.6 Error Message File (*error.out*)

Any error message generated by the OCD model will be displayed on screen, and printed to an error message file called *error.out*. For a normal OCD run, the model execution will be terminated after the occurrence of the first fatal error. For an OCD test run, the model will validate all user inputs specified in the control file and generate all relevant error messages, if any. The error message informs the user why an error has occurred, and when applicable, provides suggested solutions.

The new OCD model (OCD/5) now generates roughly 70 error messages, versus less than 20 error messages generated by the previous version of the model (OCD/4).

3.2.7 Ancillary Output Listing File (*extra.out*)

As an option, the OCD model can also generate a secondary output listing file called *extra.out*. The file contains the following information for each stack-receptor pair and each hour modeled for which the plume's lateral miss distance is not extremely large (i.e., non-zero concentration was predicted):

- Julian day (DAY)
- Hour (HR)
- Source number (SR)
- Receptor number (RC)
- Receptor downwind distance from source (X, km)
- Receptor crosswind distance from source (Y, km)
- Terrain elevation relative to the water surface at receptor location (ZER, m)
- Plume height above receptor (H, m)
- Plume height above surface (HA, m)
- Distance from source to shoreline closest to receptor (XLAND, km)
- Distance from virtual source to receptor (XSR, km)
- Distance from source to receptor (XD, km)
- Distance plume must travel from shoreline before encountering the thermal internal boundary layer (TIBL) (XTIBL, km)
- Height of the sloping TIBL at receptor (HT, m)
- Lateral dispersion coefficient at receptor (SY, m)
- Vertical dispersion coefficient at receptor (SZ, m)
- Mixing height at receptor (HLR, m)
- Virtual Y distance (VIRTY, km)
- Virtual Z distance (VIRTZ, km)
- Distance from source to where plume enters the TIBL (XL, km)
- Flag indicating whether the plume is in the TIBL (T, 1=yes, 0=no)
- Flag indicating which method is used to calculate fumigation (I, 1=virtual source method, 0=Turner's method) (see DiCristofaro and Hanna, 1989)
- Predicted concentration at receptor (CHI, $\mu g/m^3$)

3.2.8 Binary Concentration File (*conc.bin*)

As an option, the OCD model will generate a binary concentration file called *conc.bin* that includes hourly meteorological information and predicted concentration at each receptor. The format for the *conc.bin* file is shown in Table 3-17. (Note that since the OCD model arbitrarily sets the overland and overwater wind directions equal to each other, there are no separate overland and overwater wind direction data written to the *conc.bin* file.) This file is to be used by the ANALYSIS postprocessor (see Section 3.3) to further analyze the results predicted by the OCD model.

The format for the *conc.bin* file generated by the new OCD model (OCD/5) is different from that generated by OCD/4, in that the information about the run title, the receptor locations, and the overland meteorological conditions is now included.

Table 3-17.
Format for Binary Hourly Concentration File (*conc.bin*) Generated by OCD [1]

Header Record 1		
Type	Number	Description
character*80	3	Run title, three lines, each line up to 80 characters long
Header Record 2		
Type	Number	Description
integer	1	Number of receptors (NRECPT)
real	2×NRECPT	NRECPT pairs of x- and y-coordinates for each receptor; (x_1, y_1), (x_2, y_2), etc.
Data records (one per hour)		
Type	Number	Description
real	7	Meteorological conditions for the hour, including, in the following order, (1) overwater mixing height (m); (2) wind direction from which the wind blows (deg; recall that the OCD model arbitrarily sets the land and sea wind directions equal to each other); (3) inferred overwater stability class; (4) overwater wind speed (m/s); (5) overland mixing height (m); (6) overland stability class; and (7) overland wind speed (m/s)
real	NRECPT	Predicted concentration (g/m^3) at each receptor

[1] Note that the format for this file has been modified from the previous version of the OCD model (OCD/4).

3.3 ANALYSIS Postprocessor Program

After a sequential OCD model run, the resultant binary file of predicted concentrations (see Section 3.2.8) can be processed by one or more of the modules in the ANALYSIS postprocessor program. The six modules included in ANALYSIS are as follows:

TOPVAL	Displays for each receptor the top N X-hour (block) average concentrations, together with the day and hour of occurrence. The TOPVAL module also generates a separate file called *ana.top* that includes the locations and values of the top N X-hour average concentrations for *all averaging periods*. The information is in turn used by the GUI to produce the top concentration map for *an averaging period specified by the user* (see Section 4.6.8).
CUMFRQ	Tabulates for each receptor the cumulative frequencies of X-hour (block) average concentrations. The user-specified concentration levels denote upper bounds, and the program calculates the percentages of concentrations less than or equal to the levels. CUMFRQ also prints out for each receptor the average concentration over the entire run.
PEAK	Tabulates for each receptor all X-hour (block) average concentrations, together with the corresponding meteorological conditions, where a specified threshold value was exceeded. The PEAK module also generates a separate file called *ana.pek* that includes the locations and values of the X-hour average concentrations that exceeded a certain threshold value for *all averaging periods*. The information is in turn used by the GUI to produce the exceedance map for *an averaging period specified by the user* (see Section 4.6.9).
EXTRCT	Extracts the X-hour (block) average concentrations from the binary file for *an averaging period* specified by the user, and then writes out the data in fixed-width ASCII format so that concentration isopleths can be generated by independent plotting software.
AVERGE	Calculates X-hour running average concentrations, and then writes out the average concentrations to a new binary file similar to the input file.
SEQADD	Reads up to 12 binary concentration files, synchronized in time, and adds hourly concentrations from each file. A scaling factor can be applied to each data set independently before the data are merged. The merged hourly concentrations are written to a new binary file similar to the input files.

Any combinations of the TOPVAL, CUMFRQ, PEAK, and EXTRCT modules can be applied in a single ANALYSIS run. However, the AVERGE and SEQADD modules must be applied individually. There is a logical order of application for the six modules listed above. The following rule is suggested:

SEQADD

↓

AVERGE

↓

TOPVAL, CUMFRQ, PEAK, and EXTRCT

In other words, it is recommended that contributions from all sources be first merged (if there are multiple sources of interest), running averages be performed (if necessary), and then the resultant predicted concentrations be analyzed.

The following input and output files can be involved in the execution of the ANALYSIS postprocessor:

ana.dat	User control file.
conc01.bin - *conc12.bin*	Input binary concentration files previously generated by the OCD model or the ANALYSIS postprocessor. All modules, except SEQADD, accept only one concentration file, conc01.bin. The SEQADD module can accept up to 12 concentration files. For example, if the concentrations from three binary files are to be merged by SEQADD, then the input binary files are conc01.bin, conc02.bin, and conc03.bin.
ana.out	Output listing file.
avconc.bin	Output binary concentration file generated by the AVERGE module. The file in turn can be used as input (i.e., the conc01.bin file) to other modules.
sqconc.bin	Output binary concentration file generated by the SEQADD module. The file in turn can be used as input (i.e., the conc01.bin file) to other modules.
ana.pek	Output file generated by the PEAK module. The file includes the locations and values of exceedances for X-hour average concentrations. The information is used by the GUI to generate exceedance maps (see Section 4.6.9).
ana.top	Output file generated by the TOPVAL module. The file includes the locations and values of top N X-hour average concentrations. The information is used by the GUI to generate top concentration maps (see Section 4.6.8).
ana.plt	Output file generated by the EXTRCT module. The file includes predicted concentrations at all receptors for a specified X-hour period.

The information can be used by external plotting software to generate contour plots.

As mentioned before, in order to simplify the interaction between the GUI program and the ANALYSIS postprocessor, the names of the above files are all hardwired in the code. Therefore, it is strongly recommended that the user prepare the data files using different names, and then let the file management feature of the GUI copy the files, or manually copy the files, before running the ANALYSIS postprocessor.

Control file inputs for the TOPVAL, CUMFRQ, PEAK, EXTRCT, AVERGE, and SEQADD modules of the ANALYSIS postprocessor are described in Tables 3-18 through 3-23, respectively. Since any combinations of the TOPVAL, CUMFRQ, PEAK, and EXTRCT modules are acceptable, the inputs for the four modules can be freely combined in any order. Table 3-24 shows a sample control file, *ana.dat*, for ANALYSIS where the inputs for the TOPVAL, CUMFRQ, PEAK, and EXTRCT modules are included. Since the AVERGE and SEQADD modules must be run individually, their corresponding inputs (Tables 3-22 and 3-23) cannot simultaneously appear with the inputs for any other modules in the *ana.dat* file. The formats for the *ana.pek, ana.top,* and *ana.plt* files generated by the PEAK, TOPVAL, and EXTRCT modules are shown in Tables 3-25 through 3-27, respectively. The samples for the *ana.pek, ana.top,* and *ana.plt* files are shown in Tables 3-28 through 3-30, respectively.

The maximum number of receptors allowed in ANALYSIS is currently set at 2000. The limit is defined by a single statement,

```
MAXREC=2000
```

in the FORTRAN code of ANALYSIS, and can be easily changed by the user. (Code recompilation is required.) When using the TOPVAL module, the product of the number of receptors (NR) for the current case and the number of top concentration levels desired (NM) cannot be greater than 50000. For example, if there are 500 receptors included in the current run, then the maximum number of top concentrations reported by the TOPVAL module for each receptor cannot be greater than 50000/500 = 100. The maximum of the product of NR×NM is defined by a single statement,

```
MAXPROD=50000
```

in the FORTRAN code of ANALYSIS, and can be easily changed by the user. (Code recompilation is required.)

Table 3-18.
Control file (*ana.dat*) for TOPVAL Module of ANALYSIS Postprocessor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	KEY	character	*TOPVAL*, the keyword for the TOPVAL module; must appear in columns 1 through 6
2	1	LP	integer	Number of records in an averaging period, $1 \leq LP \leq 24$
	2	NH	integer	Number of hours represented by each record of the input binary file (> 0, should = 1 for most applications)
	3	NM	integer	Number of topmost average values to be printed for each receptor, $0 < NM \times NR \leq 50000$, where NR is the number of receptors.
	4	LM	integer	Number of topmost average values to be printed for each averaging period, $0 < LM \leq NR$, where NR is the number of receptors
	5	DAYIN	real	Number of days to be read; if DAYIN = 0. and HOURIN = 0. (see below), the complete input binary file will be processed. If DAYIN and HOURIN are not both zero, then the data for the first ($DAYIN \times 24 + HOURIN$) hours in the input binary file will be processed.
	6	HOURIN	real	Number of hours to be read; if HOURIN = 0. and DAYIN = 0. (see above), the complete input binary file will be processed. If DAYIN and HOURIN are not both zero, then the data for the first ($DAYIN \times 24 + HOURIN$) hours in the input binary file will be processed.
	7	RFACT	real	The factor that converts internal concentration unit (g/m^3) to external units for printing (> 0). For example, RFACT = 1000000 to convert g/m^3 to $\mu g/m^3$; assume an ambient temperature of 300 K, then RFACT = 384000 to convert g/m^3 to ppb for SO_2, RFACT = 879000 to convert g/m^3 to ppb for CO, RFACT = 820000 to convert g/m^3 to ppb for NO, and RFACT = 535000 to convert g/m^3 to ppb for NO_2.
	8	SCALE	real	The scaling factor for input concentrations (> 0). Use 1.0 if no scaling is desired.
	9	UNITS	character	Label for external concentration units, cannot be longer than 20 characters and must be enclosed in apostrophes, for example, ‘ug/m**3’ or ‘ppb’.

[1] The file is read with free-format. The above inputs for the TOPVAL module can be combined with the inputs for the CUMFRQ, PEAK, and EXTRCT modules.

Table 3-19.
Control file (*ana.dat*) for CUMFRQ Module of ANALYSIS Postprocessor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	KEY	character	*CUMFRQ*, the keyword for the CUMFRQ module; must appear in columns 1 through 6
2	1	LP	integer	Number of records in an averaging period, $1 \leq LP \leq 24$
	2	NH	integer	Number of hours represented by each record of the input binary file (> 0, should = 1 for most applications)
	3	DAYIN	real	Number of days to be read; if DAYIN = 0. and HOURIN = 0. (see below), the complete input binary file will be processed. If DAYIN and HOURIN are not both zero, then the data for the first (DAYIN×24 + HOURIN) hours in the input binary file will be processed.
	4	HOURIN	real	Number of hours to be read; if HOURIN = 0. and DAYIN = 0. (see above), the complete input binary file will be processed. If DAYIN and HOURIN are not both zero, then the data for the first (DAYIN×24 + HOURIN) hours in the input binary file will be processed.
	5	RFACT	real	The factor that converts internal concentration unit (g/m^3) to external units for printing (> 0). For example, RFACT = 1000000 to convert g/m^3 to $\mu g/m^3$; assume an ambient temperature of 300 K, then RFACT = 384000 to convert g/m^3 to ppb for SO_2, RFACT = 879000 to convert g/m^3 to ppb for CO, RFACT = 820000 to convert g/m^3 to ppb for NO, and RFACT = 535000 to convert g/m^3 to ppb for NO_2.
	6	SCALE	real	The scaling factor for input concentrations (> 0). Use 1.0 if no scaling is desired.
	7	NLEV	integer	Number of concentration levels, $0 < NLEV \leq 20$
	8	UNITS	character	Label for external concentration units, cannot be longer than 20 characters and must be enclosed in apostrophes, for example, 'ug/m**3' or 'ppb'.
3	1 - NLEV	LEV	real	NLEV concentration levels in external units (> 0). The concentration level denotes an upper bound, and the program calculates the percentage concentrations less than or equal to that value.

[1] The file is read with free-format. The above inputs for the CUMFRQ module can be combined with the inputs for the TOPVAL, PEAK, and EXTRCT modules.

Table 3-20.
Control file (*ana.dat*) for PEAK Module of ANALYSIS Postprocessor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	KEY	character	*PEAK*, the keyword for the PEAK module; must appear in columns 1 through 4
2	1	LP	integer	Number of records in an averaging period, $1 \leq LP \leq 24$
	2	NH	integer	Number of hours represented by each record of the input binary file (> 0, should = 1 for most applications)
	3	THR	real	Threshold concentration in external units (> 0)
	4	DAYIN	real	Number of days to be read; if DAYIN = 0. and HOURIN = 0. (see below), the complete input binary file will be processed. If DAYIN and HOURIN are not both zero, then the data for the first (DAYIN×24 + HOURIN) hours in the input binary file will be processed.
	5	HOURIN	real	Number of hours to be read; if HOURIN = 0. and DAYIN = 0. (see above), the complete input binary file will be processed. If DAYIN and HOURIN are not both zero, then the data for the first (DAYIN×24 + HOURIN) hours in the input binary file will be processed.
	6	RFACT	real	The factor that converts internal concentration unit (g/m^3) to external units for printing (> 0). For example, RFACT = 1000000 to convert g/m^3 to $\mu g/m^3$; assume an ambient temperature of 300 K, then RFACT = 384000 to convert g/m^3 to ppb for SO_2, RFACT = 879000 to convert g/m^3 to ppb for CO, RFACT = 820000 to convert g/m^3 to ppb for NO, and RFACT = 535000 to convert g/m^3 to ppb for NO_2.
	7	SCALE	real	The scaling factor for input concentrations (> 0). Use 1.0 if no scaling is desired.
	8	LPRINT	character	The flag to control the amount of output, must be one character in length and enclosed in apostrophes. = ‘Y’, a detailed breakdown for threshold violation is generated; = ‘N’, a summary of violation is obtained
	9	UNITS	character	Label for external concentration units, cannot be longer than 20 characters and must be enclosed in apostrophes, for example, ‘ug/m**3’ or ‘ppb’.

[1]The file is read with free-format. The above inputs for the PEAK module can be combined with the inputs for the TOPVAL, CUMFRQ, and EXTRCT modules.

Table 3-21.
Control file (*ana.dat*) for EXTRCT Module of ANALYSIS Postprocessor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	KEY	character	*EXTRCT*, the keyword for the EXTRCT module; must appear in columns 1 through 6
2	1	LP	integer	Number of records in an averaging period, $1 \le LP \le 24$
	2	NH	integer	Number of hours represented by each record of the input binary file (> 0, should = 1 for most applications)
	3	DAYEND	real	The day for the averaging period where the corresponding concentrations at each receptor are to be extracted. For example, DAYEND = 24 and HOUREND (see below) = 12 will cause the program to extract the concentration field for day 24 and hour 12. For a multiple-hour averaging period (i.e., LP > 1), DAYEND and HOUREND correspond to the last hour of the period of interest. If DAYEND and HOUREND are both zero, then the data for the last averaging period will be extracted.
	4	HOUREND	real	The hour for the averaging period where the corresponding concentrations at each receptor are to be extracted. For example, DAYEND (see above) = 24 and HOUREND = 12 will cause the program to extract the concentration field for day 24 and hour 12. For a multiple-hour averaging period (i.e., LP > 1), DAYEND and HOUREND correspond to the last hour of the period of interest. If DAYEND and HOUREND are both zero, then the data for the last averaging period will be extracted.
	5	RFACT	real	The factor that converts internal concentration unit (g/m^3) to external units for printing (> 0). For example, RFACT = 1000000 to convert g/m^3 to $\mu g/m^3$; assume an ambient temperature of 300 K, then RFACT = 384000 to convert g/m^3 to ppb for SO_2, RFACT = 879000 to convert g/m^3 to ppb for CO, RFACT = 820000 to convert g/m^3 to ppb for NO, and RFACT = 535000 to convert g/m^3 to ppb for NO_2.
	6	SCALE	real	The scaling factor for input concentrations (> 0). Use 1.0 if no scaling is desired.
	7	UNITS	character	Label for external concentration units, cannot be longer than 20 characters and must be enclosed in apostrophes, for example, ‘ug/m**3’ or ‘ppb’.

[1]The file is read with free-format. The above inputs for the EXTRCT module can be combined with the inputs for the TOPVAL, CUMFRQ, and PEAK modules.

Table 3-22.
Control file (*ana.dat*) for AVERGE Module of ANALYSIS Postprocessor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	KEY	character	*AVERGE*, the keyword for the AVERGE module; must appear in columns 1 through 6
2	1	N	integer	The averaging period, in hours, where moving average is performed, $1 < N \leq 24$

[1]The file is read with free-format. The above inputs for the AVERGE module *cannot* be combined with the inputs for any other modules, including TOPVAL, CUMFRQ, PEAK, EXTRCT, and SEQADD. If the input binary concentration file contains M hourly records, then the new binary concentration file will contain M-N+1 hourly records, each record corresponds to an N-hour moving average.

Table 3-23.
Control file (*ana.dat*) for SEQADD Module of ANALYSIS Postprocessor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	KEY	character	*SEQADD*, the keyword for the SEQADD module; must appear in columns 1 through 6
2	1	N	integer	Number of binary concentration files to be scaled and merged, $1 \leq N \leq 12$
3	1 - N	SCALE	real	Scaling factor for each respective binary concentration file, > 0. (Use 1.0 if no scaling is desired.) Concentrations are multiplied by the scaling factor for that file before being merged.

[1] The file is read with free-format. The above inputs for the SEQADD module *cannot* be combined with the inputs for any other modules, including TOPVAL, CUMFRQ, PEAK, EXTRCT, and AVERGE.

Table 3-24.

Sample User Control File (*ana.dat*) for ANALYSIS Postprocessor, Where the TOPVAL, CUMFRQ, PEAK, and EXTRCT Modules are Selected. The Inputs for the Modules Can be in Any Order.

```
TOPVAL
 3   1   12   5   0.   0.   1000000.   1.  'ug/m**3'
CUMFRQ
 3   1   0.   0.   1000000.   1.   3  'ug/m**3'
 10.   20.   30.
PEAK
 3   1   80.   0.   0.   1000000.   1.  'Y'  'ug/m**3'
EXTRCT
 3   1   2.   12.   1000000.   1.   'ug/m**3'
```

Table 3-25.
Output File (*ana.pek*) Created by PEAK Module of ANALYSIS Processor,
Used by GUI to Generate Exceedance Maps

Record no.	Variable no.	Variable	Type	Description
1	1	LINE1	character	Line 1 of the run title, up to 80 characters
2	1	LINE2	character	Line 2 of the run title, up to 80 characters
3	1	LINE3	character	Line 3 of the run title, up to 80 characters
4	1	NREC	integer	Number of receptors
The next record is repeated NREC times, one for each receptor				
	1	I	integer	Counter for receptor I (1 - NREC)
	2	X	real	x-coordinate of receptor I, user units
	3	Y	real	y-coordinate of receptor I, user units
The next set of (1+NEX) records is repeated for each averaging period where exceedances were predicted				
K	1	IDAY	integer	Day for the averaging period
K	2	IHR	integer	Hour for the averaging period (the last hour for a multi-hour averaging period)
K	3	NEX	integer	Number of receptors that showed exceedances
K	4	THR	real	Threshold concentration level, user units (see Table 3-20)
K	5	UNITS	character	Units for the threshold concentration, up to 20 characters
K	6	IHW	integer	Overwater mixing height for the averaging period, m
K	7	IWD	integer	Wind direction for the averaging period, deg (Once the data are read in and assimilated, OCD does not keep track of individual overwater and overland wind directions.)
K	8	ISTW	integer	Overwater stability class for the averaging period
K	9	WSW	real	Overwater wind speed for the averaging period, m/s
K	10	IHL	integer	Overland mixing height for the averaging period
K	11	ISTL	integer	Overland stability class for the averaging period
K	12	WSL	real	Overland wind speed for the averaging period, m/s
K+1	1	J	integer	Receptor number (this record of two data values is repeated NEX times)
K+1	2	CONC	real	Concentration at receptor J, user units (see Table 3-20) (this record of two data values is repeated NEX times)

Table 3-26.
Output File (*ana.top*) Created by TOPVAL Module of ANALYSIS Processor,
Used by GUI to Generate Exceedance Maps

Record no.	Variable no.	Variable	Type	Description
1	1	LINE1	character	Line 1 of the run title, up to 80 characters
2	1	LINE2	character	Line 2 of the run title, up to 80 characters
3	1	LINE3	character	Line 3 of the run title, up to 80 characters
4	1	NREC	integer	Number of receptors
The next record is repeated NREC times, one for each receptor				
	1	I	integer	Counter for receptor I (1 - NREC)
	2	X	real	x-coordinate of receptor I, user units
	3	Y	real	y-coordinate of receptor I, user units
The next set of (1+NTOP) records is repeated for each averaging period				
K	1	IDAY	integer	Day for the averaging period
K	2	IHR	integer	Hour for the averaging period (the last hour for a multi-hour averaging period)
K	3	NTOP	integer	Number of top concentrations to be displayed
K	4	UNITS	character	Units for the threshold concentration, up to 20 characters
K	5	IHW	integer	Overwater mixing height for the averaging period, m
K	6	IWD	integer	Wind direction for the averaging period, deg (Once the data are read in and assimilated, OCD does not keep track of individual overwater and overland wind directions.)
K	7	ISTW	integer	Overwater stability class for the averaging period
K	8	WSW	real	Overwater wind speed for the averaging period, m/s
K	9	IHL	integer	Overland mixing height for the averaging period
K	10	ISTL	integer	Overland stability class for the averaging period
K	11	WSL	real	Overland wind speed for the averaging period, m/s
K+1	1	J	integer	Receptor number (this record of two data values is repeated NTOP times)
K+1	2	CONC	real	Concentration at receptor J, user units (see Table 3-18) (this record of two data values is repeated NTOP times)

Table 3-27.
Output File (*ana.plt*) Created by EXTRCT Module of ANALYSIS Processor[1]

Record no.	Variable no.	Variable	Type	Description
1	1	LINE1	character	Line 1 of the run title, up to 80 characters
2	1	LINE2	character	Line 2 of the run title, up to 80 characters
3	1	LINE3	character	Line 3 of the run title, up to 80 characters
4	1	IDAY	integer	Day for the user-specified averaging period
4	2	IHR	integer	Hour for the user-specified averaging period (the last hour for a multi-hour averaging period)
4	3	NREC	integer	Number of receptors
The next record is repeated NREC times, one for each receptor				
	1	X	real	x-coordinate of receptor, user units
	2	Y	real	y-coordinate of receptor, user units
	3	CONC	real	Concentration at receptor, user units

[1] Except for the first three records, each data value in this file occupies 14 columns. As a result, this file can be read by external software packages accepting a fixed-width or space-delimited data structure.

Table 3-28.

Sample *ana.pek* File Generated by the PEAK Module of the ANALYSIS Postprocessor

```
OCD Test Case
Line 2 of run title
Line 3 of run title
          28
           1    270.627        3807.49
           2    270.718        3807.46
           3    270.801        3807.43
           4    270.884        3807.39
           5    270.966        3807.34
           6    271.054        3807.29
           7    271.139        3807.24
           8    271.239        3807.19
           9    271.314        3807.15
          10    271.403        3807.10
          11    271.484        3807.05
          12    271.576        3807.01
          13    271.653        3806.96
          14    272.000        3806.54
          15    270.596        3807.56
          16    270.813        3807.49
          17    271.060        3807.36
          18    271.202        3807.28
          19    271.508        3807.20
          20    271.411        3807.49
          21    271.472        3807.47
          22    271.547        3807.41
          23    271.636        3807.38
          24    271.758        3807.35
          25    272.006        3807.39
          26    272.437        3807.37
          27    271.682        3807.33
          28    271.893        3807.22
    1 12      1      80.0000     'ug/m**3'  500  206    5  1.5  500    1  1.6
         16     88.6809
    2  3      5      80.0000     'ug/m**3'  500  240    6  1.8  500    2  1.7
          2   122.5085
          3   158.7302
          4   159.4163
         16    90.4808
         18   101.2329
    2  6      7      80.0000     'ug/m**3'  500  167    6  1.2  500    2  2.4
          2   251.5861
          3   387.9255
          4   460.7136
          5   104.1763
         15   115.6458
         16   238.3165
         17   162.4228
```

Table 3-29.

Sample *ana.top* File Generated by the TOPVAL Module of the ANALYSIS Postprocessor

```
OCD Test Case
Line 2 of run title
Line 3 of run title
          28
           1     270.627        3807.49
           2     270.718        3807.46
           3     270.801        3807.43
           4     270.884        3807.39
           5     270.966        3807.34
           6     271.054        3807.29
           7     271.139        3807.24
           8     271.239        3807.19
           9     271.314        3807.15
          10     271.403        3807.10
          11     271.484        3807.05
          12     271.576        3807.01
          13     271.653        3806.96
          14     272.000        3806.54
          15     270.596        3807.56
          16     270.813        3807.49
          17     271.060        3807.36
          18     271.202        3807.28
          19     271.508        3807.20
          20     271.411        3807.49
          21     271.472        3807.47
          22     271.547        3807.41
          23     271.636        3807.38
          24     271.758        3807.35
          25     272.006        3807.39
          26     272.437        3807.37
          27     271.682        3807.33
          28     271.893        3807.22
    1  3      5      'ug/m**3'  500  246    5  2.9  500    3  2.4
     17      54.0350
     12      40.4781
     11      37.1614
     19      22.7977
     28      21.5740
    1  6      5      'ug/m**3'  500  190    3  2.9  500    3  2.4
      5      13.1387
      1      12.2117
     15       9.0278
      2       7.6600
     11       7.5207
    1  9      5      'ug/m**3'  500  226    2  2.2  500    2  2.3
      4      30.5679
      3      28.0185
      5      26.6587
     11      26.0826
      2      26.0452
    1 12      5      'ug/m**3'  500  206    5  1.5  500    1  1.6
     16      88.6809
      3      76.3412
      4      70.9604
      2      70.1762
     15      39.1569
    1 15      5      'ug/m**3'  500  215    6  1.9  500    2  2.2
     17      68.3453
     16      53.2825
     19      43.3572
     18      42.3540
     11      28.2061
```

Table 3-30.

Sample *ana.plt* File Generated by the EXTRCT Module of the ANALYSIS Postprocessor

```
OCD Test Case
Line 2 of run title
Line 3 of run title
           2            12            28
    270.6270     3807.4880       23.6135
    270.7180     3807.4641       42.8697
    270.8010     3807.4290       33.6910
    270.8840     3807.3870       20.9863
    270.9660     3807.3391       40.0182
    271.0540     3807.2920       60.1101
    271.1390     3807.2439       42.2037
    271.2390     3807.1851       36.0497
    271.3140     3807.1489       57.3087
    271.4030     3807.1011       42.8246
    271.4840     3807.0540       17.1018
    271.5760     3807.0120       51.7638
    271.6530     3806.9600       52.3023
    272.0000     3806.5420        0.0000
    270.5960     3807.5649       13.5280
    270.8130     3807.4880       34.2276
    271.0600     3807.3630       53.8203
    271.2020     3807.2800       48.1867
    271.5080     3807.1990       33.1250
    271.4110     3807.4939       47.1582
    271.4720     3807.4719       51.2332
    271.5470     3807.4131       50.5956
    271.6360     3807.3811       36.7917
    271.7580     3807.3511       19.7793
    272.0060     3807.3940       17.7043
    272.4370     3807.3730       14.6235
    271.6820     3807.3311       25.1929
    271.8930     3807.2200       32.0648
```

The TOPVAL, CUMFRQ, PEAK, and EXTRCT modules can calculate X-hour ($1 < X \le 24$) block average concentrations, if necessary. The AVERGE module can calculate X-hour ($1 < X \le 24$) running average concentrations, if necessary. For example, if the input binary file contains 36 hourly records, then 34 new hourly record, each record corresponding to an X-hour moving average, will be created by the AVERGE module, and written to the *avconc.bin* file.

The TOPVAL, CUMFRQ, and PEAK modules allow the user to process only the beginning segment of the *conc01.bin* file through the variables DAYIN and HOURIN. The total number of hours, NTOT, of data to be read and processed by the three modules is calculated as:

```
NTOT = 24 × DAYIN + HOURIN
```

For example, if the user wishes to process only the data for Julian days 1 through 30 for a one-year run, then DAYIN = 30 and HOURIN = 0 should be specified. DAYIN = 0 and HOURIN = 0 mean that the whole file will be read and processed. If the averaging period does not evenly divide into the total number of hours to be processed, the program will automatically complete the period by including the next available hours. For example, if the user specifies that 37 hours of data are to be processed, and that 3-hour averages are to be calculated, then the program will automatically read in additional two hours of data (hours 38 and 39), if available, so that the last averaging period can be completed.

For the EXTRCT module, the user is required to specify the day (DAYEND) and hour (HOUREND) for the time period where the corresponding binary concentration data are to be extracted and written to an external ASCII file called *ana.plt*. For a multiple-hour averaging period, DAYEND and HOUREND refer to the last hour of the averaging period. For example, for 8-hour averages, DAYEND = 10 and HOUREND = 16 means that the average concentrations between hours 9 and 16 in day 10 will be extracted and written to the *ana.plt* file. DAYEND = 0 and HOUREND = 0 mean that the concentration data for the last period will be extracted.

In order to run the PEAK module, the user has to specify a threshold concentration value (THR). The value of THR should be chosen with care, otherwise, massive output will be generated by the program. The results yielded by the CUMFRQ module can be used as a screening tool to determine the appropriate value for THR.

3.4 Summary of File I/O for OCD and Processor Programs

Sections 3.1, 3.2, and 3.3 provide user's instructions for the preprocessor programs (OCD4TO5, OCDPRO, MAKEGEO, and MAKEUTM), the OCD model, and the postprocessor program (ANALYSIS), respectively. It is evident that a successful application of the OCD model, including the pre-processing and post-processing stages, depends on a seamless interaction among a large number of data files. Therefore, it would be helpful to summarize the file I/O for the OCD model and the associated processor programs, in order to provide a concise overview for the user. Such a summary is presented in Table 3-31. Different key letters were used to indicate whether the files are input (I), output (O), mandatory (M), conditional (C), ASCII (A), or binary (B). Furthermore, the key letters "E" and "N" were also used to indicate whether the files can be edited by the user, or normally not to be edited by the user, respectively.

As mentioned before, in order to simplify the interaction between the GUI program and the OCD model and the processor programs, the names of the above files are all hardwired in the code. Therefore, it is strongly recommended that the user prepare the data files using different names, and then let the file management feature of the GUI copy the files, or manually copy the files, before running any program.

Note that in Table 3-31 there are files of the same type, but appear in different places under different names. For example, the *lmet.dat* file used to run OCD and the *lmetpro.dat* file used to run OCDPRO are in fact the same overland meteorological data file. Therefore, the user only needs to prepare one overland meteorological data file called, for example, *logan97.dat*. When OCDPRO is run, the GUI will automatically copy *logan97.dat* to *lmetpro.dat*. When OCD is run, the GUI will automatically copy *logan97.dat* to *lmet.dat*. As another example, the *conc.bin* file generated by OCD and the *conc01.bin* file to be input to ANALYSIS are also in fact the same binary concentration file. Assume the user wishes to name the concentration file *logan97.bin*, then after OCD is run, the GUI will automatically copy *conc.bin* to *logan97.bin*, and before ANALYSIS is run, the GUI will automatically copy *logan97.bin* to *conc01.bin*.

Table 3-31.
Summary of File I/O for the OCD Model and Supporting Processors. The Following Key Letters Are Used to Indicate File Attributes: I - Input, O - Output, M - Mandatory, C - Conditional, A - ASCII (Formatted), B - Binary (Unformatted), E - Can be Edited by the User, and N - Normally Not to be Edited by the User.

File	Descriptions	Attributes
OCD - Dispersion Model		
input.dat	Control file, self-documented	I,M,A,E
wmet.dat	Overwater meteorological data file	I,M,A,E
lmet.dat	Overland meteorological data file (can be either ASCII or binary depending on user option)	I,C,A/B,E
emis.dat	Hourly emission file	I,C,A,E
ocd.out	Output listing file	O,M,A,N
error.out	Error message file	O,M,A,N
extra.out	Secondary output summary file	O,C,A,N
conc.bin	Hourly concentration file	O,C,B,N
OCD4TO5 - Input Conversion Program		
ocd4inpt.dat	Control file for OCD/4	I,M,A,E
ocd5inpt.dat	Control file for OCD/5, same format as *input.dat* above	O,M,A,E
OCDPRO - Overwater Meteorological Data Processor		
ocdpro.dat	Control file	I,M,A,E
wmetin.dat	Overwater meteorological data file (possibly with missing data), same format as *wmet.dat* above	I,M,A,E
lmetpro.dat	Overland meteorological data file, same format as *lmet.dat* above	I,M,A,E
ocdpro.out	Output listing file	O,M,A,N
wmetout.dat	Overwater meteorological data file (no missing data), same format as *wmet.dat* above	O,M,A,E
MAKEGEO - Shoreline Data Processor		
makegeo.dat	Control file	I,M,A,E
west.bin	Shoreline data file for the Pacific Coast	I,M,B,N
gom.bin	Shoreline data file for the Gulf of Mexico	I,M,B,N
east.bin	Shoreline data file for the Atlantic Coast	I,M,B,N
alaska.bin	Shoreline data file for the Alaska Coast	I,M,B,N
makegeo.shr	Shoreline geometry data file for the model domain, to be directly included in *input.dat* as Input Group 16	O,M,A,N
makegeo.ref	UTM coordinates and zone for the origin of the modeling domain (to be used by MAKEUTM to convert receptor and source locations in latitudes and longitudes to user coordinates)	O,M,A,N
makegeo.car	Cartesian receptor network information for the model domain, to be directly included in *input.dat* as Input Group 11 (a 20×20 Cartesian receptor network will be set up to cover the entire model domain)	O,M,A,E

Table 3-31 (Continued).

MAKEUTM - Source and Receptor Data Processor		
makeutm.inp	Source or receptor information, where the coordinates must be in latitudes and longitudes	I,M,A,E
makegeo.ref	UTM coordinates and zone for the origin of the modeling domain (to be used to convert receptor and source locations in latitudes and longitudes to user coordinates)	I,M,A,N
makeutm.out	Source or receptor data, to be directly included in *input.dat* as Input Group 6 or 13	O,M,A,E
ANALYSIS - Post-processor		
ana.dat	Control file	I,M,A,E
conc01.bin - conc12.bin	Hourly concentration files, same format as *conc.bin* above. All modules, except SEQADD, of ANALYSIS accepts only one concentration file, *conc01.bin*. The SEQADD module can accept up to 12 concentration files	I,M,B,N
ana.out	Output listing file	O,M,A,N
avconc.bin	Hourly concentration file generated by the AVERGE module, same format as *conc.bin* above	O,C,B,N
sqconc.bin	Hourly concentration file generated by the SEQADD module, same format as *conc.bin* above	O,C,B,N
ana.pek	Locations and values of concentration exceedances for X-hour average, generated by the PEAK module and used by GUI to prepare exceedance maps	O,C,A,N
ana.top	Locations and values of top N concentrations for X-hour average, generated by the TOPVAL module and used by GUI to prepare top-concentration maps	O,C,A,N
ana.plt	Concentrations at all receptors for X-hour average at a specified time, generated by the EXTRCT module and can be used by external plotting software to generate contour plots	O,C,A,E

4. User's Instructions for the GUI

This section provides user's instructions for the graphical user interface (GUI) for the OCD dispersion model and the supporting processor programs. As mentioned earlier, the GUI is not required to run the OCD model. However, the GUI provides a more user-friendly environment with on-line help, map displays, and better error checking. The user is referred to Section 3 for the instructions for the OCD model and the processor programs.

4.1 Common User Interface Commands

This section provides a brief overview of common Windows terminology, keys, screen formats and usage.

4.1.1 Terminology

Click	to quickly press and release the mouse button.
Double-Click	to click the mouse button twice in rapid succession.
Cursor	In text boxes, the cursor is a flashing vertical line. In menus, the cursor is a reverse highlight on the current menu option.
Selection Cursor	The selection cursor (a reverse highlight or a dotted rectangle) indicates what item is selected.
Mouse Pointer	The mouse pointer usually is an arrow. It changes to an hourglass when the program is processing and the user must wait. (Note that the appearance of a mouse pointer can be customized by the user.)
Insertion Point	In text boxes, a flashing vertical line that indicates where the user's typing will appear.
Record Selector	In table screens, the record selector is the small box displayed at the left edge of each row. The user may click on this box to select the entire row (see Figure 4-11 for an example).
Command Buttons	The user can choose a command button to initiate an immediate action. The user can move the selection cursor to the desired command button and execute the corresponding command by performing one of the following: • Use the mouse to click on the button. • Use the cursor (arrow) keys or the <TAB> or <SHIFT><TAB> keys to move the highlight to the button and press <ENTER>.

The following are the major command buttons used in the GUI:

Regular Mode Command Buttons (see Figure 4-10 for an example)

- <OK>: This button accepts all the changes on the current screen. Note: changes are not written to disk until the file is saved from the File Menu.
- <Cancel>: This button aborts all the changes on the current screen.
- <Help>: This button displays on-line help for the current screen.

Sequential Mode Command Buttons (see Figure 4-6 for an example)

- <Previous>: In sequential mode, this button accepts all the changes on the current screen and proceeds to the previous screen.
- <Next>: In sequential mode, this button accepts all the changes on the current screen and proceeds to the next screen.
- <Terminate Sequential>: This button ends the sequential mode without completing the sequence of screens. The user is prompted whether to save or abort the changes on the current screen.
- <Done>: This button completes the sequential mode and returns the user to the Main Menu.

File Management Command Button (see Figure 4-9 for an example)

- <Browse...>: This button displays the Files Dialog Box (described below). Select an existing file or enter the name of a new file.

Minimize Button The down arrow for Windows 3.1, or the underscore bar for Windows 95 in the upper right corner of the screen. It is used to shrink an application to an icon. This suspends the operation of the application. To restore the application, double click the icon.

Option Buttons Option buttons display a group of mutually exclusive options. Only one option can be selected at a time. The selected option contains a filled-in dot. To select an option with the mouse, click on the desired option. To select an option with the keyboard, use <TAB> to move to the group of options and then use the arrow keys to select the option. Press <TAB> to move to the next item on the screen and keep the option selected. An example of Option Buttons is shown in Figure 4-10.

Scroll Bars Some screens contain more information than can be displayed at once (see Figure 4-16 as an example). These screens have scroll bars which move the information that is displayed.

With the mouse, do the following to scroll the displayed information:

- Click the up or down scroll arrows to move one line of data.

- Click the scroll bar above or below the scroll box to move one screen's worth of data.
- Click and hold the mouse pointer on the up or down arrow to move the screen continuously.

With the keyboard, do the following to scroll the displayed information:

- Use up or down arrow keys to move one line of data.
- Use the <PAGE UP> or <PAGE DOWN> keys to move one screen's worth of data.

Menu Bar — The menu bar lists the available menus (see Figure 4-2). To select a menu option, click on the menu name and then the menu item. To use the keyboard, press and hold the <ALT> key while typing the underlined letter in the menu name, and then type the underlined letter in the menu item.

Text Boxes — Text boxes allow the user to type in text. Position the cursor on the text box and type at the insertion point. Press <ENTER> or <TAB> when finished typing, and the cursor moves to the next item.

Check Boxes — Check boxes are options that can be individually turned on or off. If the box is empty, the option is turned off. If there is an X in the box, the option is selected. The user may select as many check-box options as needed. To turn a check box on or off with the mouse, click the check box. To change an option with the keyboard, use <TAB> to move to the checkbox and press <SPACEBAR> to select or de-select it. An example of check boxes is shown in Figure 4-12.

List Box — A list box contains a list of choices from which the user may select one or more items. To select items using the mouse, click on the items desired. To clear the selection, click on the item again. To select items using the keyboard, use the <TAB> key to move to the list box, use the arrow keys to move to the item desired, and then press <SHIFT> to select the item. Repeat the above for additional items. See Figure 4-10 for an example of list box.

Drop-Down List Box — A drop-down list box initially appears as a rectangular box with the current selection displayed. Select the down arrow at the right of the box to display the list of available choices. With the mouse, click on the arrow at the right of the box and then click on the option desired. With the keyboard, use the <TAB> key to move to the drop-down list box and press <ALT><DOWNARROW> to open the box. Then use the arrow keys to move to the item desired and press <ENTER> to select the option. An example of drop-down list box is shown in Figure 4-19.

Files Dialog Box — The files dialog box appears when the user opens, saves or selects a file. It allows the user to choose a file name in any disk drive or directory. It contains a text box for the directory and file name chosen, a file name list box, a file type drop-down list box, a disk drive drop-down list box and a directory list box. Figure 4-3 shows an example of the files dialog box. Type the directory and file name in the text box, or specify the information by using the disk drive, directory and file name list boxes as follows.

- To change the current drive with the mouse, click the down arrow at the right of the disk drive drop-down list box. Click the disk drive desired. This updates the directory and file name listings. To change the disk drive using the keyboard, press <TAB> to move to the disk drive drop-down list box and use the arrow keys to change the disk drive. Press <ENTER> when the desired drive is selected.
- To change the directory with the mouse, double click the directory name in the directory list box, and the files in that directory appear in the files list box. To change directories using the keyboard, press <TAB> to move to the directory list box, use the arrow keys to move to the directory desired, and press <ENTER>.
- To select a file with the mouse, click the file name in the file name list box. To use the keyboard to select a file, press <TAB> to move to the file name list box, and then use the arrow keys to move to the file desired.

Message Boxes

The GUI program uses pop-up message boxes to ask Yes/No questions, and to display error or informative messages. For error and informative message boxes, click <OK> or press <ENTER> to remove the message box. For Yes/No message boxes, click the appropriate button or use <TAB> to move to the button and press <ENTER>. Figure 4-30 shows an example of the message box.

4.1.2 General Program Keys

<ENTER>	Selects options in menus or dialog boxes. This key is also used for accepting the data entered in each individual field on data entry screens.
<TAB>, <SHIFT TAB>	Move between items on the data entry screens.
ARROW KEYS	Move the cursor up and down the items on the menus, and move the cursor within a data field for editing.

4.1.3 Program Keys in Tables

<ENTER>	Moves the cursor between adjacent fields on a row, and accepts the data entered in a field.
<TAB>, <SHIFT TAB>	Move the cursor between adjacent fields on a row.
ARROW KEYS	Move the cursor between adjacent data fields in a row or column.
<PAGE UP>, <PAGE DOWN>	Move the cursor up or down a page of data.
<HOME>, <END>	Move the cursor to the first or last cell in the row.
<DEL>	Deletes the current data field, or, if the entire row is selected, deletes the row of data.
To Add a Row	Move to the record selector box marked with an asterisk (see Figure 4-11), and enter the new data. As soon as the user begins to type, the record selector box will contain a pencil icon (see Figure 4-17). To save the data in this new row, click or move to another row of data. The pencil icon will disappear.

4.1.4 Screen Formats

The GUI uses three types of screens - menu selection, data entry, and graphical output display. These screens are discussed below.

4.1.4.1 Menu Screens

The GUI is a menu driven application. To perform any function, select the appropriate menu item. From the Main Menu, the user may select the six major functions (File, Input, Run, Utilities, Setup, and Help) of the software (see Figure 4-5). The Main Menu and the six major functions are discussed below in Sections 4.2 through 4.8.

4.1.4.2 Data Entry Screens

The data entry screens include titles, labeled data fields and a group of command buttons located at the bottom of the screen (see Figure 4-6 for an example). These screens receive data by loading an existing file, or manual editing by the user. Data entered manually into individual fields are accepted using the <ENTER> or <TAB> keys. Once data entry is complete, click the <OK> command button to save the data and return to the Main Menu; or, in sequential mode, click the <Next> command button to continue to the next screen. <u>Note: Data entered by the user is not saved to the disk file until the user chooses File Save from the Main Menu.</u>

4.1.4.3 Output Screens

Graphic screens display (1) the shoreline geometry together with the locations for all sources and receptors, (2) the values and locations of the top N concentrations predicted by the model (N is selected by the user), and (3) the values and locations of predicted concentrations where a certain threshold value specified by the user was exceeded (see Figure 4-45 for an example). These maps may be printed or saved as disk files.

4.2 Main Menu

When the GUI is started, the first screen displayed is the Main Menu (see Figure 4-1). This menu provides the user access to all of the GUI functions.

The General Information Screen is displayed whenever the Main Menu is active in order to provide a summary for the current OCD control file (see Section 3.2.1). This screen lists the current working directory, control file and log file names. It lists the starting time (year, day and hour) and the run length in hours for the current modeling episode. The numbers of point, area or line sources, and polar, Cartesian and discrete receptors are also displayed. As model data are changed by the user, this screen is automatically updated.

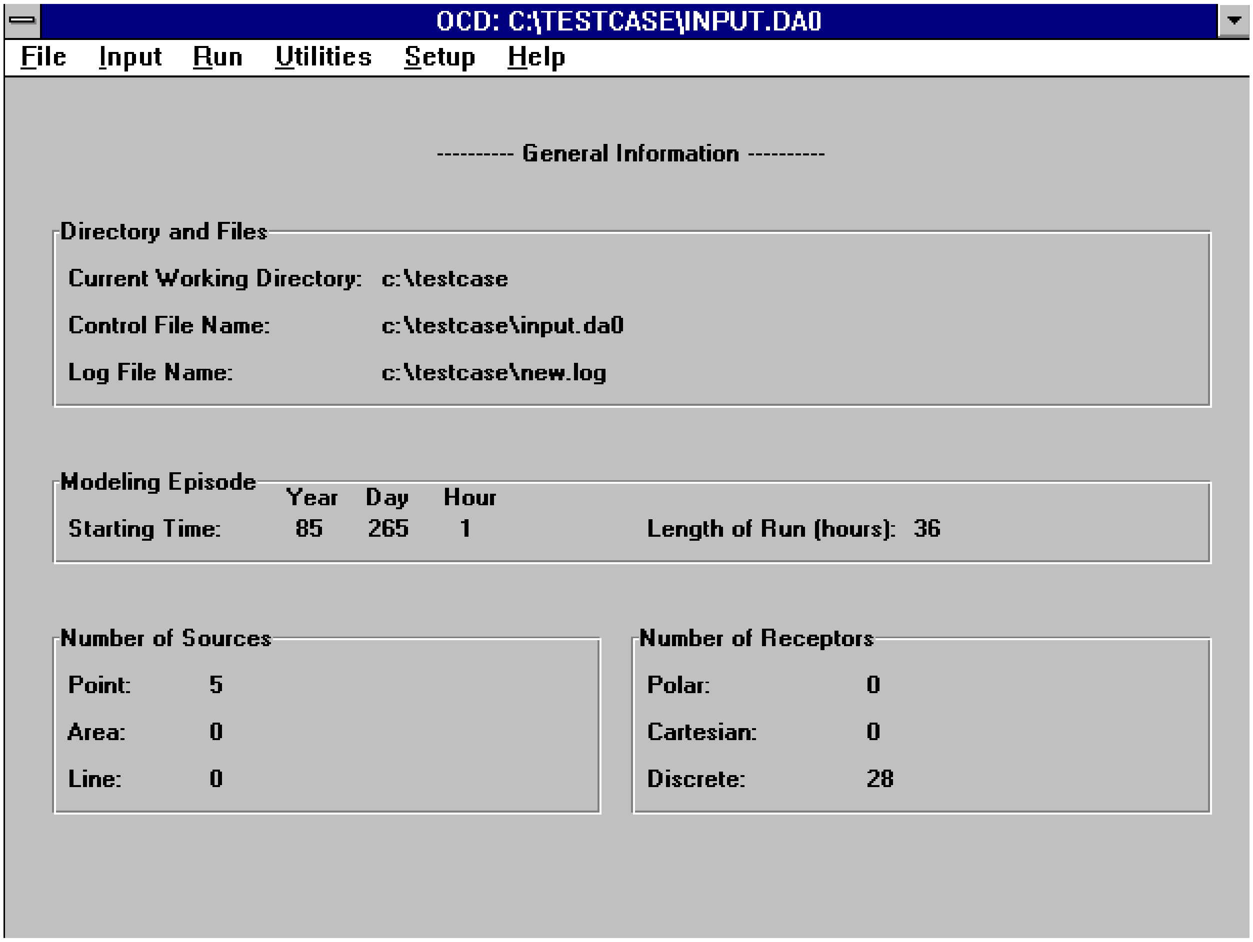


Figure 4-1. An example of the OCD Main Menu.

4.3 File Menu

The File Menu (see Figure 4-2) contains the following options for file management: New, Open, Save, Save As, and Set Working Directory. This menu also allows the user to exit the GUI program.

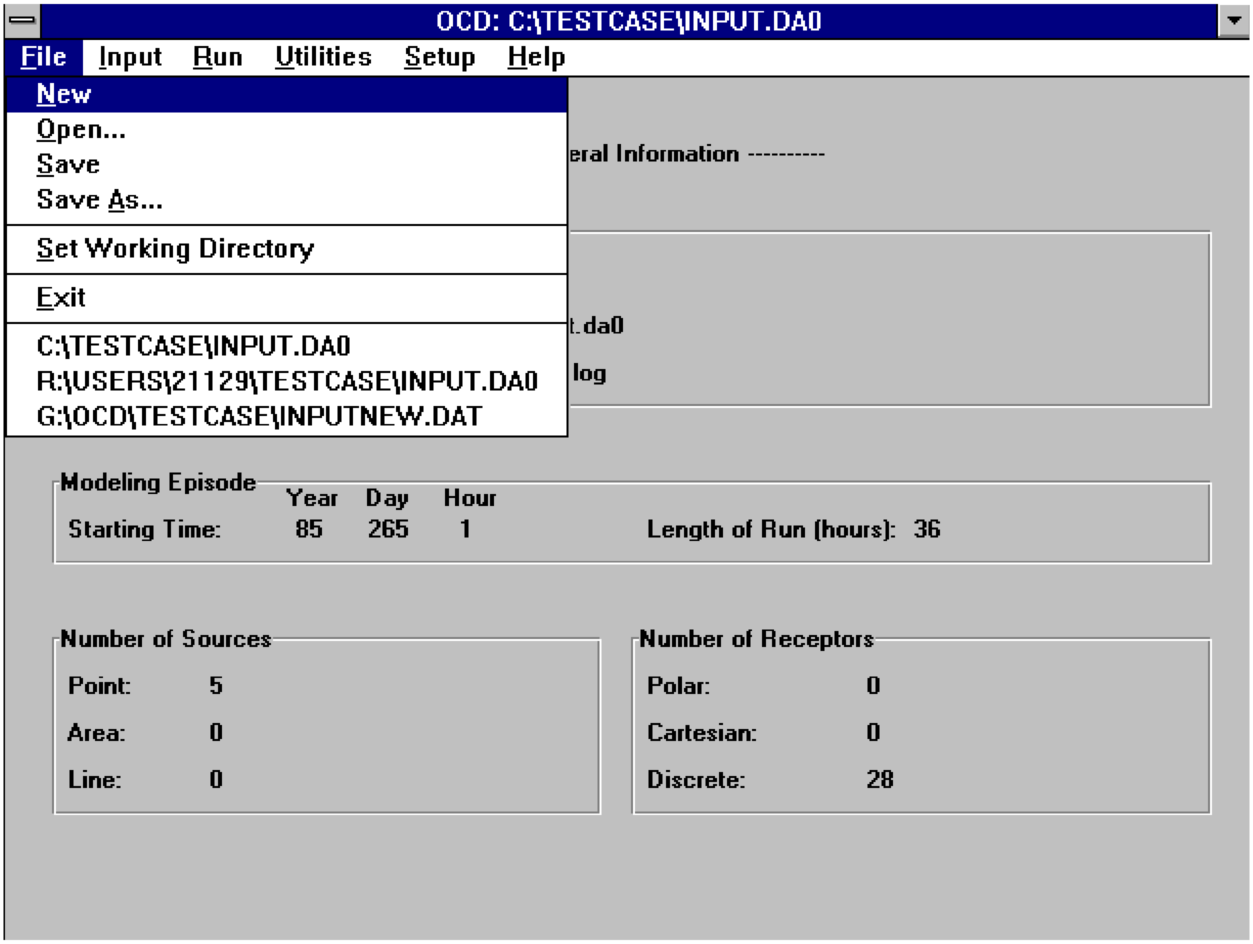


Figure 4-2. An example of the File Menu.

The File/New menu option clears any current information in the program memory, and resets data values to their defaults. The control file name is changed to the default setting of *new.dat*. If a file was already loaded, the model prompts the user whether to save the data for that file before clearing the program memory. Click <Yes> to save the current data to disk and clear the data in memory. Click <No> to abort the current data and clear data in memory. Click <Cancel> to continue editing the current file.

File/Open displays a files dialog box, and allows the user to load an existing OCD control file (see Figure 4-3). The mouse changes to an hour glass while the file is being read. The GUI is ready for user interaction when the mouse changes back to the arrow and the General Information Screen is updated to reflect the information included in the file. The GUI displays any errors encountered while reading the file, such as invalid variables or values above the limits set in the FORTRAN INCLUDE file *params.cmn* (see Section 6.1).

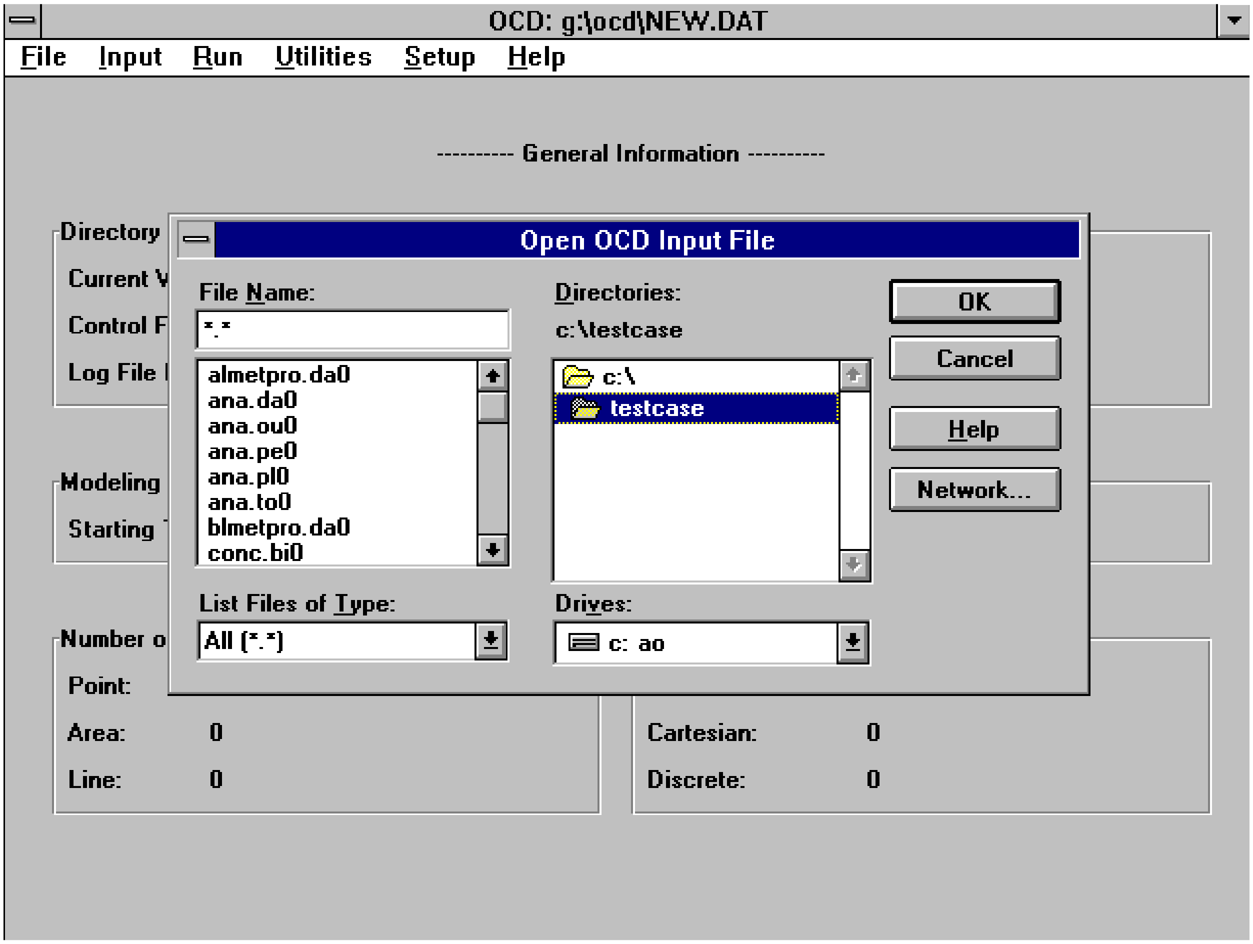


Figure 4-3. An example of the File/Open Menu.

The File/Save menu option saves the current control file to disk using the same file name. Any old information on disk is overwritten.

File/Save As option displays a files dialog box to prompt the user for a file name under which the current information can be saved. If the file name selected already exists, the GUI prompts the user to either overwrite the old file or to enter another file name.

The File/Set Working Directory option prompts the user to select the working directory for the current modeling session. The user must select a disk drive and a directory. The GUI program assumes that all input and output data files reside on the working directory, unless explicitly instructed by the user otherwise. Figure 4-4 shows an example of the Set Working Directory screen.

File/Exit returns the user to the operating system. If the current file was changed, the GUI prompts the user to save the current data before exiting. Click <Yes> to save the current data to disk and exit. Click <No> to abort the current data and exit. Click <Cancel> to continue editing the current file.

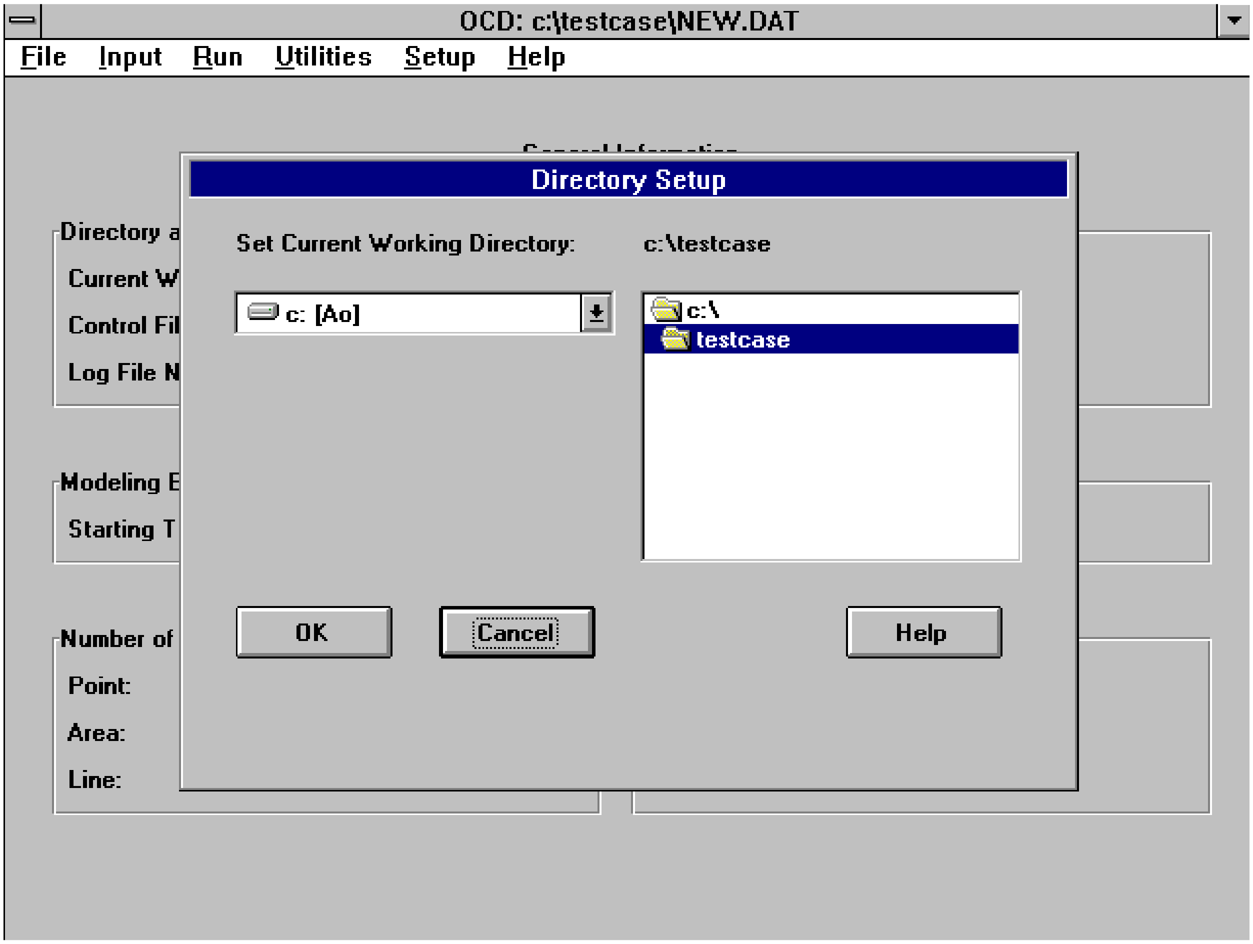


Figure 4-4. An example of the Set Working Directory screen.

Once the GUI is used to create or read at least one OCD Control file, the last three files accessed by the GUI are displayed at the bottom of the File Menu (see Figure 4-2). To read one of these files again, simply click on the appropriate name.

4.4 Input Menu

The Input Menu contains menu options for entering or editing the input data required by the OCD model. The order of the options does not necessarily follow the Input Groups in the control file described in Section 3.2.1. Instead, these options are grouped according to their functions. Figure 4-5 shows an example of the Input Menu.

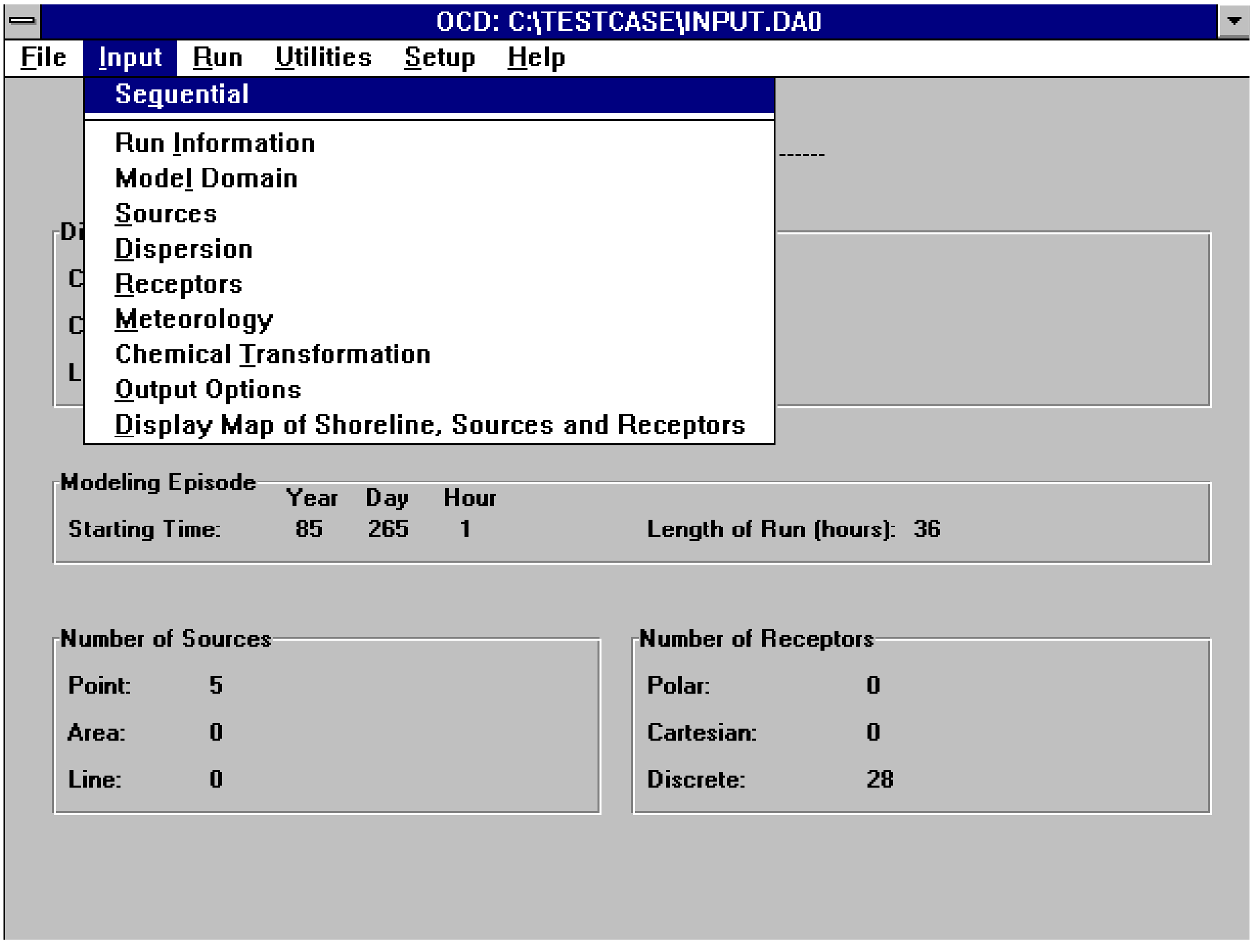


Figure 4-5. An example of the Input Menu screen.

4.4.1 Sequential Submenu

The Sequential submenu (see Figure 4-5) displays each data entry screen in sequence, so that all required input for an OCD run can be specified. In this mode, the user can back up to the previous screen by pressing the <Previous> button, or can move to the next screen by pressing the <Next> button. When either of these buttons is used, the data on the current screen are saved to memory. To stop the sequential mode without completing the sequence of screens, press the <Terminate Sequential> button. The user is prompted whether to save the information for the current screen. Click <Yes> to save the information for the current screen to memory, and return to the Main Menu. Click <No> to return to the Main Menu without saving the information for the current screen. Click <Cancel> to continue in sequential mode. When the sequential mode is complete, click <Done> to return to the Main Menu.

Each data entry screen is described in detail in Sections 4.4.2 through 4.4.10, where frequent references to Section 3, the OCD variables listed in Table 3-11 in particular, are made.

4.4.2 Run Information Submenu

The Run Information submenu (see Figure 4-6) displays data for Input Group 1, and some data for Input Group 3 of the OCD control file (see Section 3.2.1).

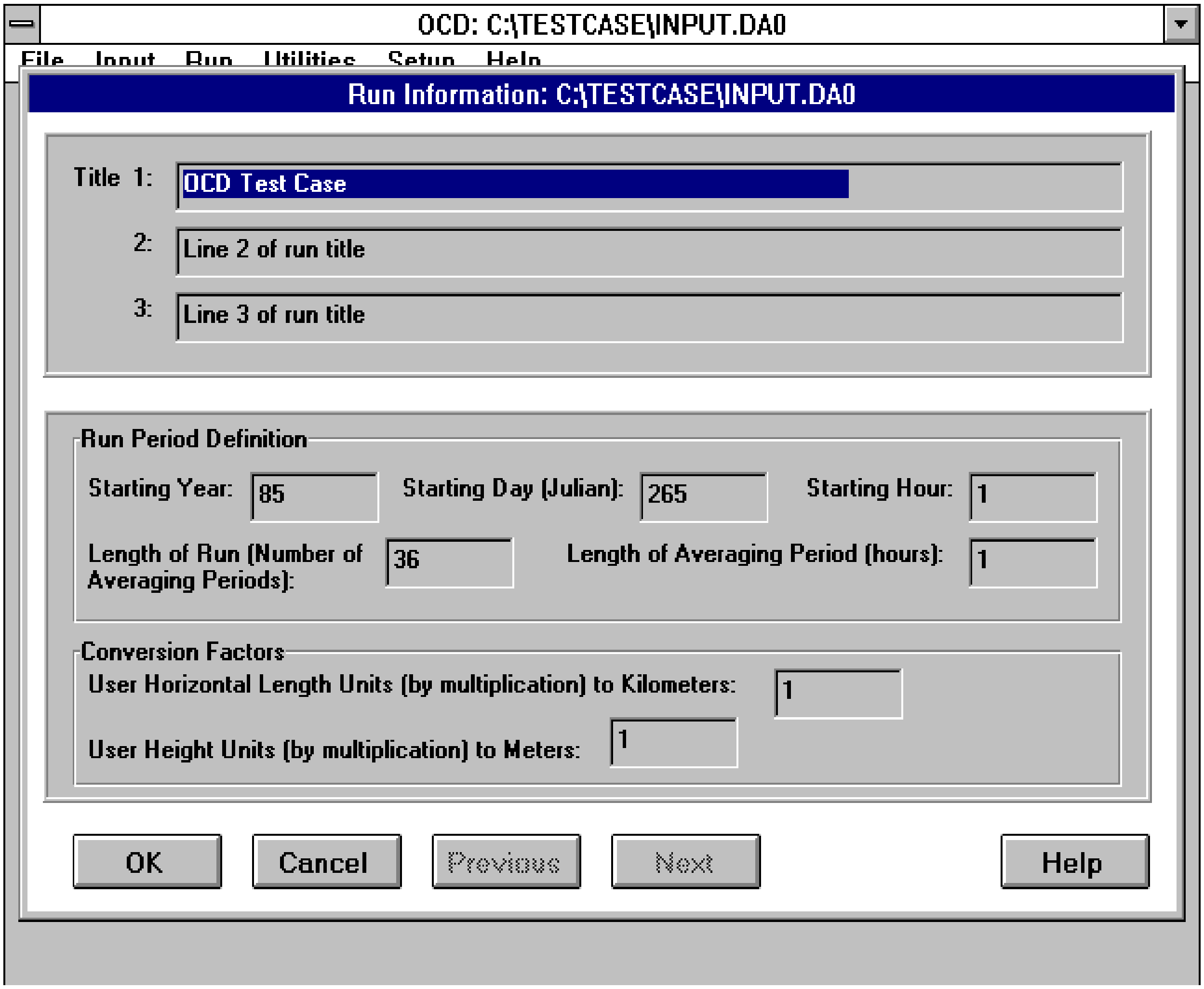


Figure 4-6. An example of the Run Information screen.

For the run title, enter up to three lines of text, each line with less than 80 characters. This information is stored in the OCD variable TITLE.

The user also needs to enter the run period by defining the starting year (0 to 99), starting Julian day (1 to 366), starting hour (1 to 24) and run length in hours. These data are stored in the OCD variables IDATE(1), IDATE(2), IHSTRT and NPER, respectively. The GUI always assumes that the number of hours in an averaging period (the OCD variable NAVG, not displayed on the screen) is one.

The user is also required to enter the conversion factors that convert the user horizontal units (by multiplication) to kilometer, and convert the user vertical units (by multiplication) to meters. The two conversion factors correspond to the OCD variables CONTWO and CELM.

4.4.3 Model Domain Submenu

The Model Domain submenu (see Figure 4-7) displays the information needed to run the MAKEGEO utility (see Section 3.1.3), so that the shoreline geometry data (OCD Input Group 16) can be prepared, and that a 20×20 Cartesian receptor network (OCD Input Group 11) covering the entire model domain can be specified. This submenu is applicable only if the model domain is in the continental U.S., where the shoreline database files are currently available. If the model domain is in, for example, the South China Sea, then the user must manually prepare the shoreline geometry data (see DiCristofaro and Hanna, 1989). Data entry for this submenu is not necessary if the shoreline geometry is already defined in the control file.

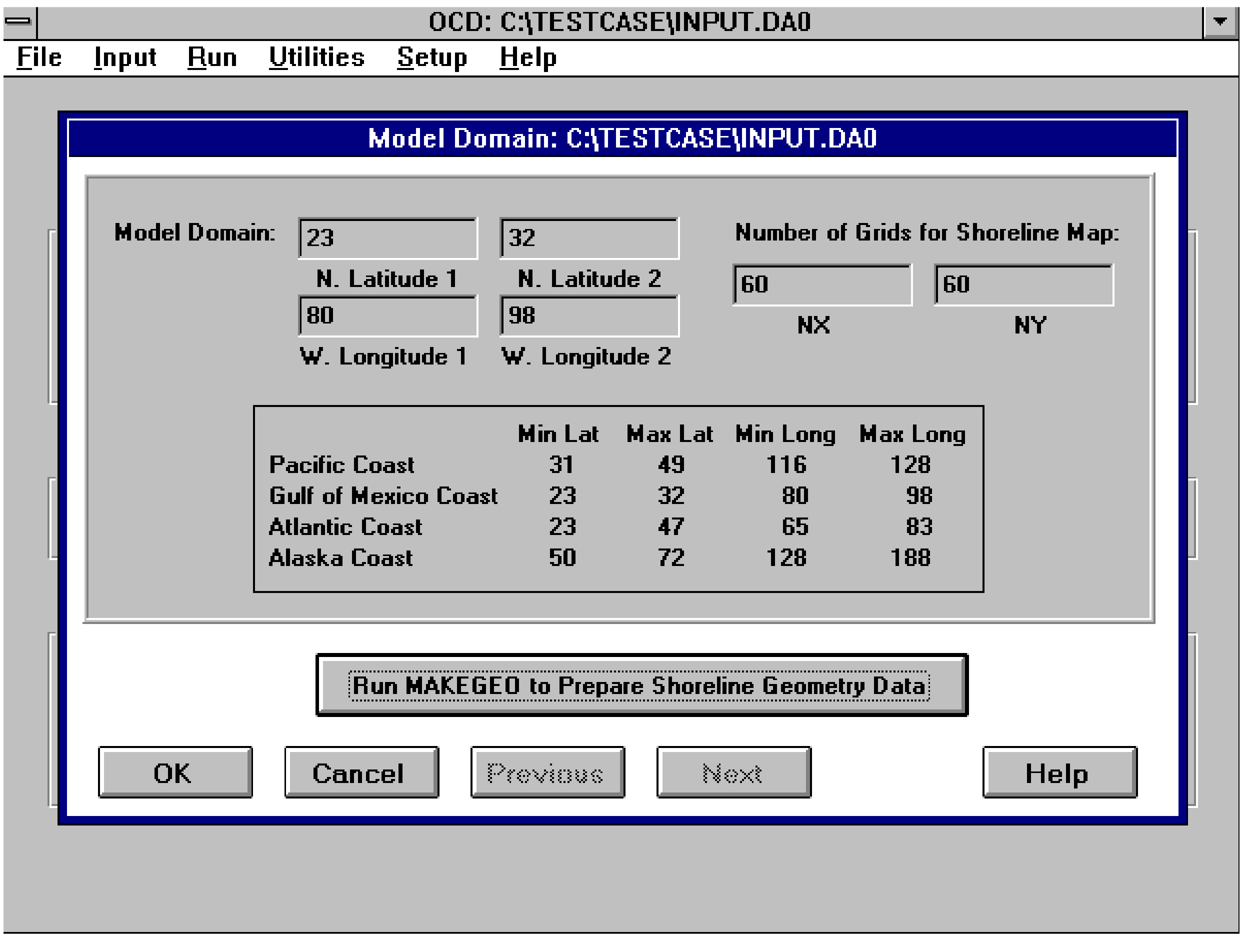


Figure 4-7. An example of the Model Domain screen.

To run MAKEGEO, the user needs to enter two northern latitudes and two western longitudes (the MAKEGEO variables SLAT1, SLAT2, SLON1 and SLON2) to define the model domain. The values for latitudes and longitudes must be entered in decimal notation. The screen notes the limits on latitudes and longitudes for different geographical regions. Next, enter the number of grid rectangles along the x-axis and the y-axis (60-120, in increments of 10) for the digitized shoreline map. They correspond to the MAKEGEO variables IXG and IYG.

After entering the data mentioned above, the user clicks on the <Run MAKEGEO to Prepare Shoreline Geometry Data> button. The GUI checks the model domain specified by the user against the valid ranges displayed on screen. If any errors are found, an error message is displayed and the model domain is cleared to allow the user another opportunity to enter valid data. After data validation, the GUI program invokes the MAKEGEO utility to generate (1) the *makegeo.dat* file, to be included as Input Group 16 (shoreline geometry data) for the current control file; and (2) the *makegeo.car* file, to be included as Input Group 11 (Cartesian receptor network data) for the current control file. Note that the MAKEGEO utility may take a few minutes to run.

Once MAKEGEO is finished processing, the program displays whether the run was successful, and waits for the user to press any key to return to the GUI. The GUI displays a message stating that "Shoreline geometry read from MAKEGEO output file!" That is, the shoreline geometry data for the model domain specified by the user have been incorporated into the current control file.

To bring in the data generated by the MAKEGEO utility for the Cartesian receptor network, the user needs to proceed to the Receptors submenu (see Section 4.4.6), select Cartesian receptors, click on the <Define Cartesian Receptors> button, and then click <OK> to confirm data inclusion. That is, the Cartesian receptor network will not be included unless the user goes through the procedures just described. This is because the specification of the Cartesian receptor network is optional to the OCD model.

Note that if the current session is started with an existing OCD input file, and the user has just run MAKEGEO to redefine the shoreline geometry, then all the receptor and source locations included in the original input file <u>are now relative to the southwest corner of the model domain just defined</u> (see Figure 4-7). The user should carefully review the receptor and source locations and make changes if necessary.

In the Model Domain submenu, if the user directly clicks <OK>, or <Previous> or <Next> in sequential mode, without running the MAKEGEO utility, the model displays the message "You have not run MAKEGEO to create the shoreline geometry. Click Yes to continue to the next screen or No to return to this screen." If the shoreline geometry is already defined in the current control file, click <No>. To define or modify the shoreline geometry, click <Yes> and follow the above directions.

4.4.4 Sources Submenu

The Sources submenu is responsible for preparing all OCD data that are related to source information. These data appear in Input Groups 3, 4, 6 and 7 of the OCD control file (see Section 3.2.1). When the Sources submenu is chosen for a new control file where no sources have been previously defined, the GUI prompts the user to choose between the following two methods of data entry: <Load from File> and <Enter Manually> (see Figure 4-8). If the control file already has sources defined, then the GUI does not prompt the user for the above two choices, and displays the Sources screen directly (see Figure 4-10).

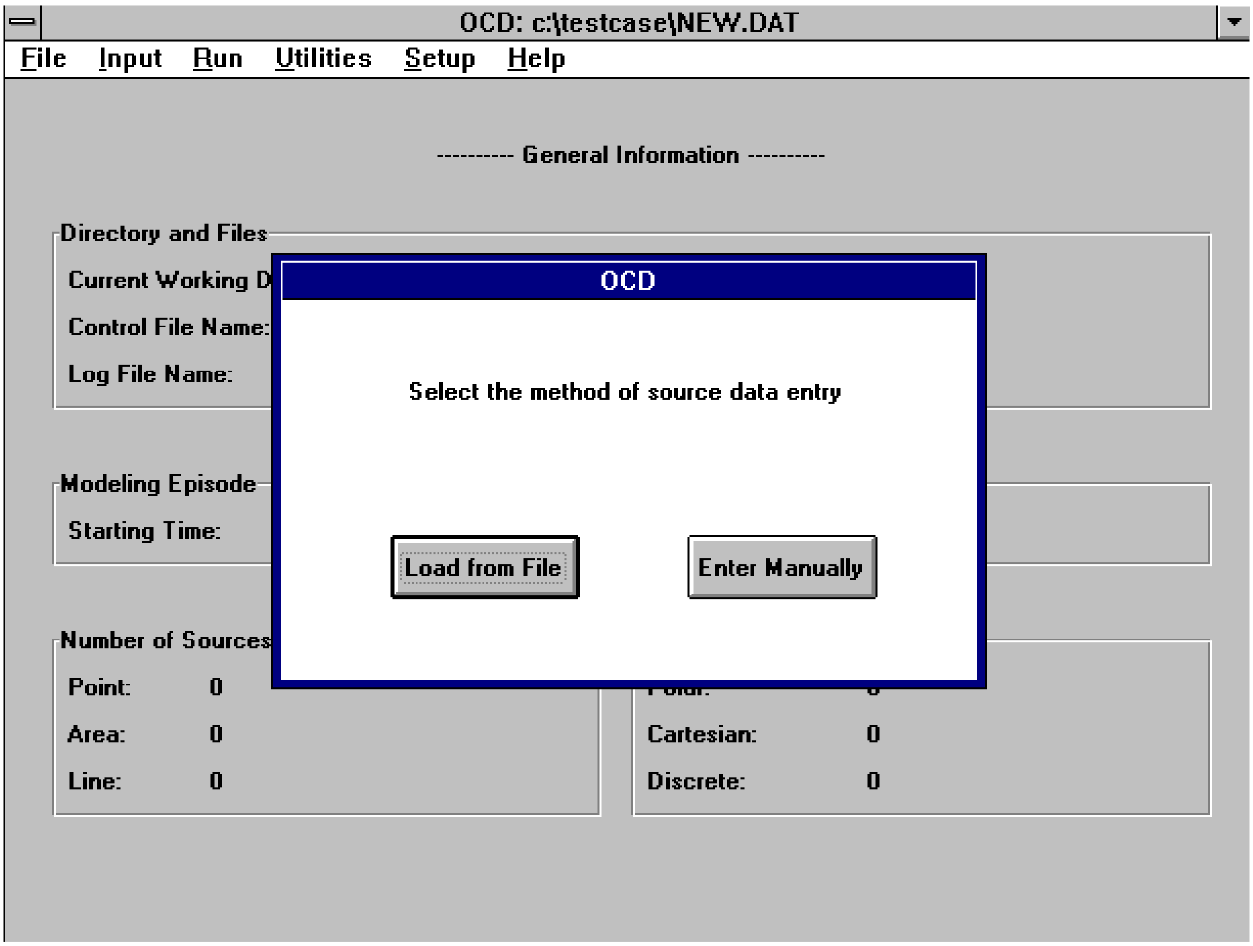


Figure 4-8. An example of the Sources Pop-Up screen.

For the case where no sources have been previously defined, if the user selects the <Load from File> option, the GUI prompts the user for the source input file name (see Figure 4-9). Either type in the path and file name, or click <Browse...> and select the file. The file must be in the format described in Section 3.1.4 and in Table 3-6, where the source locations are in latitudes and longitudes. Latitudes and longitudes will be converted by the MAKEUTM utility (see Section 3.1.4 and more below) to user coordinates. Since the user coordinates for each source depend on the reference point for the current coordinate system, it is crucial that if the <Load from File> option is chosen, the MAKEGEO utility (see Sections 3.1.3 and 4.4.3) must have just been run by the user. As a result, after the user has specified the source input file name, and then clicks <Run> to invoke the MAKEUTM conversion utility, the GUI always reminds the user that the MAKEGEO utility must be run prior to running MAKEUTM. If MAKEGEO has been run, click <Yes>. Otherwise, click <No> and go to the Model Domain submenu (section 4.4.3) to run the MAKEGEO utility. If the user clicked <Yes>, the GUI reads the source input file, and invokes the MAKEUTM utility to convert source locations from latitudes and longitudes to user coordinates, based on the information contained in the *makegeo.ref* file (see Table 3-3) generated by the MAKEGEO utility. After the MAKEUTM utility finishes its calculations, the user presses any key to return to the GUI, and clicks <OK> to display the Sources screen (see Figure 4-10). At this point, the user needs to further manually specify the source type (OCD variable IOPT(20)) and the pollutant type (OCD variable IPOL). However, it is not necessary for the user to click on the <Define Sources> button, since all source data under that screen have already been prepared by the MAKEUTM utility, and incorporated by the GUI into the current control file.

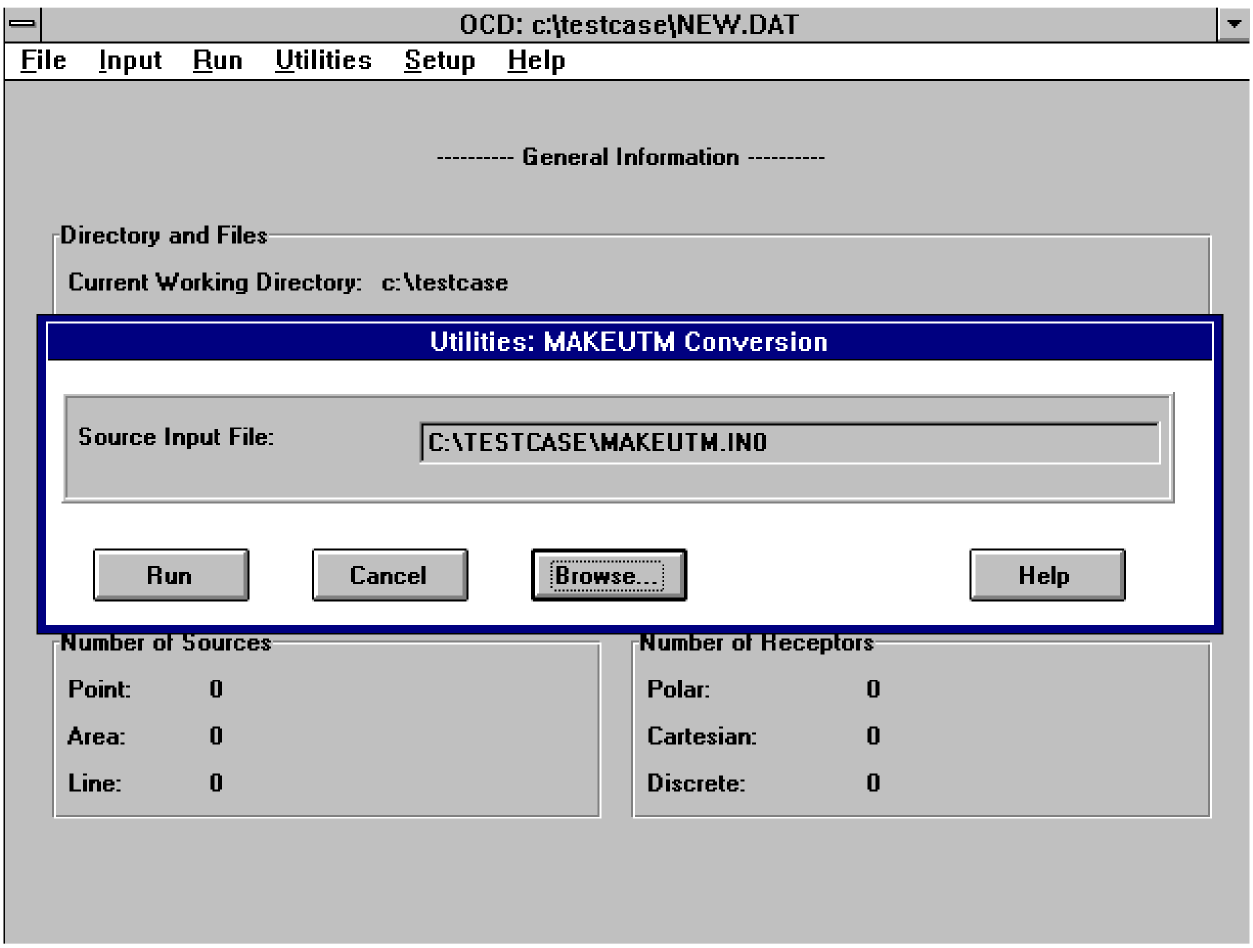


Figure 4-9. An example of the MAKEUTM Conversion screen.

For the case when (1) no sources have been previously defined and the user selects the <Enter Manually> option, or (2) sources have been previously defined, the Sources screen (see Figure 4-10) is displayed. The user needs to define the source type (OCD variable IOPT(20)), the pollutant type (OCD variable IPOL), and whether to read hourly emissions (OCD variable IOPT(6)) from the *emis.dat* file. Note that only one source type is allowed. The <Define Sources> button is then pressed to display the point source, area source, or line source input screen. Figure 4-11 shows the point sources screen. If there are sources already defined in the current control file, the information on this screen is filled in. If there are no sources already defined, the user needs to fill in the information (OCD Input Group 6, see Section 3.2.1 and Table 3-11) for one source at a time. The total number of sources defined (OCD variable NPT) is updated by the GUI as the user adds or deletes sources. Follow the instructions in Section 4.1.3 for adding, deleting, and editing sources in the table. When source data entry is finished, click <OK> to return to the Sources submenu.

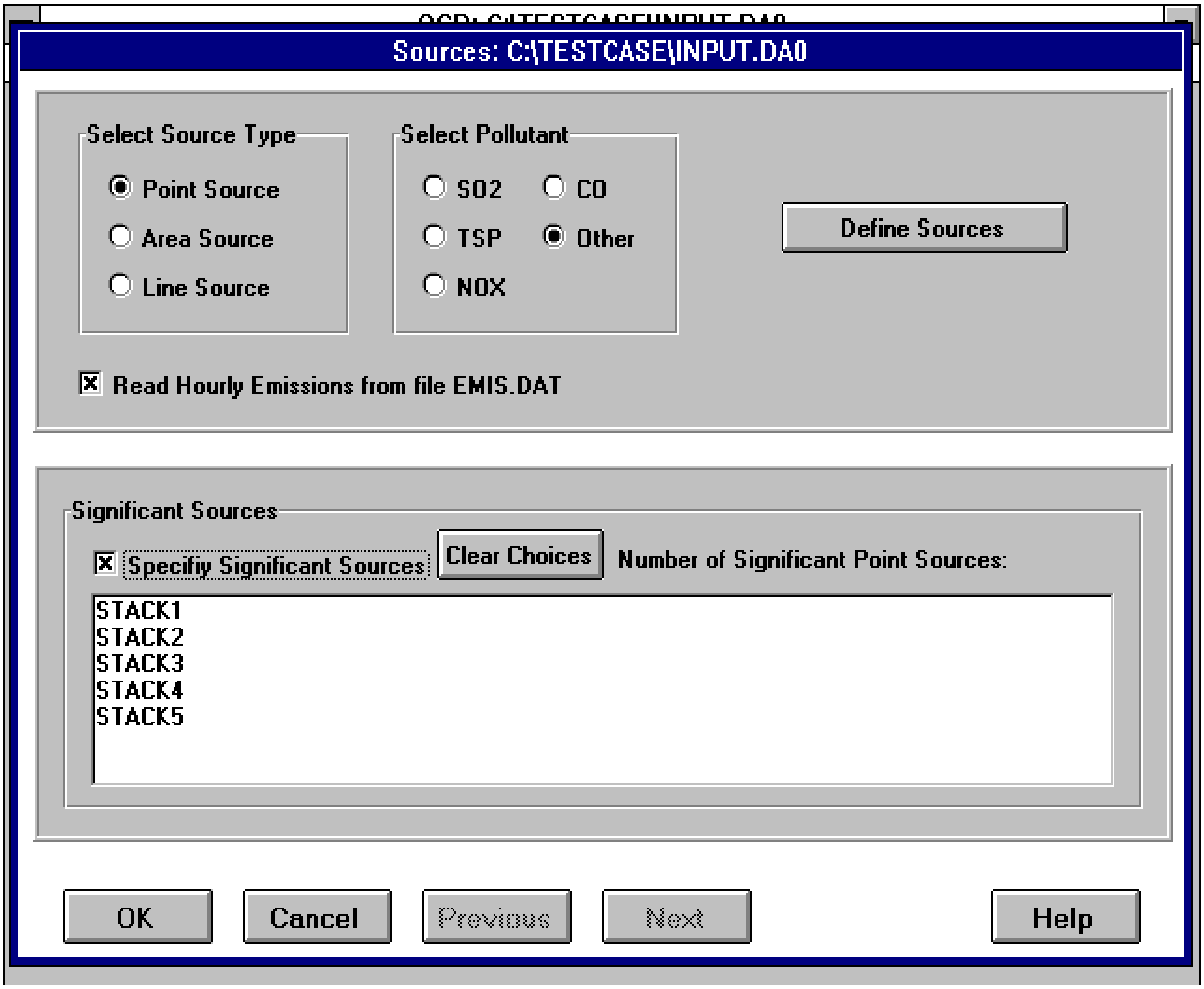


Figure 4-10. An example of the Sources screen.

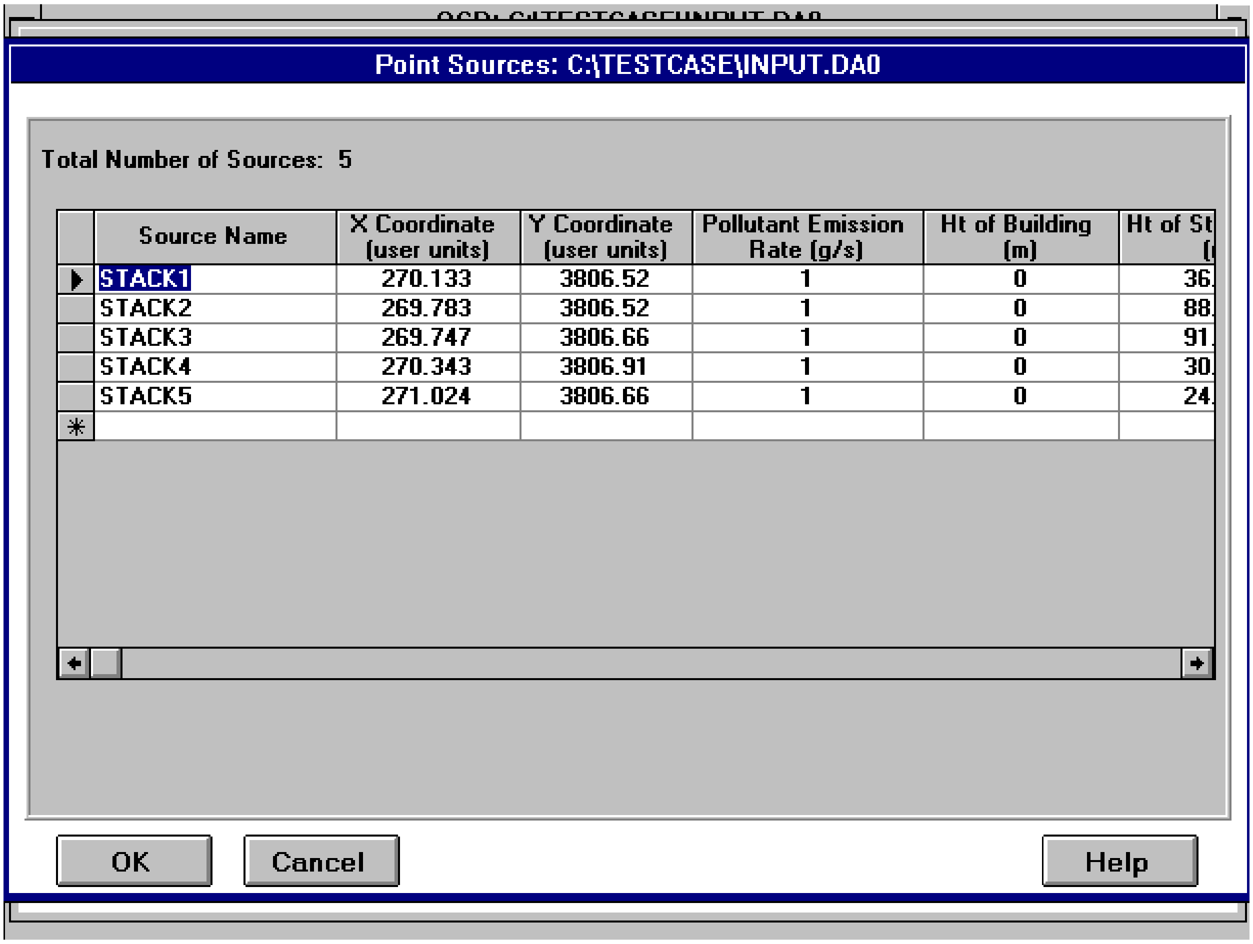


Figure 4-11. An example of the Point Sources Definition screen.

As an option, the user can also specify significant sources (OCD variable IOPT(7)). If this option is selected, choose from the list box the sources that are to be designated significant. The GUI automatically updates the number of significant sources chosen by the user. The user clicks <Clear Choices> to reset the selection of significant sources. If the option of specifying significant sources is not selected, any sources in the list box are grayed out, i.e., they can not be selected by the user.

4.4.5 Dispersion Submenu

The Dispersion submenu (see Figure 4-12) contains the information for those OCD model options in Input Group 4 that are used to determine how dispersion calculations are performed. This screen displays check boxes that are used to turn on or off model options.

The first option in the Dispersion submenu determines whether to use terrain adjustments (OCD variable IOPT(1)). If this option is selected, the user will later be prompted to enter the elevation data for receptors. (The user always has to specify base elevations for all sources regardless of the value of IOPT(1).) The second option determines whether the model will use stack-tip downwash (OCD variable IOPT(2)). The third option determines whether the model will use gradual plume rise (OCD variable IOPT(3)). The last option determines whether the model will use buoyancy-induced dispersion (OCD variable IOPT(4)). Refer to DiCristofaro and Hanna (1989) for a technical description of the above modeling options.

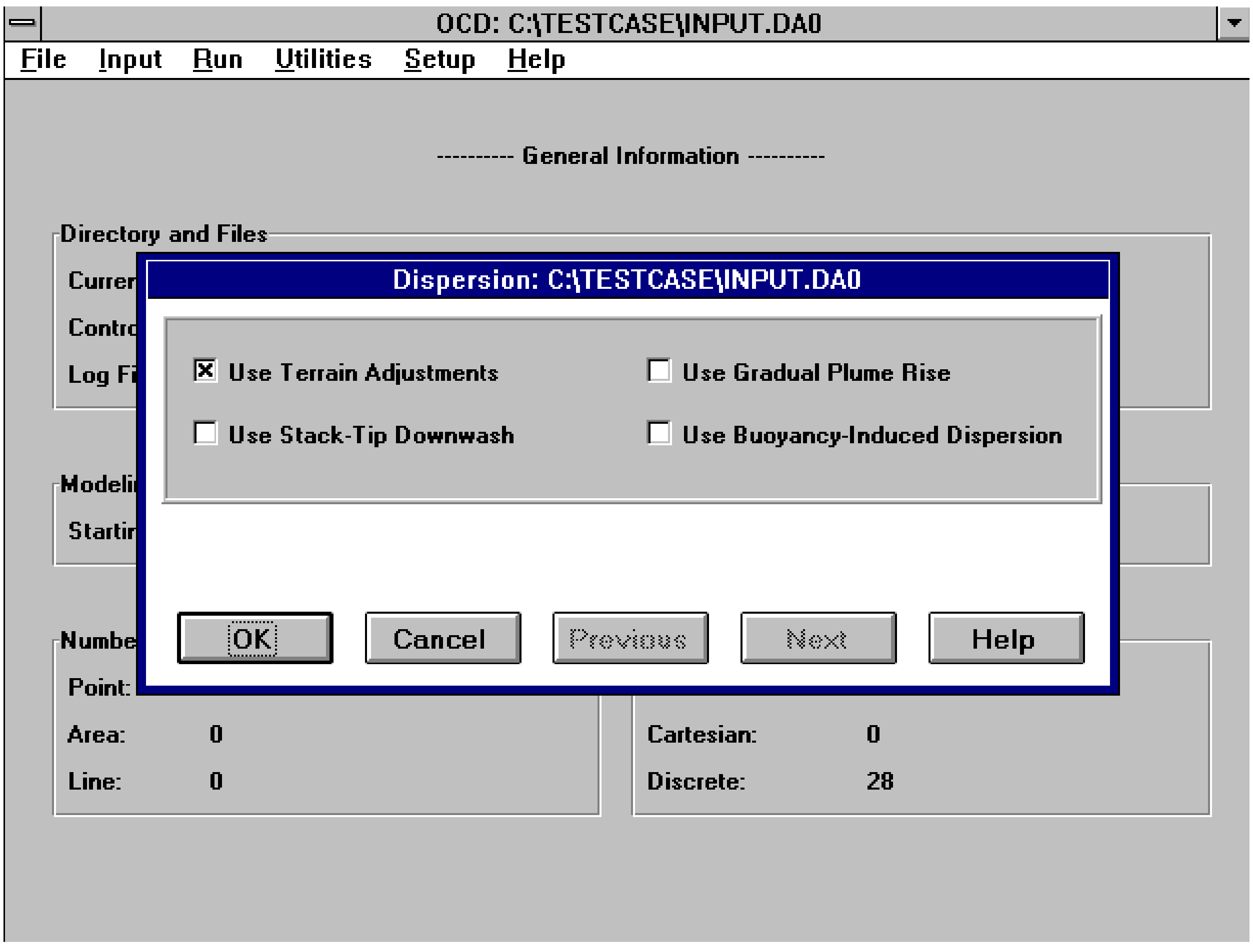


Figure 4-12. An example of the Dispersion screen.

4.4.6 Receptors Submenu

The Receptors submenu is responsible for preparing all OCD data that are related to receptor information. These data appear in Input Groups 4, and 9 through 13 of the OCD control file (see Section 3.2.1). When the Receptors submenu is chosen for a new control file where no receptors have been previously defined, the GUI prompts the user to choose between the following two methods of data entry: <Load from File> and <Enter Manually> (see Figure 4-13). If the control file already has receptors defined, then the GUI does not prompt the user for the above two choices, and displays the Receptors screen directly (see Figure 4-15). Note that the <Load from File> option applies to only *discrete* receptors.

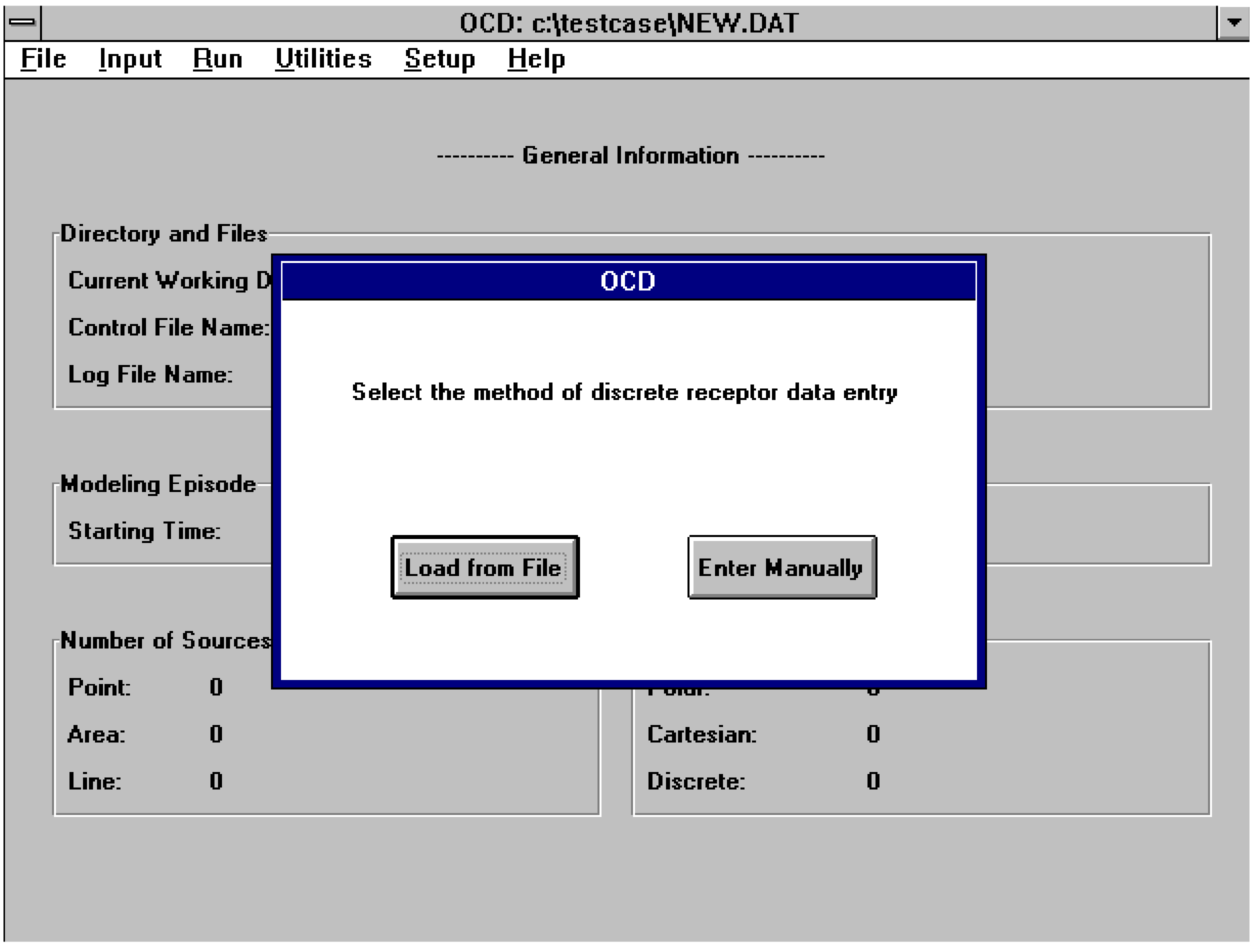


Figure 4-13. An example of the Receptors Pop-Up screen.

For the case where no receptors have been previously defined, if the user selects the <Load from File> option, the GUI prompts the user for the receptor input file name (see Figure 4-14). Either type in the path and file name, or click <Browse...> and select the file. The file must be in the format described in Section 3.1.4 and in Table 3-6, where the discrete receptor locations are in latitudes and longitudes. Latitudes and longitudes will be converted by the MAKEUTM utility (see Section 3.1.4 and more below) to user coordinates. Since the user coordinates for each discrete receptor depend on the reference point for the current coordinate system, it is crucial that if the <Load from File> option is chosen, the MAKEGEO utility (see Sections 3.1.3 and 4.4.3) must have just been run by the user. As a result, after the user has specified the receptor input file name, and then clicks <Run> to invoke the MAKEUTM conversion utility, the GUI always reminds the user that the MAKEGEO utility must be run prior to running MAKEUTM. If MAKEGEO has been run, click <Yes>. Otherwise, click <No> and go to the Model Domain submenu (section 4.4.3) to run the MAKEGEO utility. If the user clicked <Yes>, the GUI reads the receptor input file, and invokes the MAKEUTM utility to convert discrete receptor locations from latitudes and longitudes to user coordinates, based on the information contained in the *makegeo.ref* file (see Table 3-3) generated by the MAKEGEO utility. After the MAKEUTM utility finishes its calculations, the user presses any key to return to the GUI, and clicks <OK> to display the Receptors screen (see Figure 4-15). At this point, the user should see that the option of discrete receptors is automatically selected. However, it is not necessary for the user to click on the <Define Discrete Receptors> button, since all receptor data under that screen have already been prepared by the MAKEUTM utility, and incorporated by the GUI into the current control file.

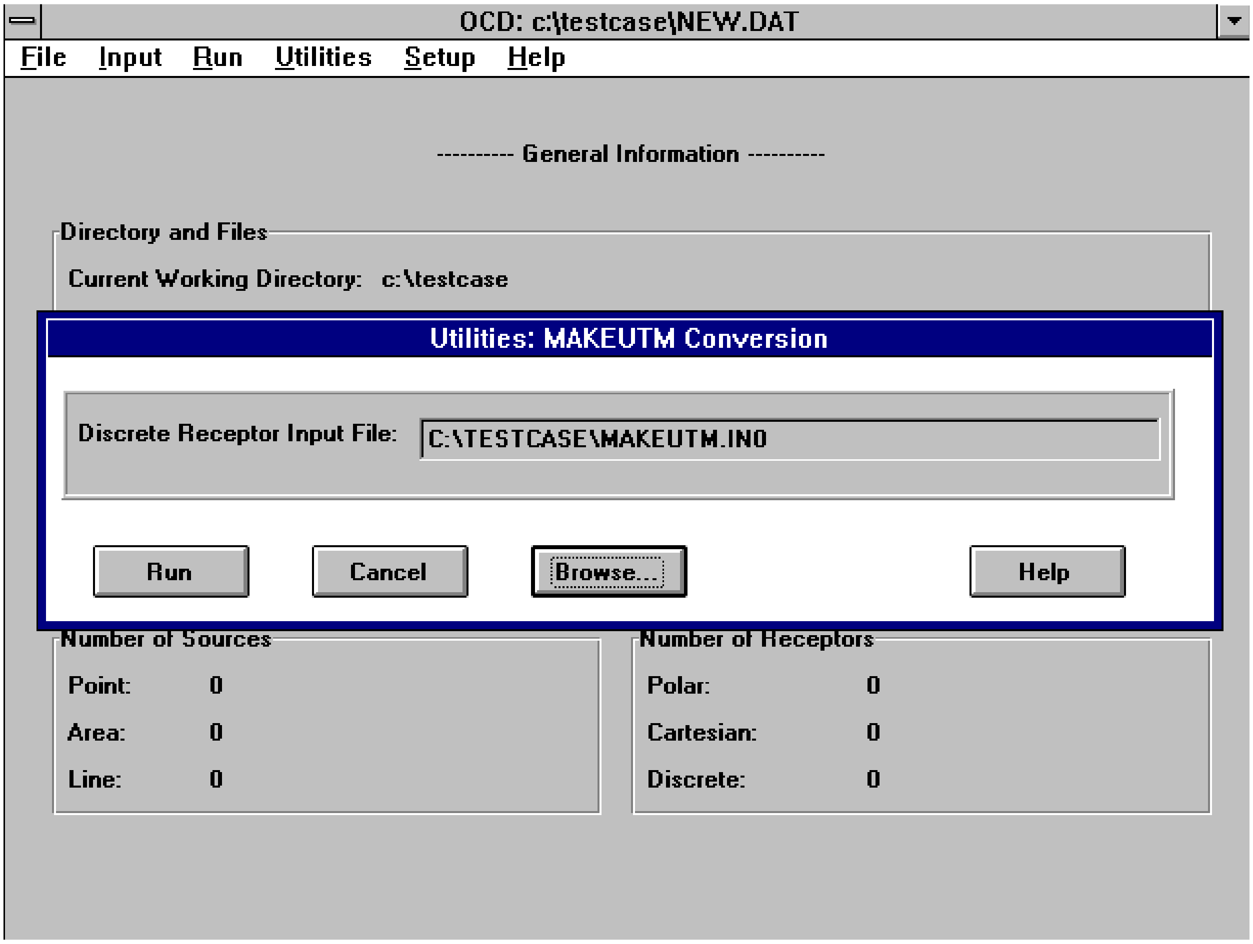


Figure 4-14. An example of the MAKEUTM Conversion screen.

For the case when (1) no receptors have been previously defined and the user selects the <Enter Manually> option, or (2) receptors have been previously defined, the Receptors screen (see Figure 4-15) is displayed. The user needs to define the receptor type (OCD variable IOPT(8)). Any combination of receptor types can be selected. To define the receptor information, click the appropriate command buttons.

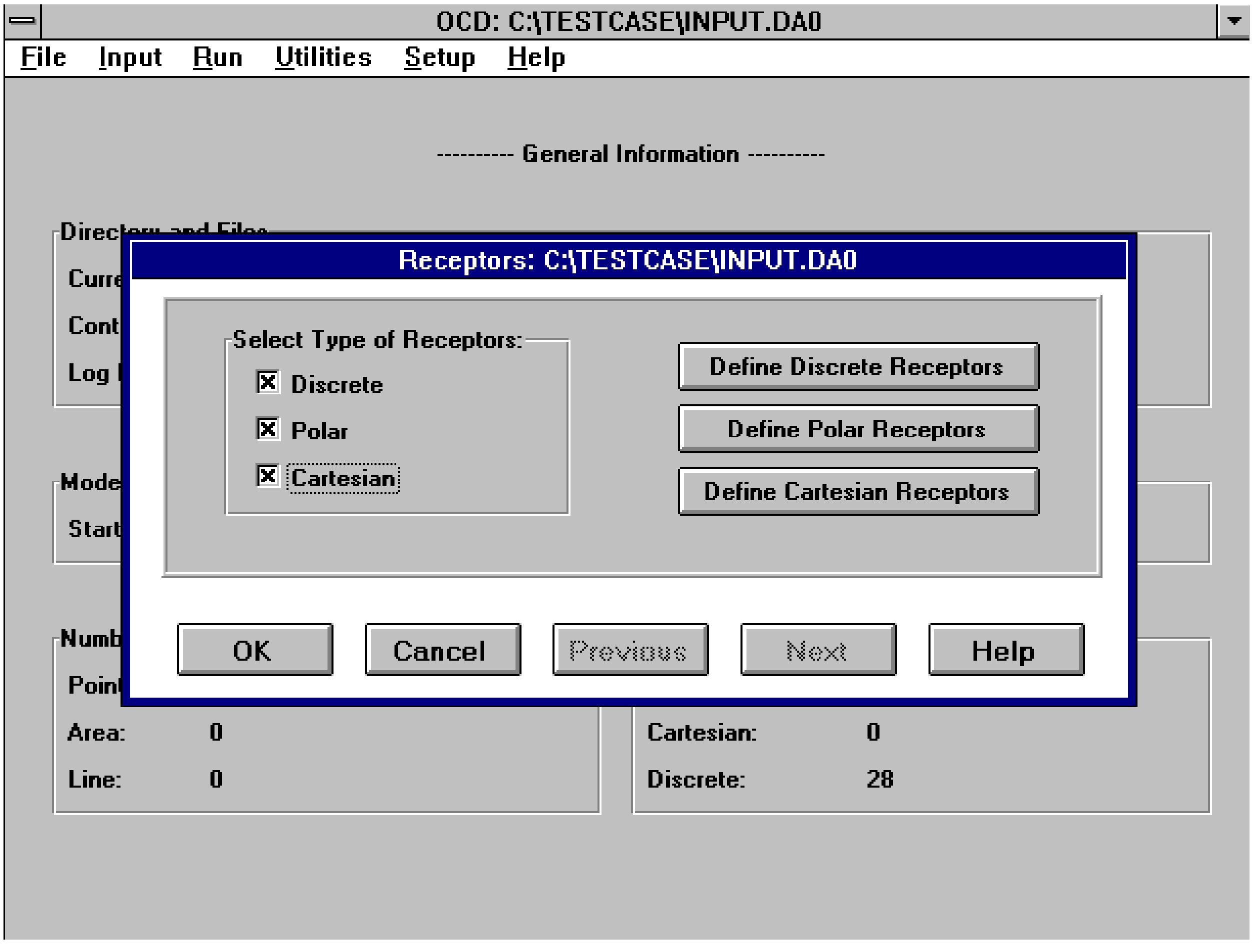


Figure 4-15. An example of the Receptors screen.

The <Define Discrete Receptors> button on the Receptors submenu displays the Discrete Receptors Screen (see Figure 4-16). If there are discrete receptors already defined in the current control file, the information on this screen is filled in. If there are no discrete receptors already defined, the user needs to fill in the information (OCD Input Group 13, see Section 3.2.1 and Table 3-11) for one discrete receptor at a time. The total number of discrete receptors defined (OCD variable NDISC) is updated by the GUI as the user adds or deletes discrete receptors. Follow the instructions in Section 4.1.3 for adding, deleting, and editing discrete receptors in the table. When discrete receptor data entry is finished, click <OK> to return to the Receptors submenu.

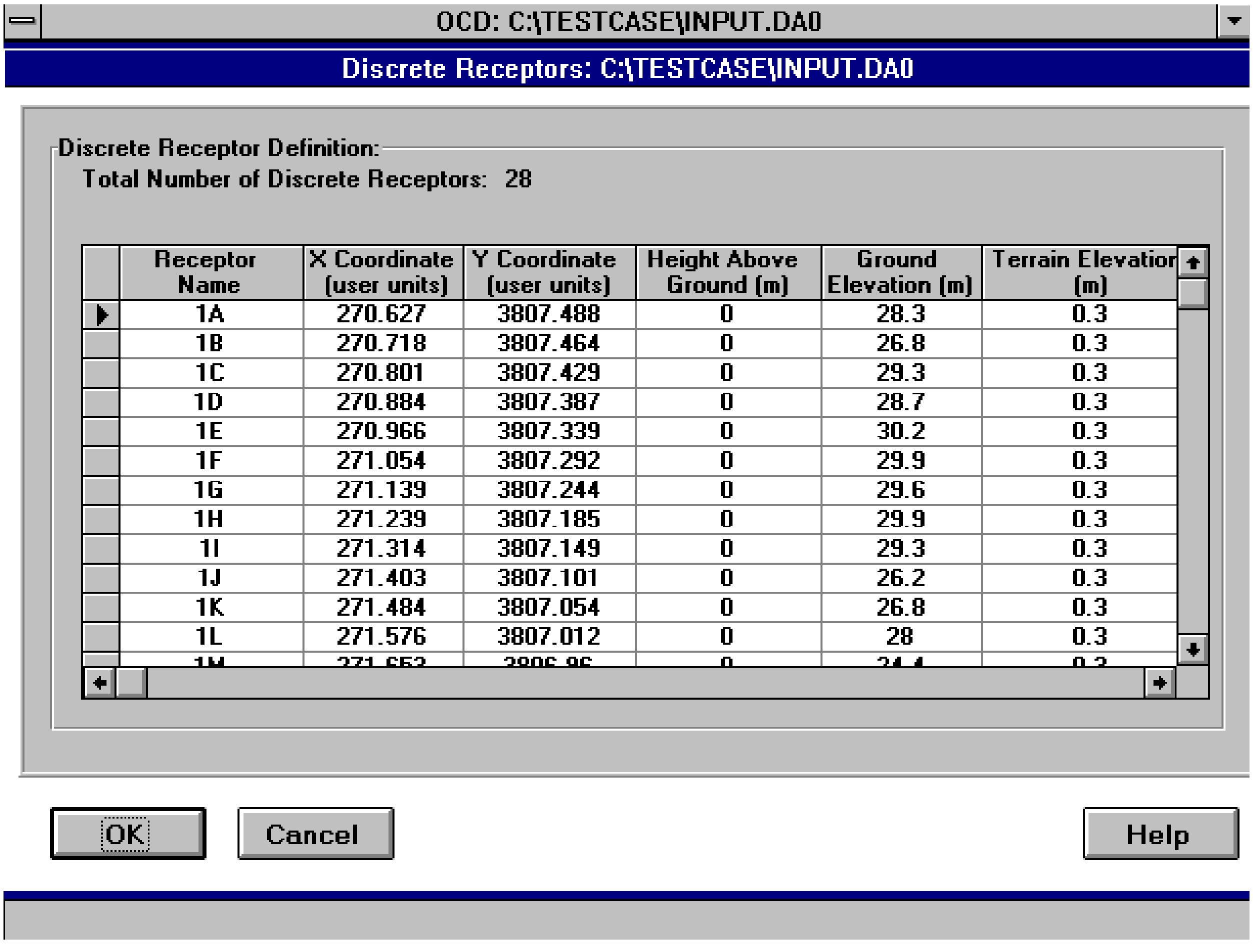


Figure 4-16. An example of the Discrete Receptors screen.

The <Define Polar Receptors> button on the Receptors submenu displays the Polar Receptors screen (see Figure 4-17). If there are polar receptors already defined in the current control file, the information on this screen is filled in. If there are no polar receptors already defined, the user needs to fill in the information for the polar receptor network (OCD Input Group 9, see Section 3.2.1 and Table 3-11). The number of polar receptors defined (= 36×NRING) is updated by the GUI as the user adds or deletes rings (OCD variable NRING). If the option of terrain adjustment (see Section 4.4.5) is selected, the user also needs to enter the elevation data (OCD Input Group 10, see Section 3.2.1 and Table 3-11) for each azimuth angle, and for each ring distance. When polar receptor data entry is finished, click <OK> to return to the Receptors submenu.

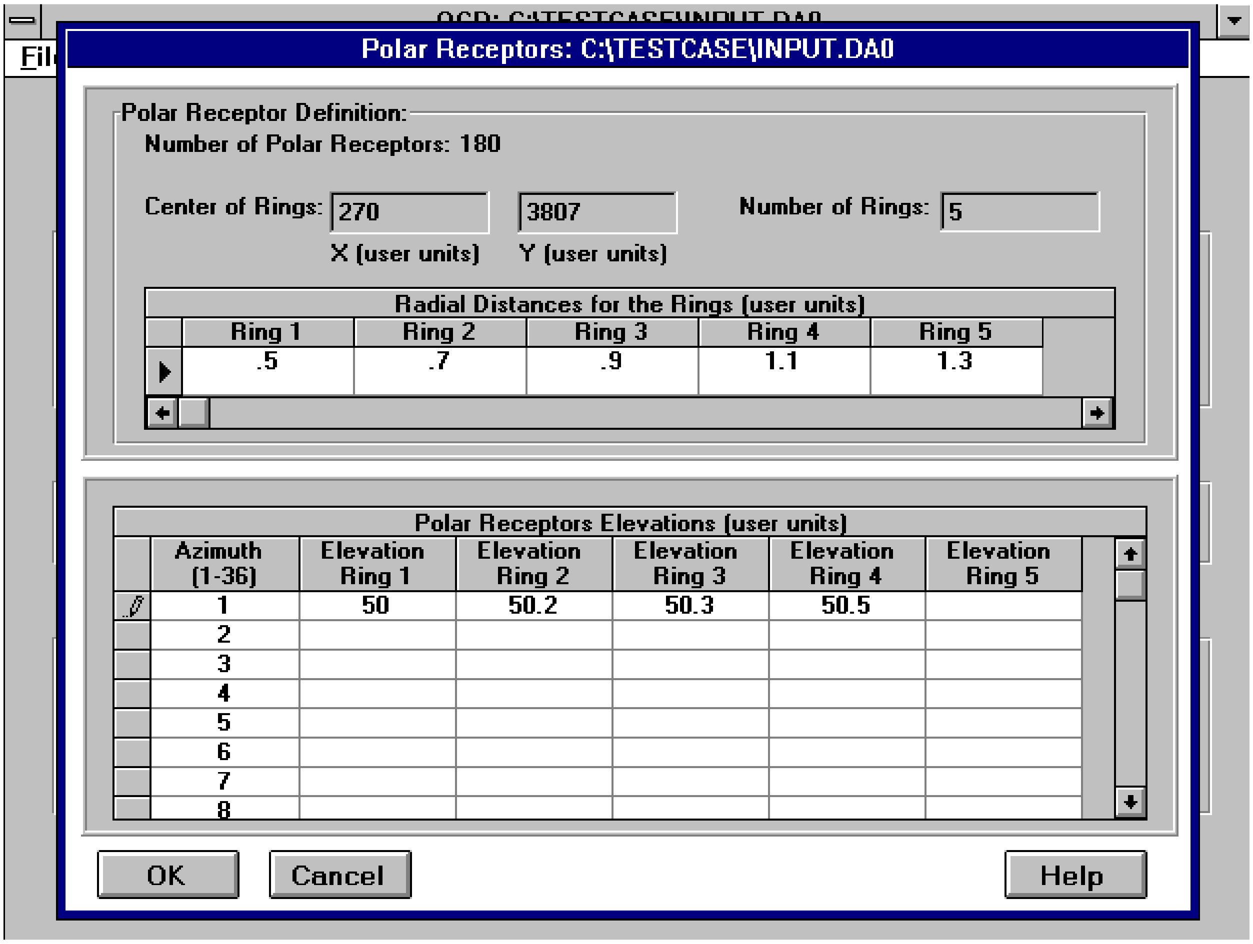


Figure 4-17. An example of the Polar Receptors screen.

The <Define Cartesian Receptors> button on the Receptors submenu displays the Cartesian Receptors screen (see Figure 4-18). If there are Cartesian receptors already defined in the current control file, the information on this screen is filled in. If there are no Cartesian receptors already defined, the user needs to fill in the information for the Cartesian receptor network (OCD Input Group 11, see Section 3.2.1 and Table 3-11). Note that if the MAKEGEO processor was run to create the shoreline geometry data (see Sections 3.1.3 and 4.4.3), then a 20×20 Cartesian receptor network covering the entire model domain will be automatically defined. The number of Cartesian receptors defined (= NX×NY) is updated by the GUI as the user changes the numbers of receptors (NX and NY, respectively) along the x and y axes. If the option of terrain adjustment (see Section 4.4.5) is selected, the user also needs to enter the elevation data (OCD Input Group 12, see Section 3.2.1 and Table 3-11) for each row, and for each column. When Cartesian receptor data entry is finished, click <OK> to return to the Receptors submenu.

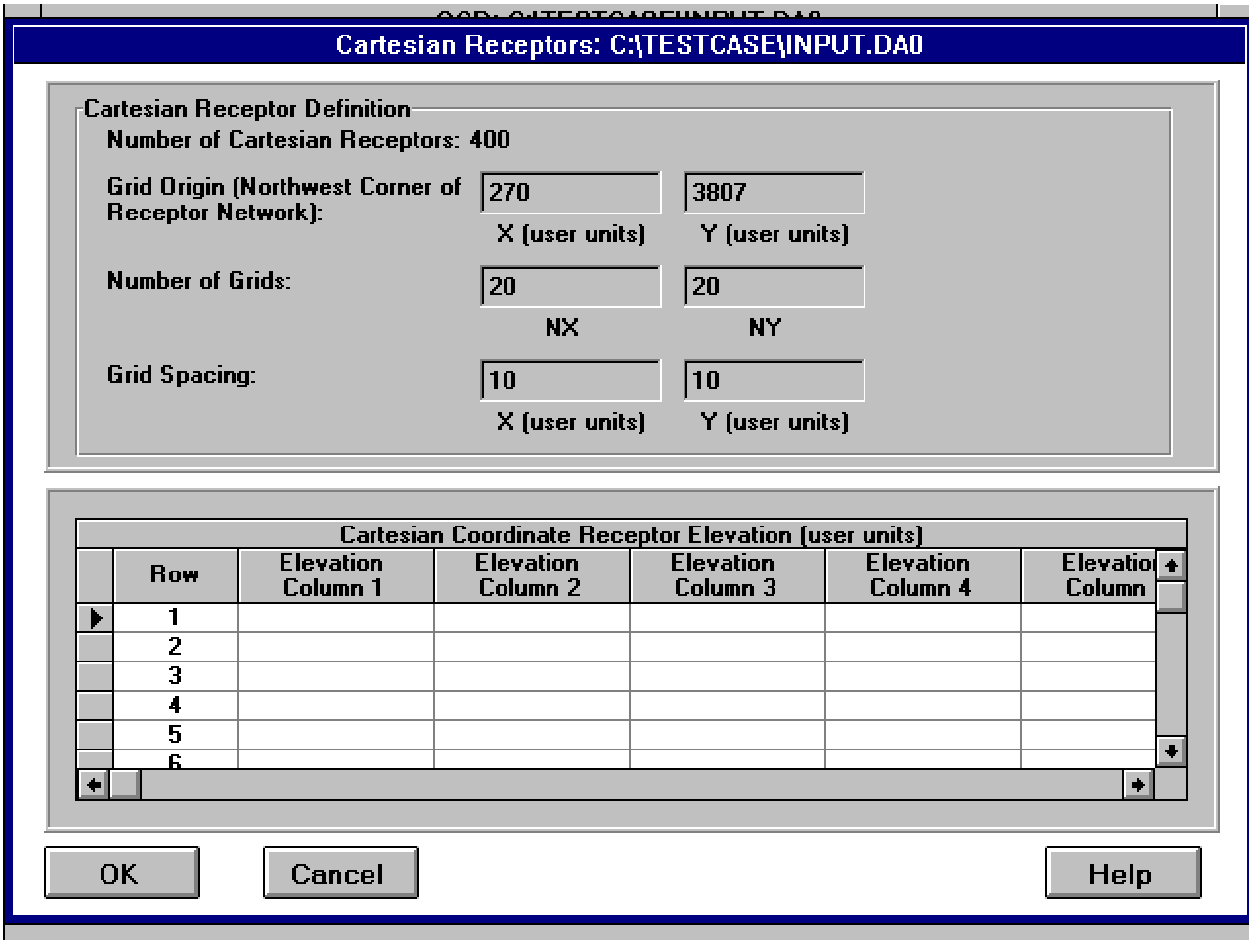


Figure 4-18. An example of the Cartesian Receptors screen.

4.4.7 Meteorology Submenu

All OCD input data (from Input Groups 4, 5, 8, 14 and 17) that are related to meteorology, site characteristics, and instrumentation are collected under the Meteorology submenu (see Figure 4-19). The user needs to first specify the source of the overland meteorological data (OCD variable IOPT(5)) from the following three options: <ASCII, Included in Control File>, <Binary, in Separate PCRAMMET file>, and <ASCII, in Separate PCRAMMET File>. If the <ASCII, Included in Control File> option is chosen, the overland meteorological data identifiers that appear in the next section of the screen are not needed, and the user may not access these boxes. However, the <Edit Overland Met Data> button is available.

If either the <Binary, in Separate PCRAMMET File> or <ASCII, in Separate PCRAMMET File> option is chosen, the overland meteorological data identifiers must be entered. These identifiers include surface station identifier code (0-99999, OCD variable ISFCD), year of surface data (0-99, OCD variable ISFCYR), upper air station identifier code (0-99999, OCD variable IMXD), and year of upper air data (0-99, OCD variable IMXYR). The <Edit Overland Met Data> button is not available.

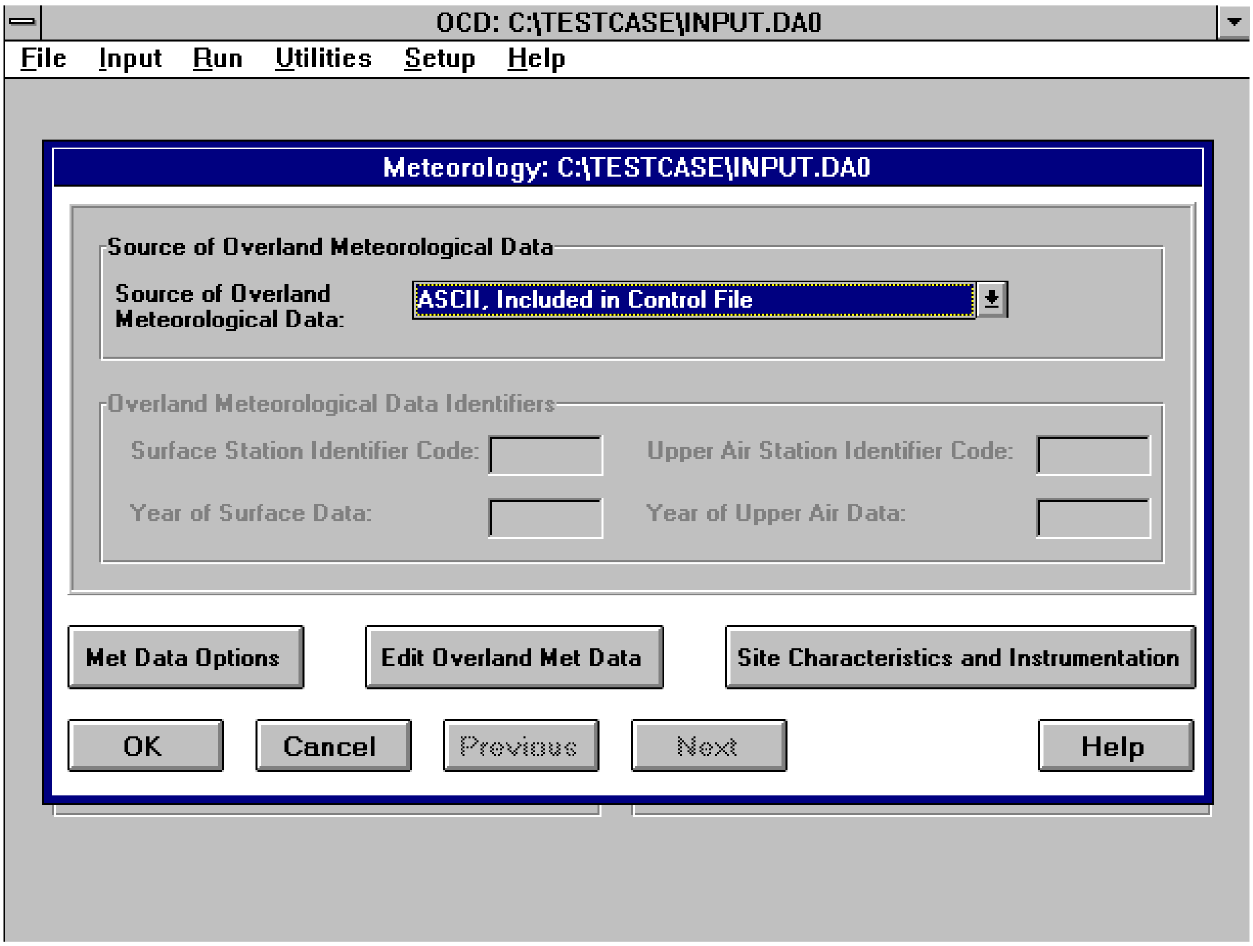
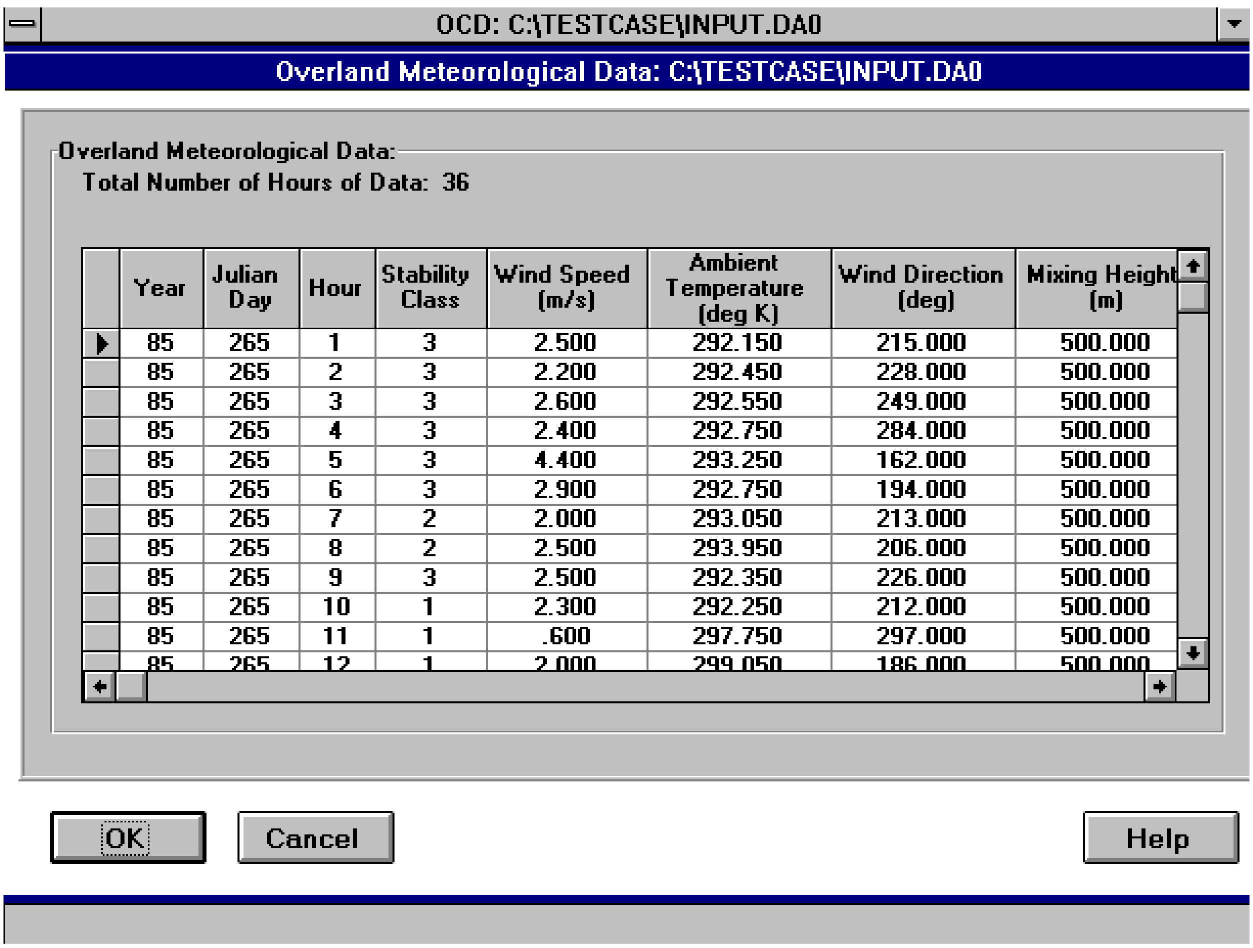


Figure 4-19. An example of the Meteorology screen.

To enter or edit the overland meteorological data in the control file, i.e., the <ASCII, Included in Control File> option is selected, click the <Edit Overland Met Data> button. The Overland Meteorological Data screen is displayed (see Figure 4-20). This screen contains the following data (see Section 3.2.1 and Table 3-11): year (0-99, OCD variable JYR), Julian day (1-366, OCD variable DAY1), hour (1-24, OCD variable KHR), overland stability class (1-6, OCD variable IKST), overland wind speed (m/s, >0, OCD variable QU), overland ambient air temperature (K, 200-330, OCD variable QTEMP), overland wind direction (degrees, 1-360, OCD variable QTHETA), and overland mixing height (m, 1-10000, OCD variable QHL). The GUI displays the total number of hours of data defined. Follow the directions in Section 4.1.3 for adding, deleting and editing the data. If the overland meteorological data to be added by the user already exist in another OCD control file, it is recommended that the user use a text editor, outside of the GUI, to copy the meteorological data from the old to the new control file, rather than using the GUI to manually enter the data.



Year	Julian Day	Hour	Stability Class	Wind Speed (m/s)	Ambient Temperature (deg K)	Wind Direction (deg)	Mixing Height (m)
85	265	1	3	2.500	292.150	215.000	500.000
85	265	2	3	2.200	292.450	228.000	500.000
85	265	3	3	2.600	292.550	249.000	500.000
85	265	4	3	2.400	292.750	284.000	500.000
85	265	5	3	4.400	293.250	162.000	500.000
85	265	6	3	2.900	292.750	194.000	500.000
85	265	7	2	2.000	293.050	213.000	500.000
85	265	8	2	2.500	293.950	206.000	500.000
85	265	9	3	2.500	292.350	226.000	500.000
85	265	10	1	2.300	292.250	212.000	500.000
85	265	11	1	.600	297.750	297.000	500.000
85	265	12	1	2.000	299.050	186.000	500.000

Figure 4-20. An example of the Overland Meteorological Data screen.

The <Met Data Options> button on the Meteorology submenu displays the Meteorological Data Options screen (see Figure 4-21). On this screen, use the check boxes to select the following options (see Section 3.2.1 and Table 3-11): whether to modify wind speed for land source (OCD variable IOPT(24); overwater wind direction data provided (OCD variable JOPT(1)); overwater wind speed data provided (OCD variable JOPT(2)); overwater vertical potential temperature gradient data provided (OCD variable JOPT(3)); overland horizontal and vertical turbulence intensity data provided (OCD variable JOPT(5)); overwater wind direction shear data provided (OCD variable JOPT(7)); overwater horizontal turbulence intensity data provided (OCD variable JOPT(8)); and overwater vertical turbulence intensity data provided (OCD variable JOPT(9)). Also on this screen, select whether the overwater humidity data are specified as relative humidity (%), wet bulb temperature (K), or dew point temperature (K) (OCD variable JOPT(4)); and whether the water surface temperature data are provided as water surface temperature (K), or air minus water surface temperature (K) (OCD variable JOPT(6)).

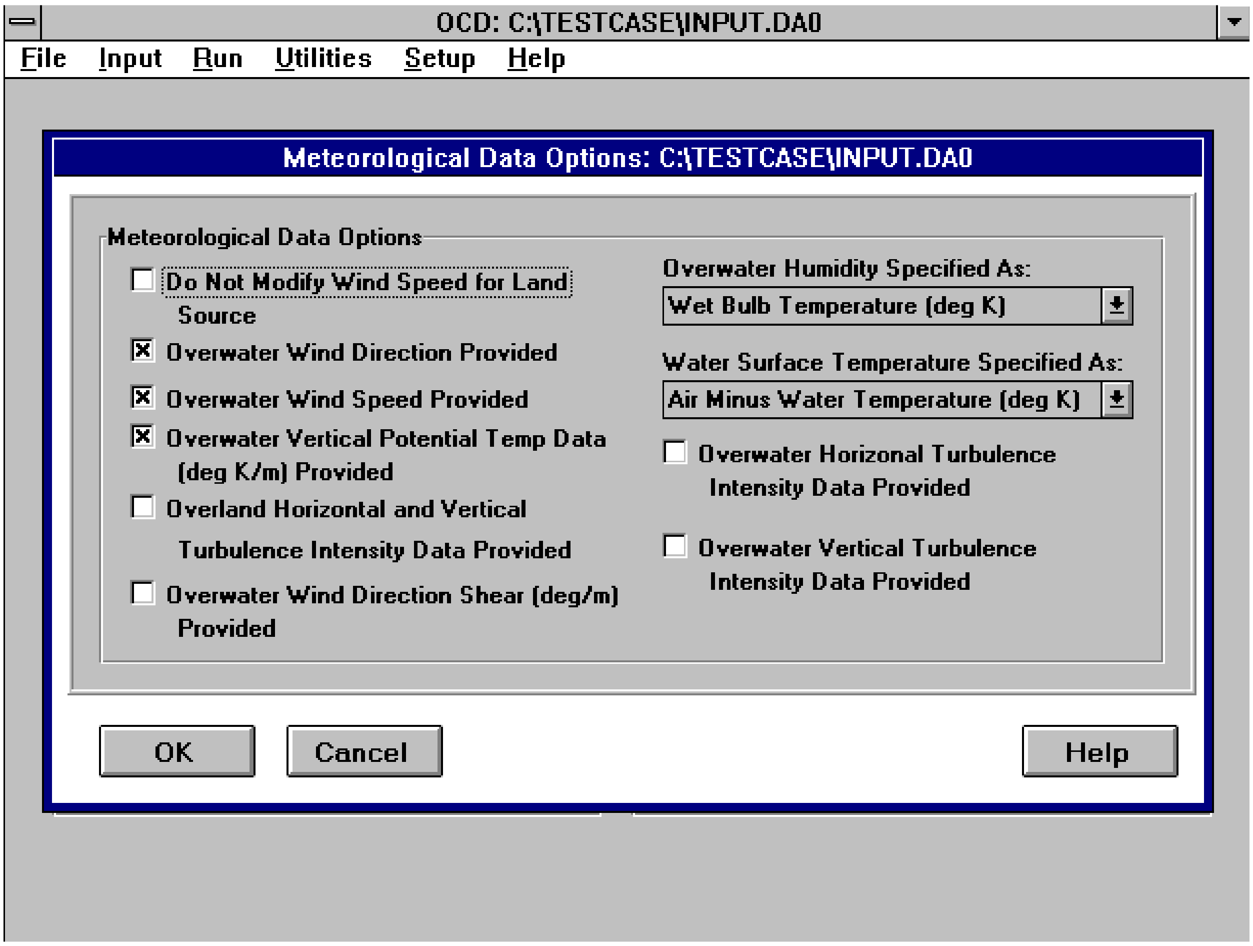


Figure 4-21. An example of the Meteorological Data Options screen.

The <Site Characteristics and Instrumentation> button on the Meteorology submenu displays the Site Characteristics and Instrumentation screen (see Figure 4-22). Enter the overland anemometer height (OCD variable HANE), the height above water level of the overwater anemometer (OCD variable HWANE), the height above water level of overwater air temperature sensor (OCD variable HWT), the surface roughness length (OCD variable Z0L), the minimum miss distance for a plume above the ground at the receptor location (OCD variable ZMIN), and the latitude of the source region (degrees in decimal notation, -90 to 90, variable SLAT). It is recommended that the latitude specified here be consistent with the latitude specified on the Chemical Transformation screen (see Section 4.4.8).

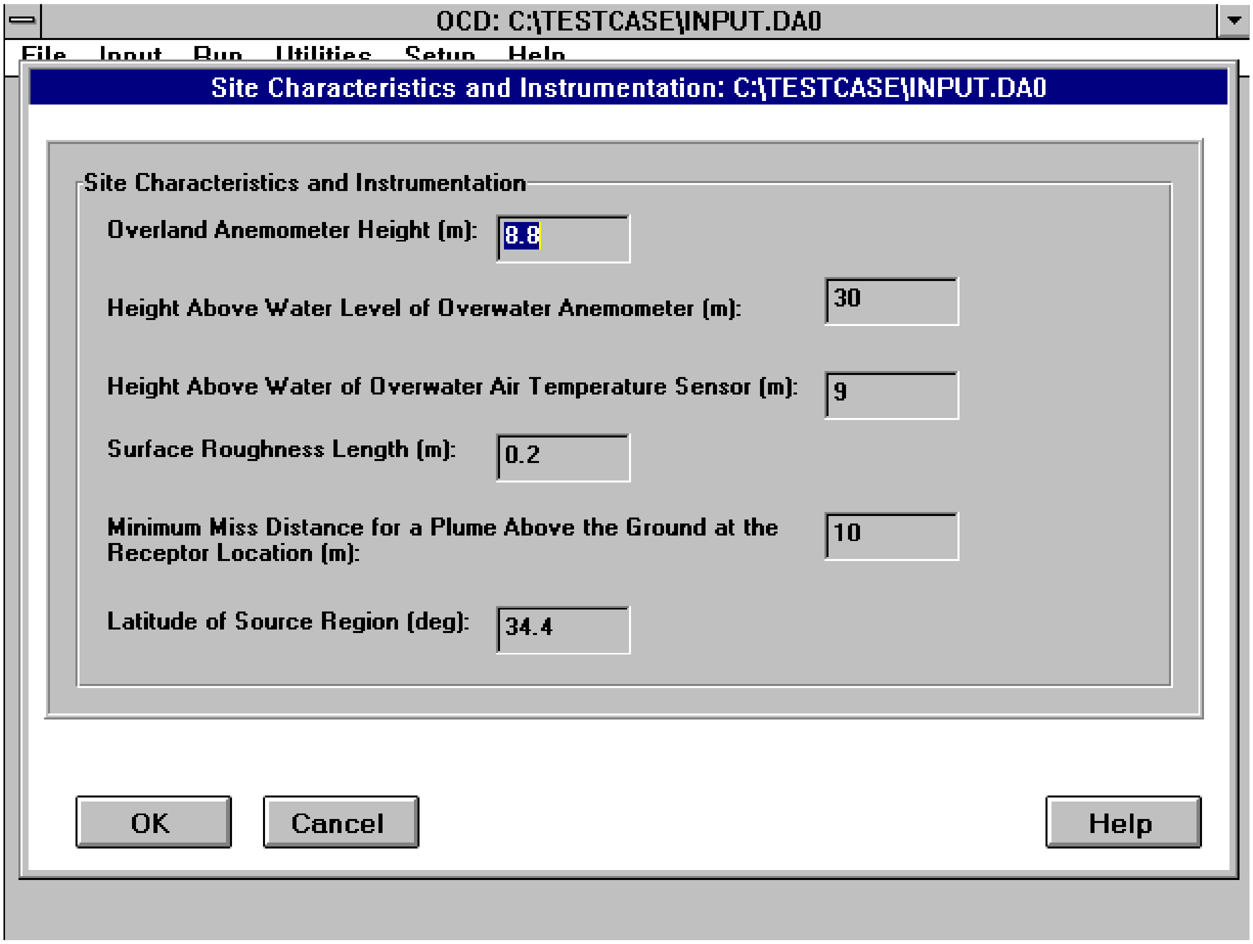


Figure 4-22. An example of the Site Characteristics and Instrumentation screen.

4.4.8 Chemical Transformation Submenu

The Chemical Transformation screen (see Figure 4-23) displays the information for OCD Input Group 15 (see Section 3.2.1). If the user selects the option to specify the pollutant decay rates via chemical transformation (OCD variable IOPT(25)), the parameters on this screen must be entered. Otherwise, it is not necessary to specify any data for this screen.

If chemical transformation is to be considered, the user needs to enter the following site location information: latitude (degrees in decimal notation, -90 to 90), longitude (degrees in decimal notation, -180 to 180) and time zone (-12 to 11). These are the OCD variables ALAT, ALONG and TZONE, respectively. As mentioned before, the latitude specified here should be consistent with the latitude specified on the Site Characteristics and Instrumentation screen (see Section 4.4.7). Next, enter 12 monthly values for the pollutant decay rate (%/hour; OCD variable DECAY) for daytime hours. OCD does not consider chemical transformation during nighttime hours.

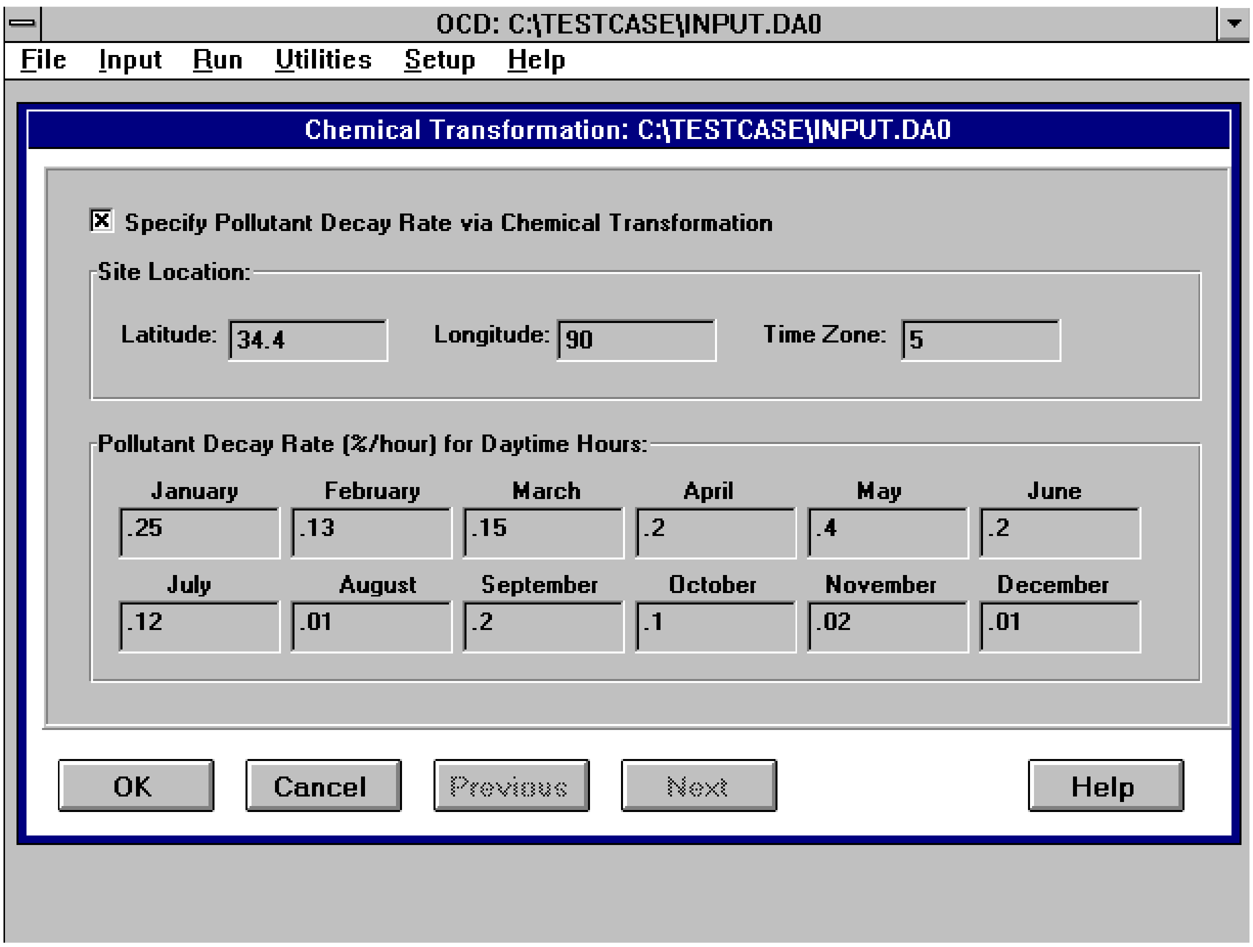


Figure 4-23. An example of the Chemical Transformation screen.

4.4.9 Output Options Submenu

All OCD input data (from Input Groups 3 and 4) that are related to output options are collected under the Output Options submenu (see Figure 4-24). First enter an optional fifth averaging time (OCD variable NAV5) for the high five tables. As mentioned in Section 3.2.1, any value between 0 and 24, except 1, 3, 8, and 24 is allowed for NAV5. NAV5=0 means that a fifth averaging time will not be added. The next check box is for the option of printing out the emissions with height table (OCD variable IOPT(9)).

The remaining output options are logically grouped as follows:

Group 1 *Options related to hourly output*

- printout of hourly contributions of significant sources (OCD variable IOPT(11)) (this option is not available if the user did not specify significant sources),
- printout of hourly summary of receptor contributions (OCD variable IOPT(14)),
- printout of meteorological data on hourly contributions/summary (OCD variables IOPT(12) and IOPT(15)) (the two options are currently the same), and
- case-study printout of plume transport and dispersion on hourly contributions/summary (OCD variable IOPT(13) and IOPT(16)) (the two options are currently the same)

Group 2 *Options related to the length of averaging period (NAVG, see Table 3-11)*

- printout of resultant meteorological data summary for averaging period (OCD variable IOPT(10)),
- printout of averaging period contributions (OCD variable IOPT(17)), and
- printout of averaging period summary (OCD variable IOPT(18))

Group 3 *Options related to the complete run-period*

- printout of average concentration and high-five tables for the entire run (OCD variable IOPT(19)),
- printout of table of annual impact assessment form non-permanent activities (OCD variable IOPT(23))

Group 4 *Options related to output files*

- create secondary summary output file (extra.out) (OCD variable IOPT(21)), and
- create hourly binary concentration file (conc.bin) (OCD variable IOPT(22)

The default is to generate printout of the average concentration and high-five tables for the entire run, and to create the *conc.bin* file.

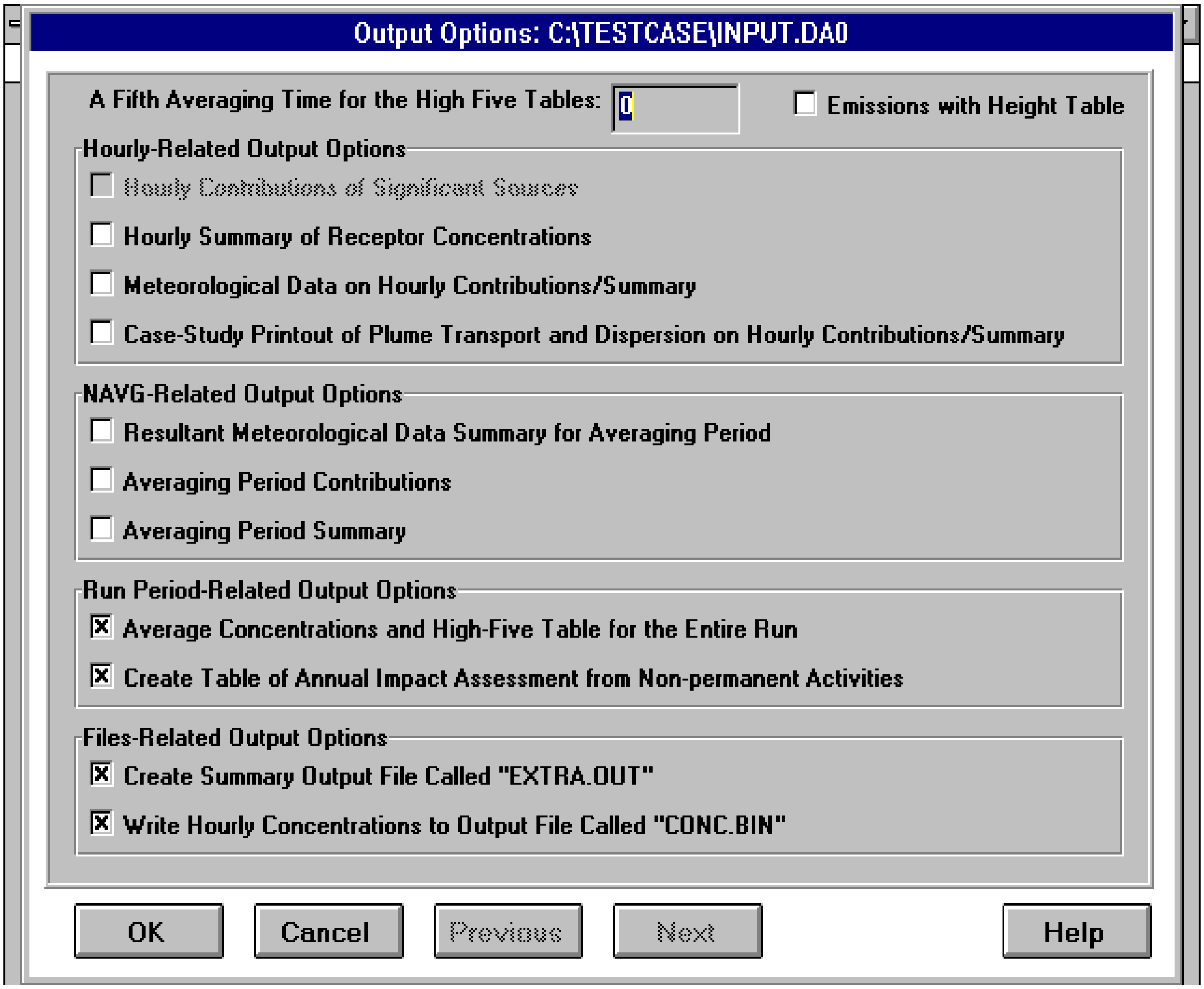


Figure 4-24. An example of the Output Options screen.

4.4.10 Map Display Submenu

The Shoreline Map screen displays the shoreline, together with the source and receptor locations (see Figure 4-25). If the shoreline geometry has not been defined, the GUI displays the message “You must define shoreline geometry BEFORE viewing the map!”. Go to the Model Domain screen (see Section 4.4.3) and run the MAKEGEO utility to define the shoreline geometry. Alternatively, the shoreline data can always be prepared by hand.

The shoreline geometry is depicted by colored blocks of green for water and blue for land. The source locations are indicated by Sn where n is the source number. Discrete, Cartesian, and polar receptor locations are shown by Dn, Cn and Pn, respectively, where n is the receptor number. The map also displays the user coordinate system and a legend. The numbers of sources and for each type of receptor are shown.

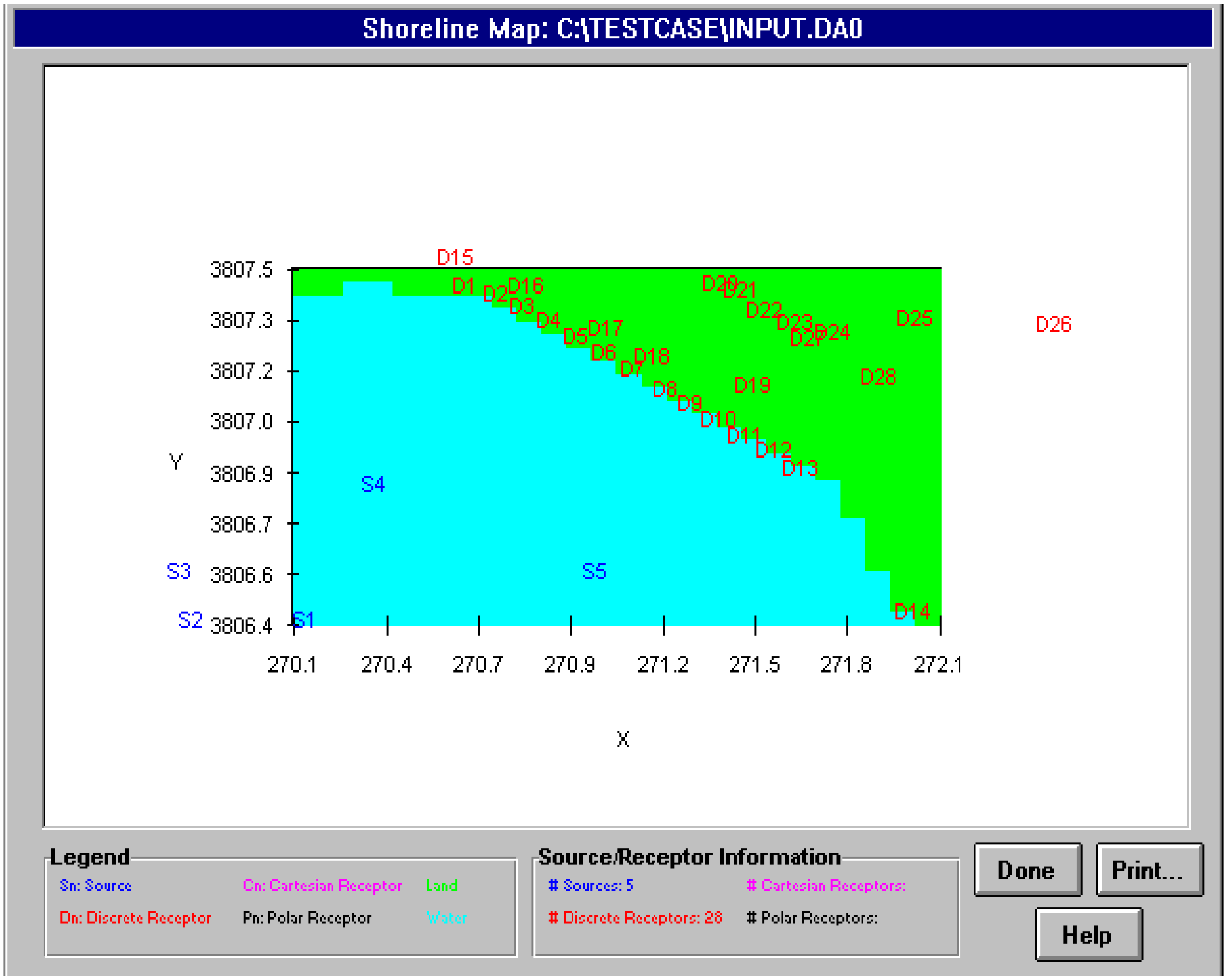


Figure 4-25. An example of the Map Display of the shoreline geometry, and all sources and receptors.

When the <Print...> button is pressed, a pop-up box appears prompting the user to select whether to print the map, or save the map to a Windows bitmapped (BMP) file. If the print option is chosen, the entire map (including legend) is printed. If the file option is chosen, a files dialog box is displayed prompting the user for a file name. The file extension must be BMP. The plot, but not the legend due to software limitations, is saved to the file.

4.5 Run Menu

The Run menu (see Figure 4-26) contains the option to run the OCD model using either the currently opened control file or another file on disk. The user must also specify other required input and output files before OCD can be run (see Figure 4-27). The GUI renames the files specified by the user on this screen to the hardwired filenames required by the OCD model (see Section 3.2 and Table 3-31). In order to avoid unnecessary confusion, it is strongly recommended that the user always prepare the data files using names that are different from the defaults.

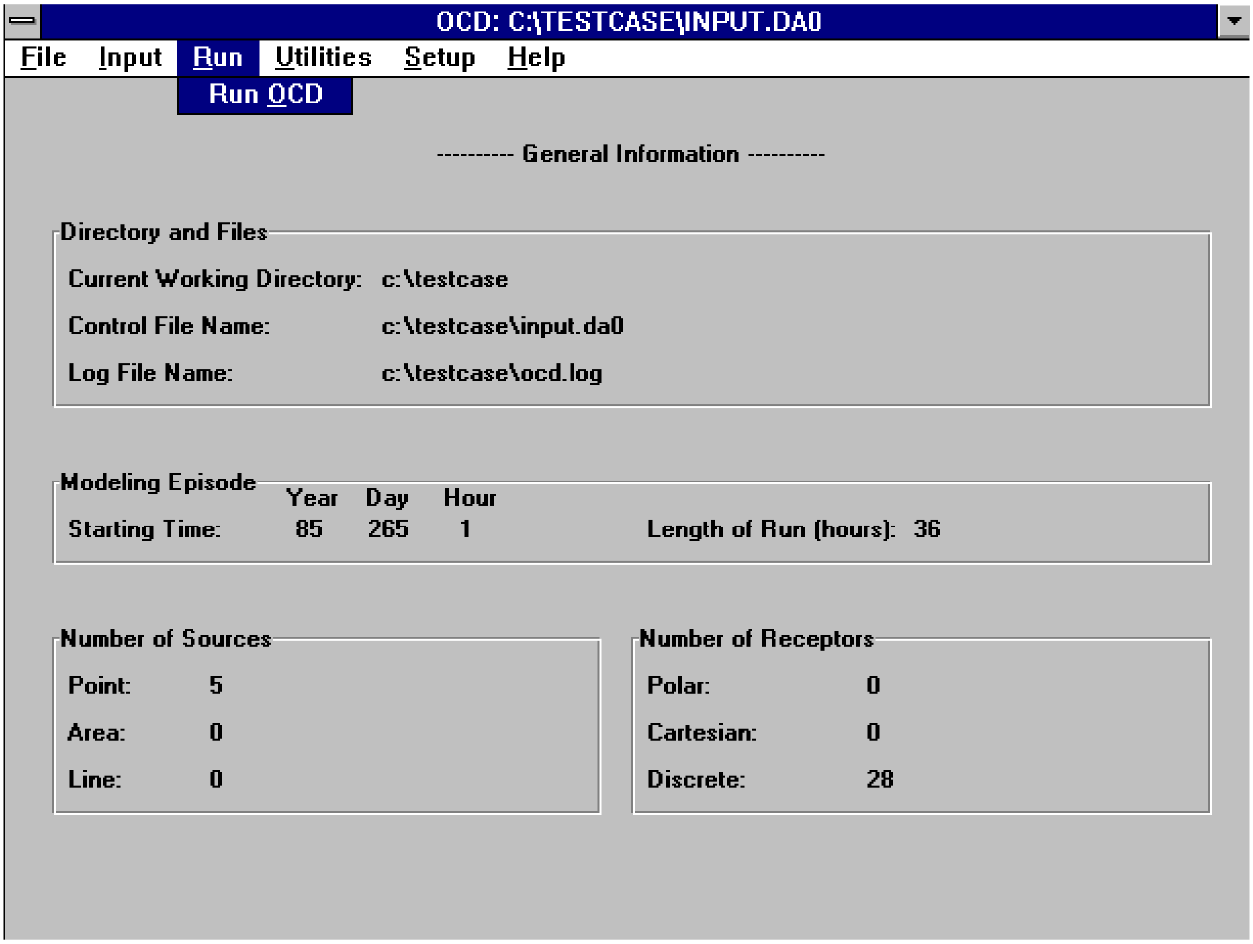


Figure 4-26. An example of the Run Menu.

4.5.1 Run OCD Submenu

To run the OCD model, the user must specify the names of the required files (see Figure 4-27). Either type in the path and file name, or click <Browse...> and select the file name.

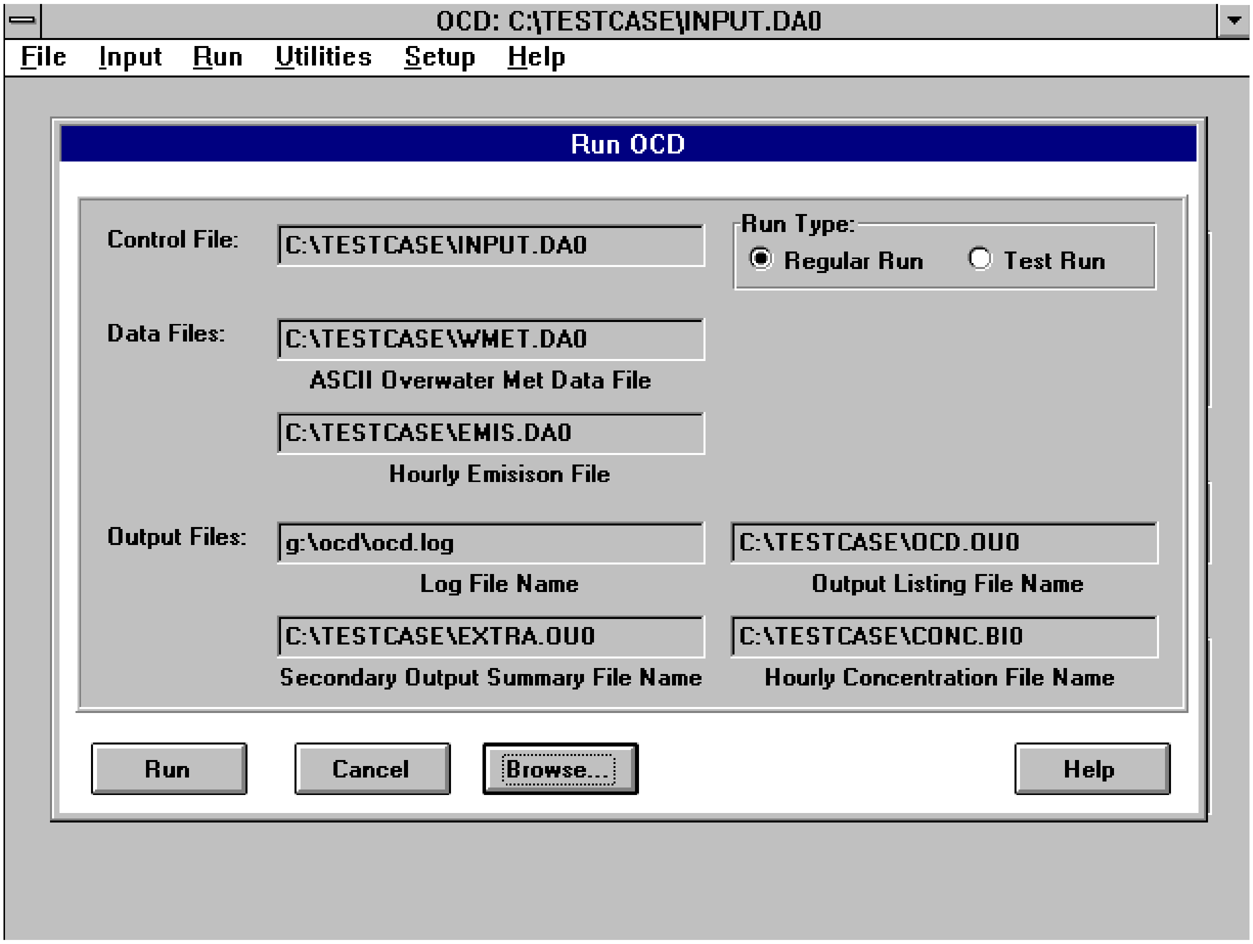


Figure 4-27. An example of the Run OCD screen.

On the Run OCD screen, the user is first required to specify the control file to run. By default, the GUI assumes that the user wants to run the currently loaded file. Next, specify whether the run is a regular run or a test run (OCD variable INORMAL, see Section 3.2.1). If the Regular Run mode is selected, the execution of the OCD model will be halted by any fatal error. Dispersion calculations will be performed when all input data are validated. If the Test Run mode is selected, the OCD model will validate all input data specified in the control file, and the validation process will not be stopped by the first fatal error, if any. No dispersion calculations will be performed in the Test Run mode.

The required input data files depend on the model options chosen on other screens. The user must always specify an ASCII overwater meteorological data file (*wmet.dat*, see Section 3.2.3). If the overland meteorological data are included in a separate file, rather than included in the control file, then depending on the type of the overland meteorological data file selected (*lmet.dat*, see Section 3.2.2), the user must specify the name for the binary or ASCII data file. If the option of using hourly emission data is chosen, the user must specify the hourly emission data file (*emis.dat*, see Section 3.2.4).

The output files include the log file, the output listing file (*ocd.out*, see Section 3.2.5), the secondary output summary file (*extra.out*, see Section 3.2.7), and the hourly binary concentration file (*conc.bin*, see Section 3.2.8). The first two files are mandatory, and the last two files are optional depending on model options. Note that the log file is a feature unique to the GUI program, and is used to keep a record of OCD model applications. The log file is not required to run the OCD model itself.

After all of the required file names are specified, click <Run> to run the OCD model. If the control file specified contains unsaved changes, the GUI prompts the user to save the current control file before running the model. Click <Yes> to save the current control file to disk and run the model. Click <No> to run the model with the control file previously saved on disk, i.e., the modified control file stored in the computer memory is not used. Click <Cancel> to return to the Run screen.

The GUI confirms that input data files exist, checks that default file names are not used, and verifies that output files do not already exist. If an input file to be used does not exist, the GUI informs the user and the model can not be run. If a default file name is used, the GUI warns the user. If an output file exists, the GUI prompts the user whether to overwrite the file, in which case, click <Yes> to overwrite the file, or <No> to return to the run screen and enter a new file name.

Once all file names are validated, the GUI copies the user-specified files to the default names required by the OCD model, writes summary information to the log file, and then runs the OCD model. The OCD model displays on screen the number of the day being processed. It then displays whether the program ran successfully or encountered an error, and waits for the user to press any key to return to the GUI. The GUI then displays the log file. At this point, the user can press <F10> to return to the GUI Main Menu.

The log file includes the following information: (1) the date and time the run was made, (2) the input and output files used by the OCD model, and (3) whether any errors were encountered.

4.6 Utilities Menu

This menu (see Figure 4-28) provides access to various utilities to assist the user in running the OCD model. The utilities include the preprocessor (OCD4TO5 and OCDPRO) and postprocessor (ANALYSIS) programs, along with other functions such as error checking for the OCD control file, resetting data in the control file to their default values, viewing and editing any files on disk, and the display of the top N concentration and exceedance maps.

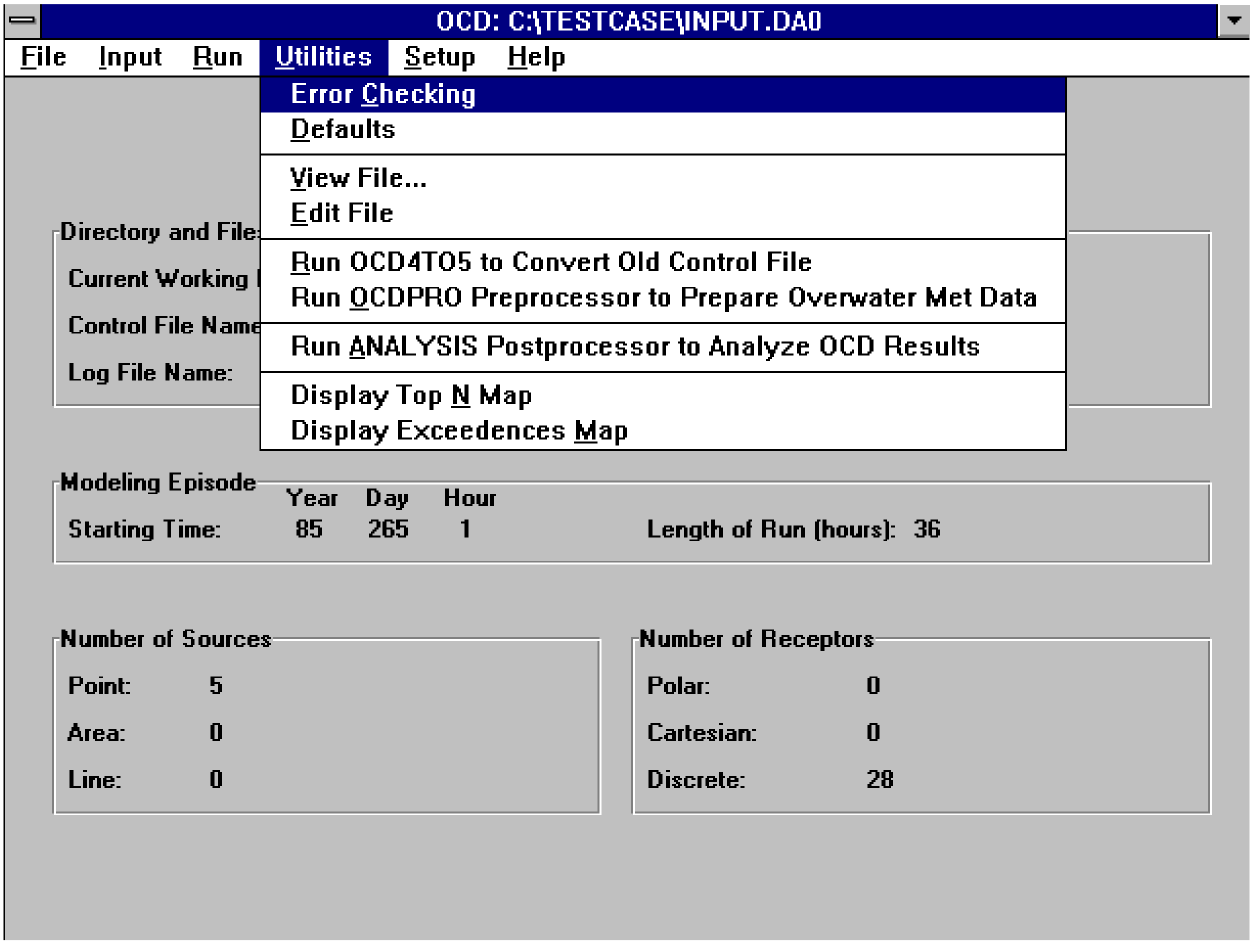


Figure 4-28. An example of the Utilities Menu.

4.6.1 Error Checking Submenu

The Error Checking utility scans the currently loaded control file for out-of-range errors and inconsistencies. Similar functions are also performed by the Test Run option of the OCD model (see Section 4.5.1). The reason why redundant error checkings are performed by the GUI program and the OCD model is because the user can run the OCD model without using the GUI. If errors are found, the Error Checking screen (see Figure 4-29) is displayed. It lists the number of errors, the screen name, the variable name, and a message for each error that was found. To correct an error, double click on the screen or variable name, and that screen is displayed. Edit the data accordingly. When finished editing the screen, click <OK> and the Error Checking screen is displayed again. To recheck the file, click <Check Again>. To return to the Main Menu, click <Quit>.

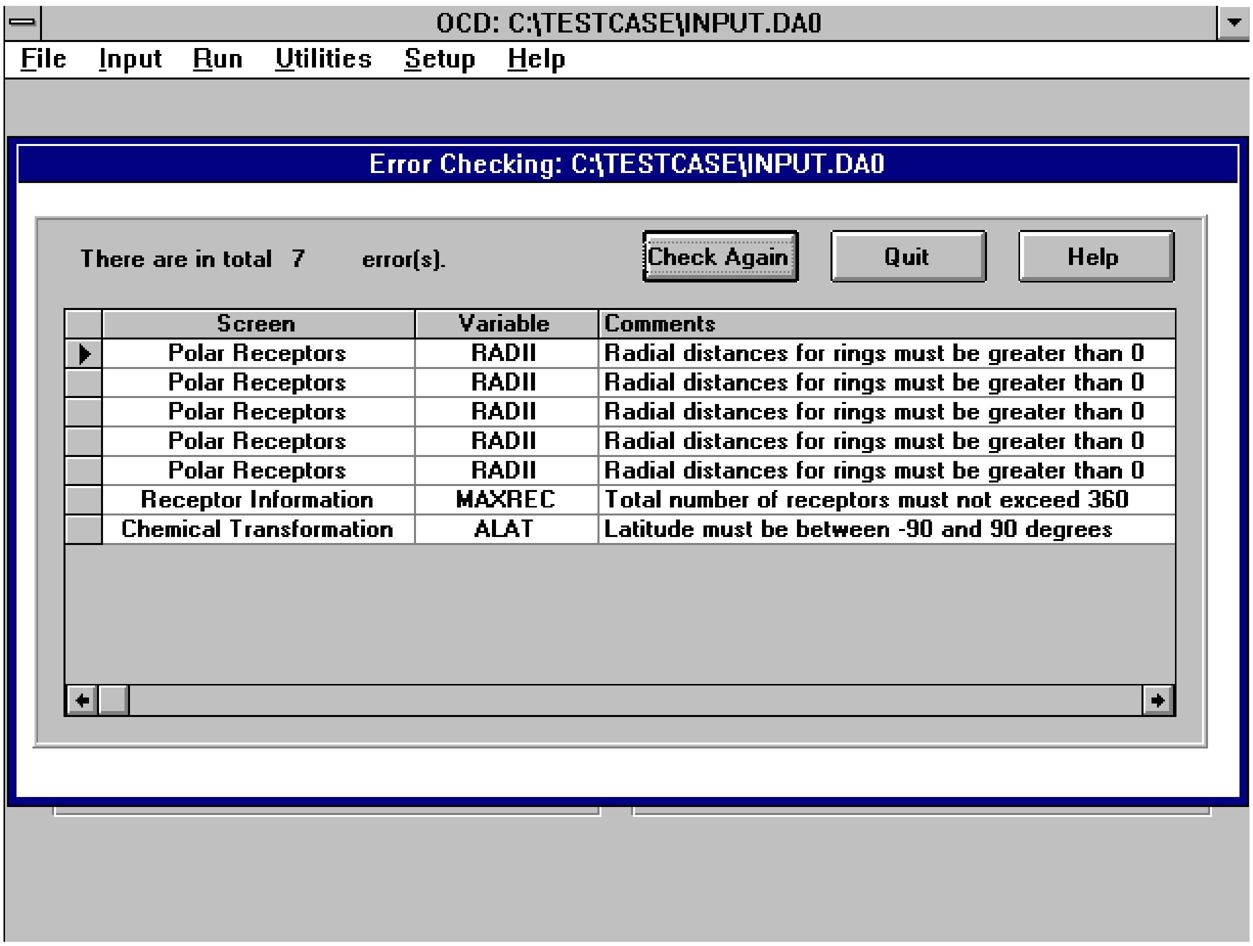


Figure 4-29. An example of the Error Checking screen.

4.6.2 Defaults Submenu

The Defaults utility resets the data in the currently loaded control file to their default values. When the user selects this option, the GUI prompts "Are you sure you want to reset values to their defaults?". Choose <Yes> to reset the values, or <No> to cancel (see Figure 4-30).

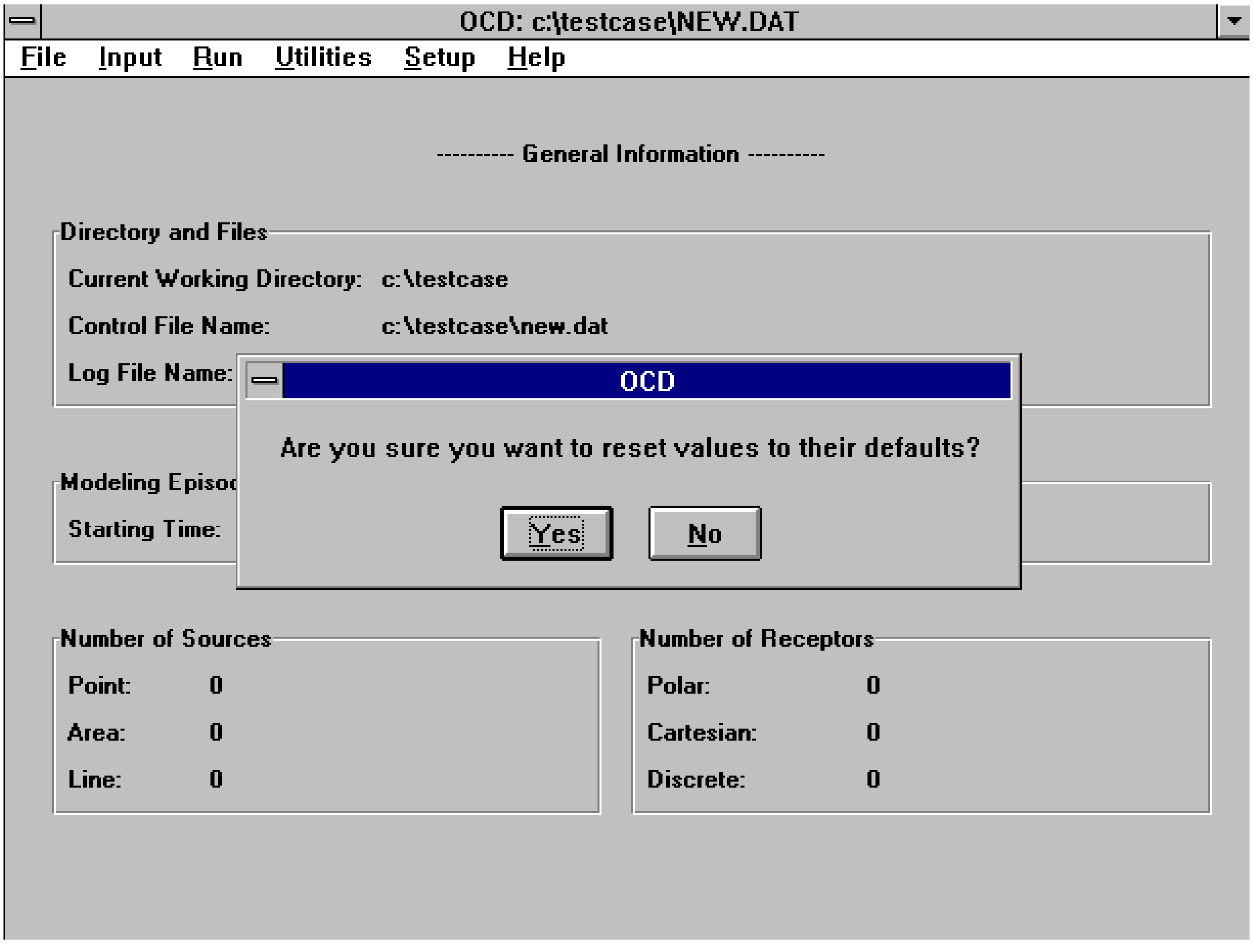


Figure 4-30. An example of the Defaults Pop-Up screen.

4.6.3 View File Submenu

The View File menu (see Figure 4-31) displays a files dialog box (see Section 4.1.1). The user may select a file to view. The selected file is displayed by a shareware utility called LIST. Once a file is displayed by the LIST utility, press <F10> to return to the GUI. The on-line help for the LIST utility can be obtained by pressing <F1>.

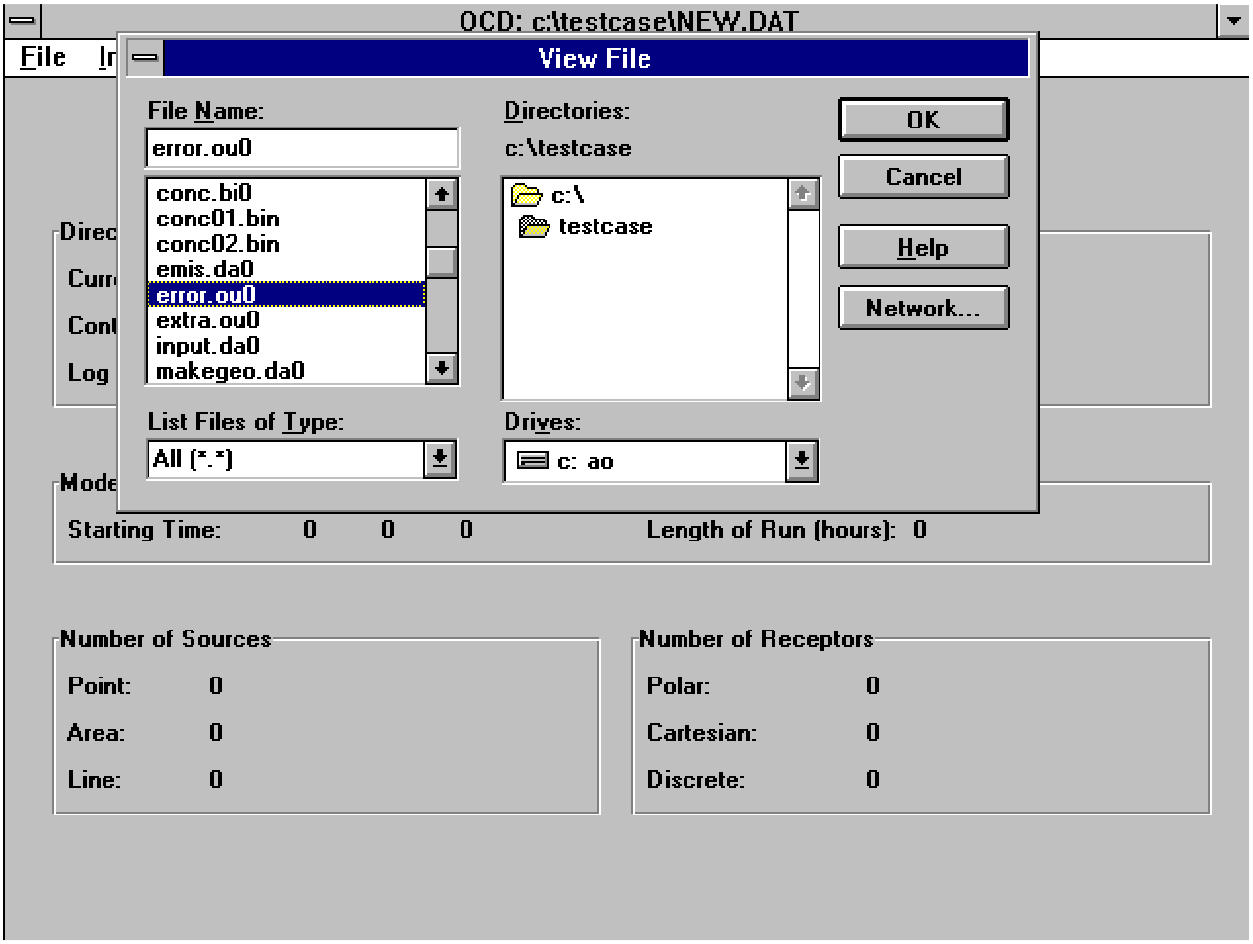


Figure 4-31. An example of the View File Dialog Box.

4.6.4 Edit File Submenu

The Edit File submenu allows the user to edit a file using the editor chosen in the Setup Editor submenu (see Section 4.7.1). When this option is chosen, the editor is started. Use the appropriate command for the editor to load the file to edit. When finished, exit the editor and the GUI is redisplayed.

4.6.5 Run OCD4TO5 Submenu

The Run OCD4TO5 submenu (see Figure 4-32) is used to invoke the OCD4TO5 utility (see Section 3.1.1) to convert an existing OCD/4 control file to an OCD/5 control file. The GUI prompts for the OCD/4 input file name and the OCD/5 output file name. Either type the path and file name for each file, or click <Browse> and select the file.

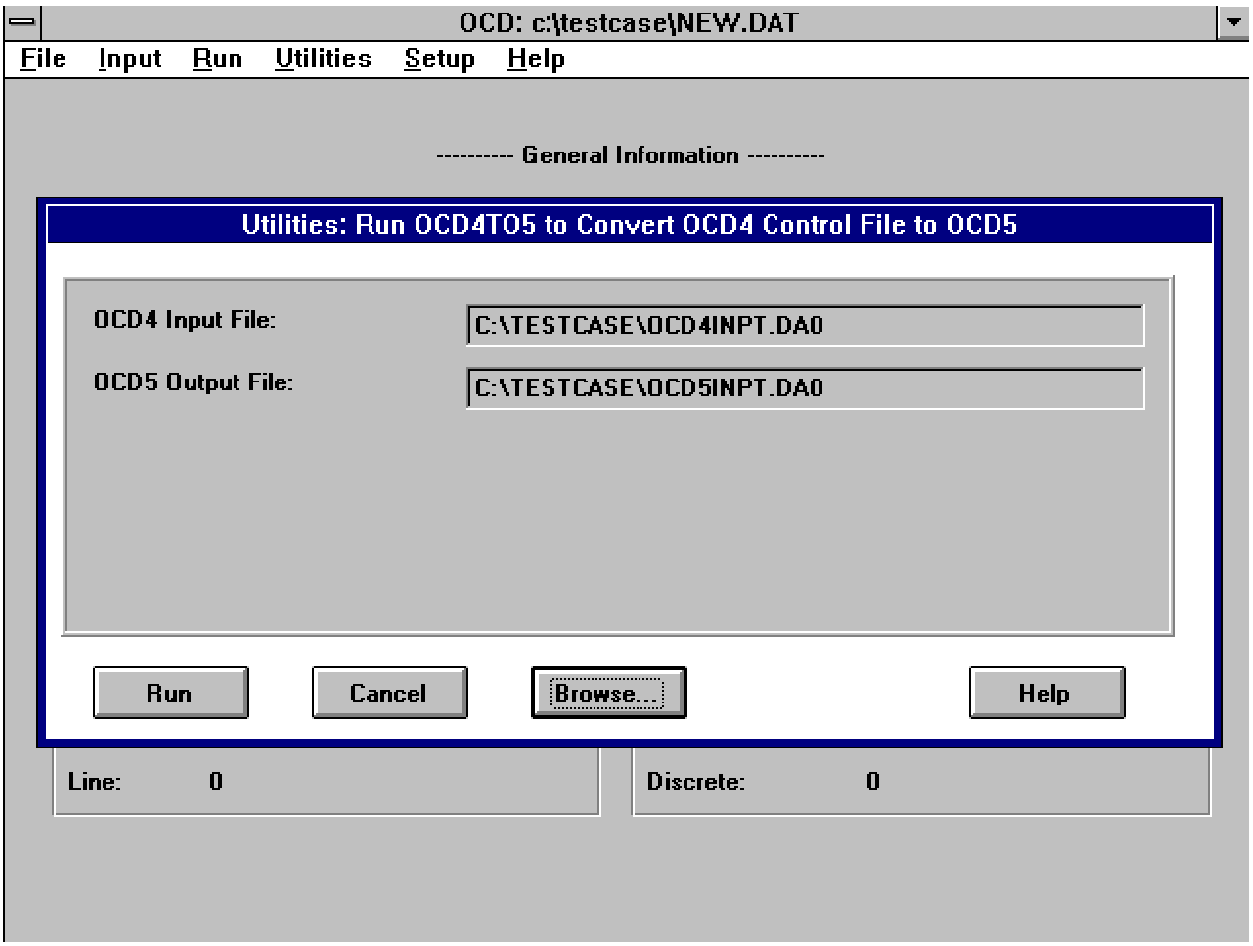


Figure 4-32. An example of the Run OCD4TO5 screen.

To run the utility, click <Run>. The GUI checks that the OCD/4 input file exists, and produces an error message if the file does not exist. Then the GUI checks whether the OCD/5 output file exists. If so, the user is prompted whether to overwrite the file. Click <Yes> to overwrite the file, or <No> to return to the previous screen and enter a new file name. Once all filenames are correct, the GUI copies the OCD/4 input file to the default (*ocd4inpt.dat*) name required by the OCD4TO5 utilty and runs the program. When it is finished processing, the program copies the newly created OCD/5 input file (*ocd5inpt.dat*) to the file name specified by the user, and waits for the user to press any key to return to the GUI. The converted OCD/5 control file may be loaded into the GUI by selecting Open from the File Menu.

4.6.6 Run OCDPRO Submenu

The Run OCDPRO submenu (see Figure 4-33) is used to invoke the OCDPRO utility (see Section 3.1.2) to fill in missing values for the overwater meteorological data. The GUI prompts for the two input files required: the overwater meteorological data file, possibly with missing data (see Section 3.2.3 for file format); and the overland meteorological data file (see Section 3.2.2 for file format). The GUI also prompts for two output files: the overwater meteorological data file with missing data, if any, filled in; and the output listing file. Either type the path and file name for each file, or click <Browse...> to select the file. The user also needs to select the source of the overland meteorological data file from the following three options: (1) ASCII, in the OCD format; (2) ASCII, in the PCRAMMET format; and (3) binary, in the PCRAMMET format. This option is identical to the model option IOPT(5) for the OCD model (see Section 3.2.1).

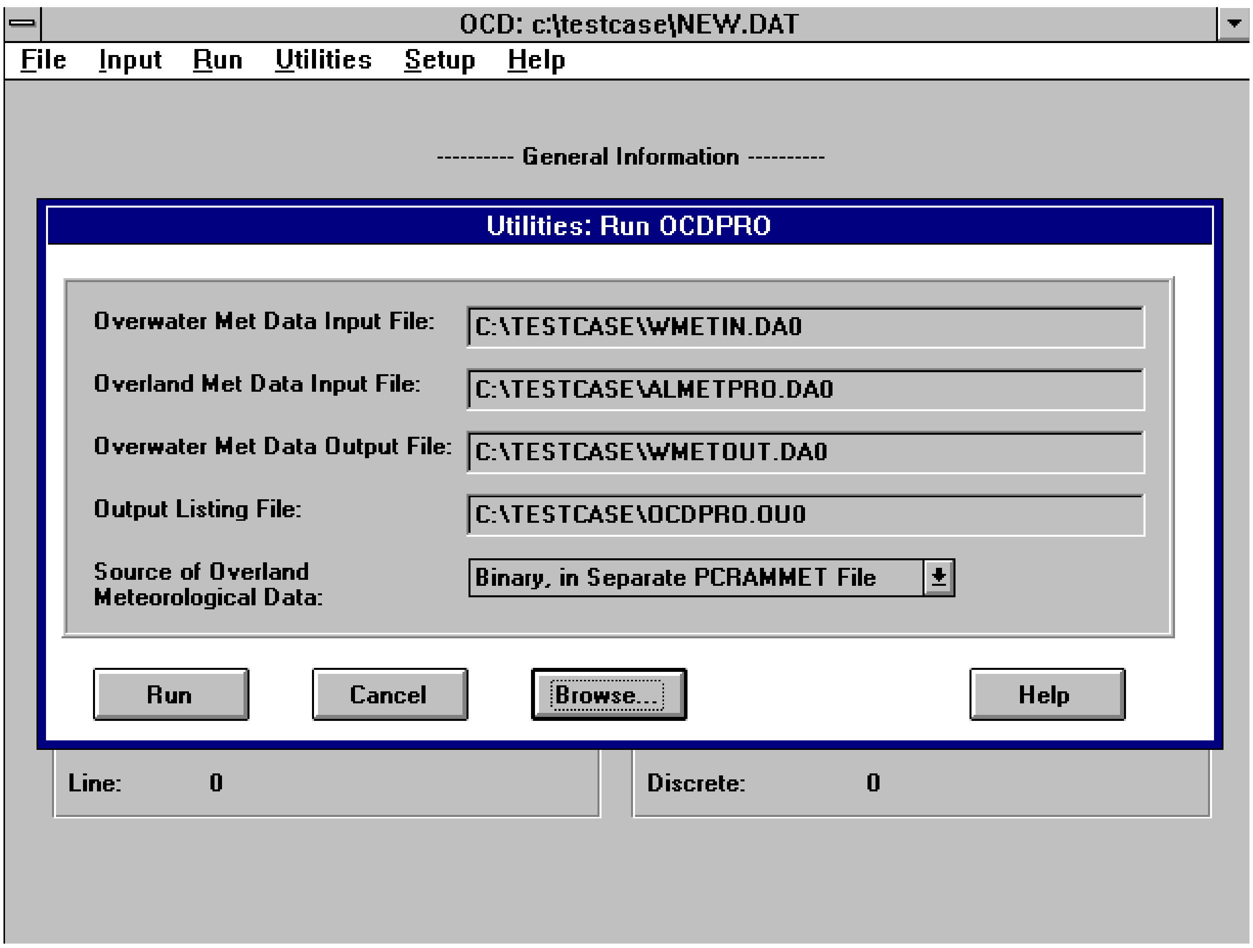


Figure 4-33. An example of the Run OCDPRO screen.

To run the OCDPRO utility, click <Run>. The GUI confirms that the input data files exist, checks that the default file names (see Section 3.1.2) are not used, and verifies that the output files do not exist. If an input file does not exist, the GUI informs the user and the utility can not be run. If a default file name is used, the GUI warns the user. If an output file exists, the GUI prompts the user whether to overwrite the file. Click <Yes> to overwrite the file, or <No> to return to the previous screen and enter a new file name. Once all file names are correct, the GUI writes the OCDPRO control file, *ocdpro.dat*, that contains the information for the source of the overland meteorological data, and then runs OCDPRO. When OCDPRO is finished processing, the program displays whether the run was successful, and waits for the user to press any key to return to the GUI.

4.6.7 Run ANALYSIS Submenu

The Run ANALYSIS submenu allows the user to invoke the ANALYSIS postprocessor to further analyze the results predicted by the OCD model. As described in Section 3.3, the ANALYSIS postprocessor consists of the following six modules:

TOPVAL	Displays for each receptor the top N X-hour (block) average concentrations, together with the day and hour of occurrence. The TOPVAL module also generates a separate file called *ana.top* that includes the locations and values of the top N X-hour average concentrations for all averaging periods. The information is in turn used by the GUI to produce the top-concentration map for an averaging period specified by the user (see Section 4.6.8)
CUMFRQ	Tabulates for each receptor the cumulative frequencies of X-hour (block) average concentrations. The user-specified concentration levels denote upper bounds, and the program calculates the percentages of concentrations less than or equal to the levels. CUMFRQ also prints out for each receptor the average concentration over the entire run.
PEAK	Tabulates for each receptor all X-hour (block) average concentrations, together with the corresponding meteorological conditions, where a specified threshold value was exceeded. The PEAK module also generates a separate file called ana.pek that includes the locations and values of the X-hour average concentrations that exceeded a certain threshold value for all averaging periods. The information is in turn used by the GUI to produce the exceedance map for an averaging period specified by the user (see Section 4.6.9).
EXTRCT	Extracts the X-hour (block) average concentrations from the binary file for an averaging period specified by the user, and then writes out the data in fixed-width ASCII format so that concentration isopleths can be generated by independent plotting software.
AVERGE	Calculates X-hour running average concentrations, and then writes out the average concentrations to a new binary file similar to the input file.
SEQADD	Reads up to 12 binary concentration files, synchronized in time, and adds hourly concentrations from each file. A scaling factor can be applied to each data set independently before the data are merged. The

merged hourly concentrations are written to a new binary file similar to the input files.

The ANALYSIS screen (see Figure 4-34) contains “tabs” by which the user can select which modules to run. As the user activates a module by clicking on the check box, the associated tab becomes active. To enter data for a particular module, click on the corresponding tab. To select a tab using the keyboard, press and hold the <Alt> key while typing the underlined letter in the tab name. As described in Section 3.3, any combination of the TOPVAL, CUMFRQ, PEAK and EXTRCT modules may be run simultaneously, whereas the AVERGE and SEQADD modules must be run individually. Each module can be selected only once in each ANALYSIS run. For example, the user is not allowed to run the TOPVAL modual twice in a single ANALYSIS run As the user selects a module, the GUI grays out the modules that can not be run concurrently.

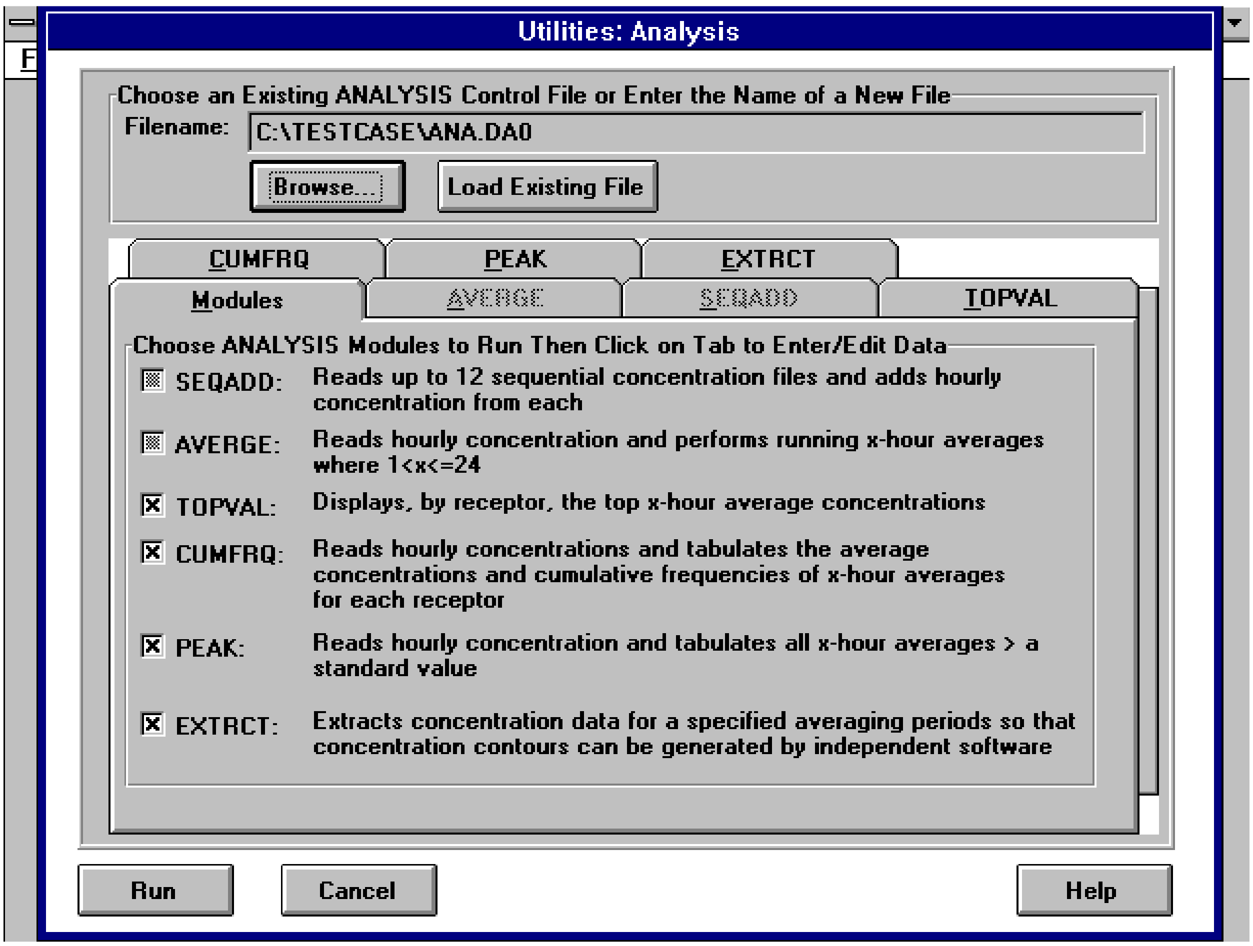


Figure 4-34. An example of the ANALYSIS screen.

The GUI first prompts for an ANALYSIS control file name. If a previous ANALYSIS control file exists, type the path and file name and then click <Load File>, or click <Browse...> to select the file and the GUI automatically loads the file. The GUI then reads the ANALYSIS control file and fills in the data for the appropriate modules. To start from a new ANALYSIS control file, simply enter the path and file name for the new control file, and select the modules to run.

For the SEQADD module (see Figure 4-35), enter the number of binary concentration files (see Section 3.2.8) to be scaled and merged. Up to 12 concentration files can be processed at a time. For each file, enter the scaling factor for the predicted concentration. Refer to Table 3-23 for a detailed description for the above variables.

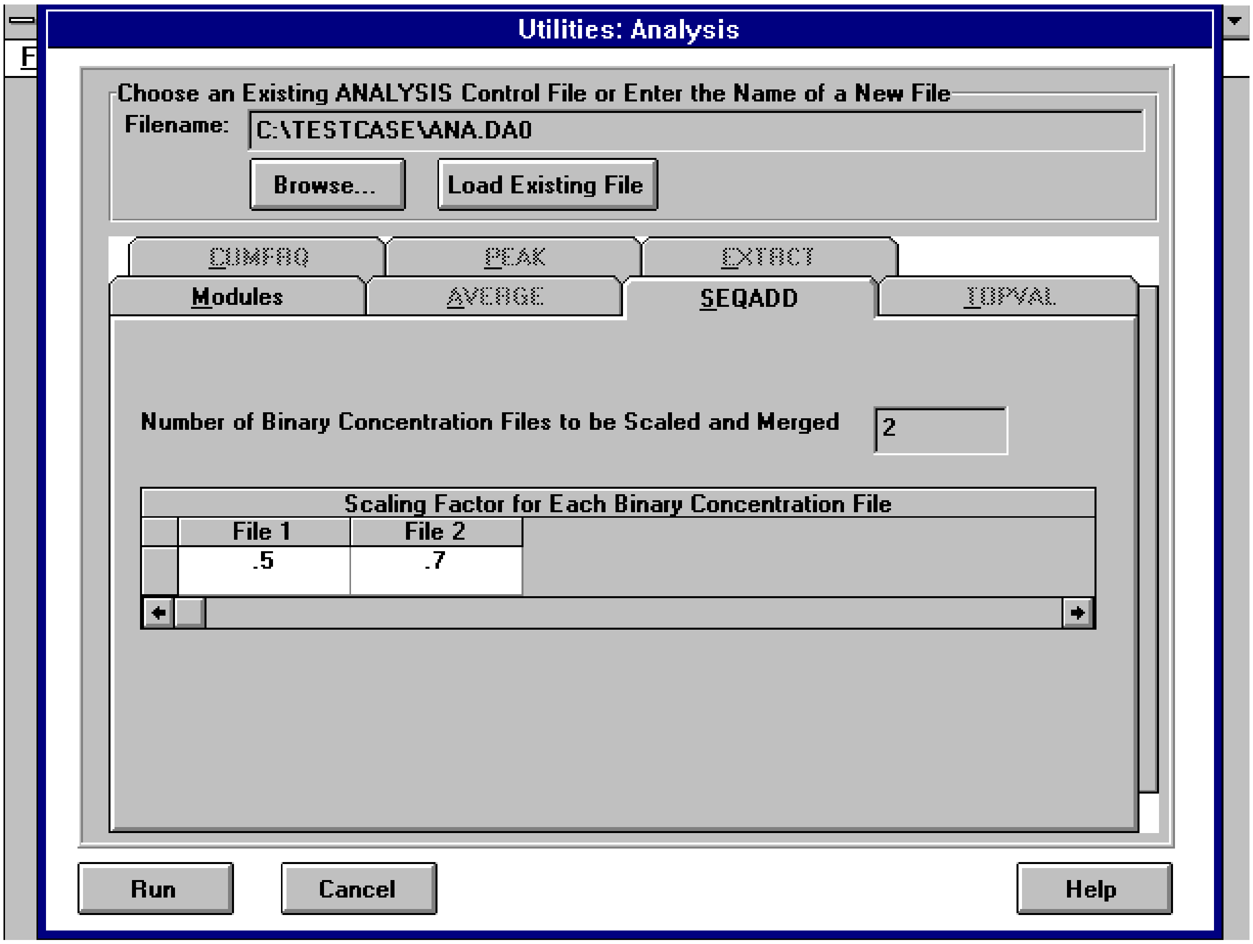


Figure 4-35. An example of the SEQADD screen for the ANALYSIS postprocessor.

For the AVERGE Module (see Figure 4-36), enter the length of the averaging period (up to 24 hours) where moving average is to be performed. Refer to Table 3-22 for a detailed description for the above variable.

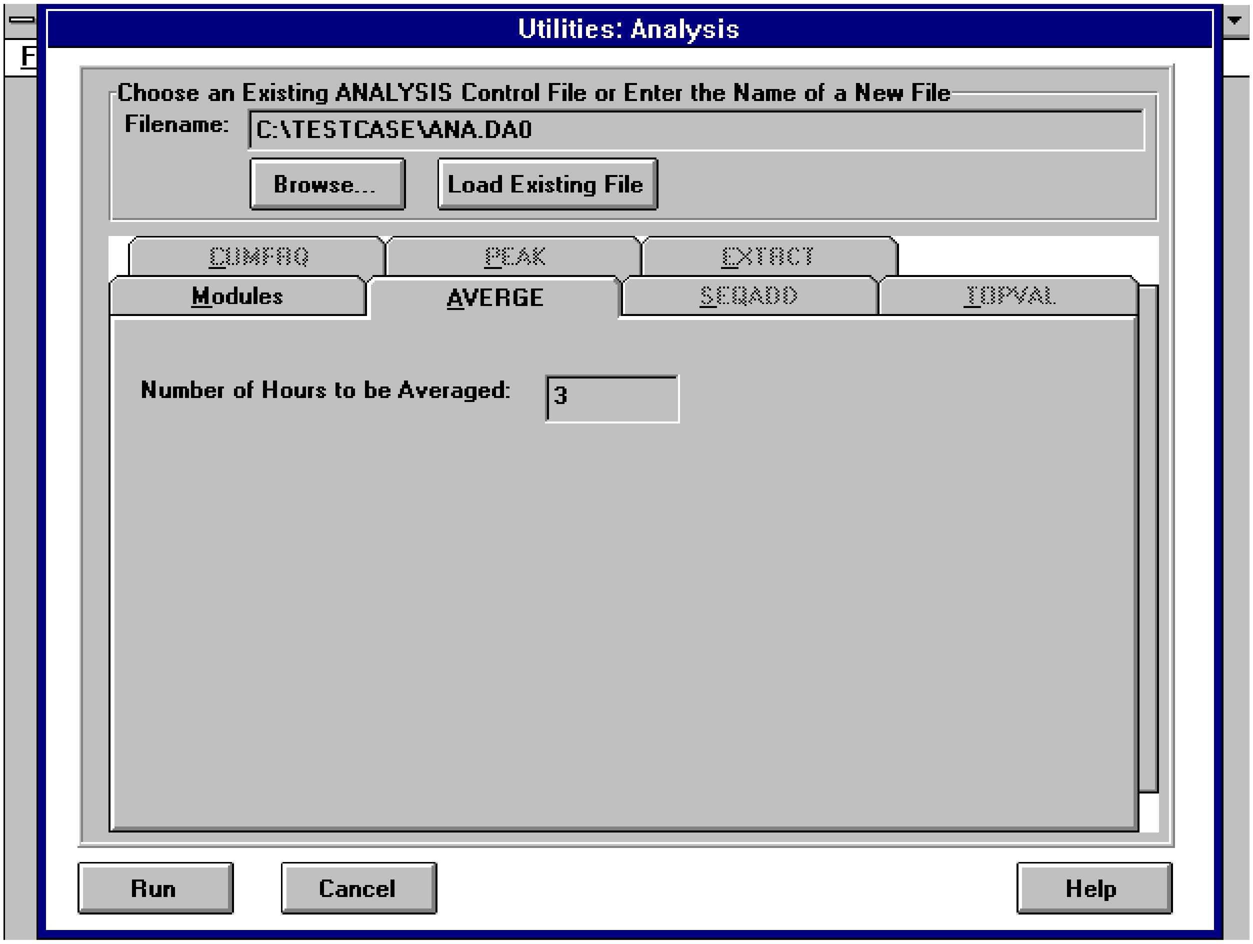


Figure 4-36. An example of the AVERGE screen for the ANALYSIS postprocessor.

For the TOPVAL module (see Figure 4-37), enter the following information: the number of records in an averaging period (variable LP); the number of hours represented by each record of the input binary file (variable NH); the number of the topmost average values to be printed for each receptor (variable NM), the number of the topmost average values to be printed for each averaging period (variable LM), the number of days to be read (variable DAYIN), the number of hours to be read (variable HOURIN), the factor that converts the internal concentration unit (g/m3) to the external units for printing (variable RFACT), the scaling factor for input concentrations (variable SCALE), and the external concentration units for printing (variable UNITS). Refer to Table 3-18 for a detailed description of the above input variables.

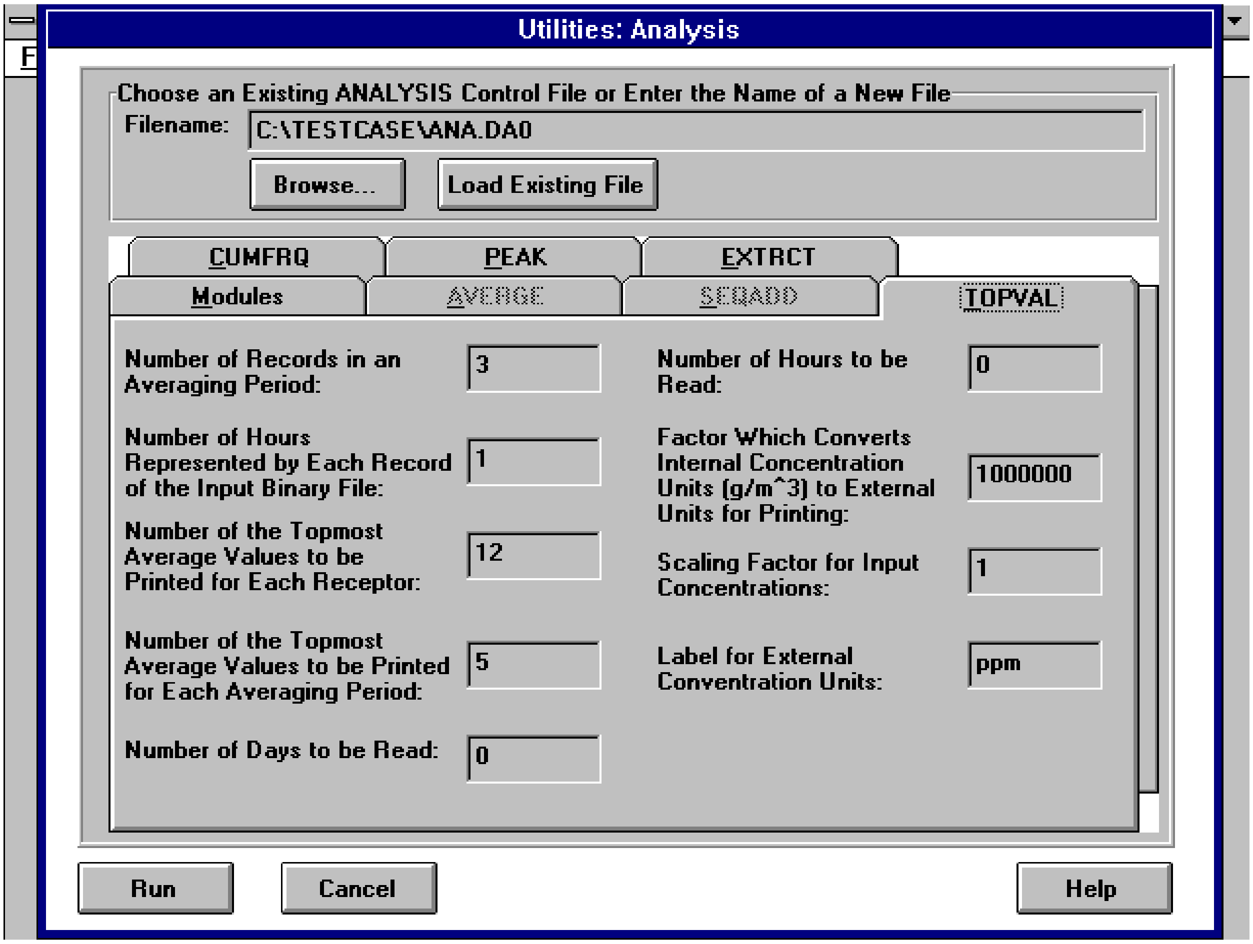


Figure 4-37. An example of the TOPVAL screen for the ANALYSIS postprocessor.

For the CUMFRQ module (see Figure 4-38), enter the following information: the number of records in an averaging period (variable LP), the number of hours represented by each record of the input binary file (variable NH), the number of days to be read (variable DAYIN), the number of hours to be read (variable HOURIN), the factor that converts the internal concentration unit (g/m^3) to the external units for printing (variable RFACT), the scaling factor for input concentrations (variable SCALE), the external concentration units for printing (variable UNITS), the number of concentration levels (variable NLEV), and the value for each concentration level (variable LEV). Refer to Table 3-19 for a detailed description of the above input variables.

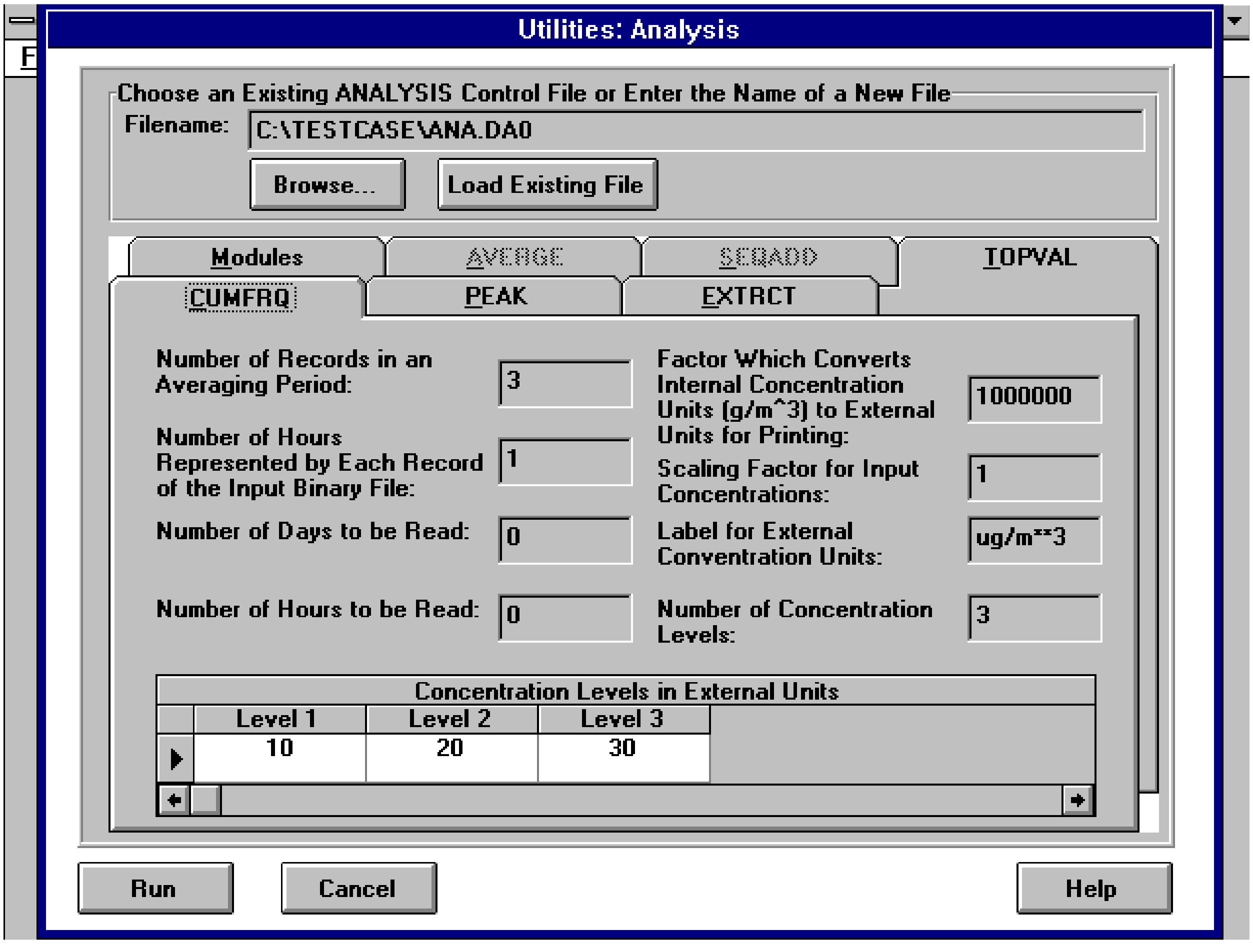


Figure 4-38. An example of the CUMFRQ screen for the ANALYSIS postprocessor.

For the PEAK module (see Figure 4-39), enter the following information: the number of records in an averaging period (variable LP), the number of hours represented by each record of the input binary file (variable NH), the threshold concentration in external units (variable THR), the number of days to be read (variable DAYIN), the number of hours to be read (variable HOURIN), the factor that converts the internal concentration unit (g/m3) to the external units for printing (variable RFACT), the scaling factor for input concentrations (variable SCALE), the flag indicating whether to output a detailed breakdown for threshold (LRPINT), and the external concentration units for printing (variable UNITS). Refer to Table 3-20 for a detailed description for the above input variables.

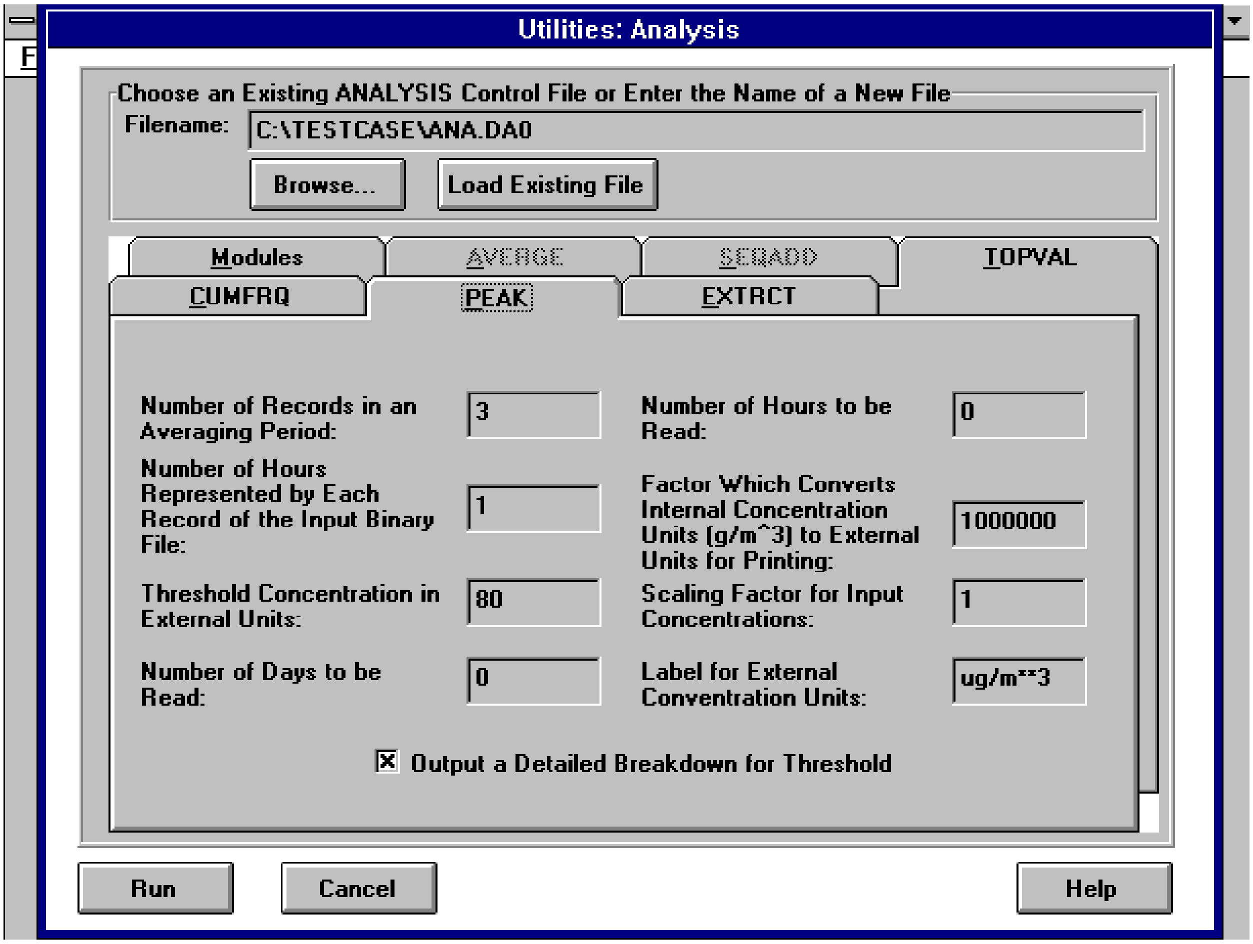


Figure 4-39. An example of the PEAK screen for the ANALYSIS postprocessor.

For the EXTRCT module (see Figure 4-40), enter the following information: the number of records in an averaging period (variable LP), the number of hours represented by each record of the input binary file (variable NH), the day for the averaging period where the corresponding concentrations at each receptor are to be extracted (variable DAYEND), the hour for the averaging period where the corresponding concentrations at each receptor are to be extracted (variable HOUREND), the factor that converts the internal concentration unit (g/m3) to the external units for printing (variable RFACT), the scaling factor for input concentrations (variable SCALE), and the external concentration units for printing (variable UNITS). Refer to Table 3-21 for a detailed description for the above input variables.

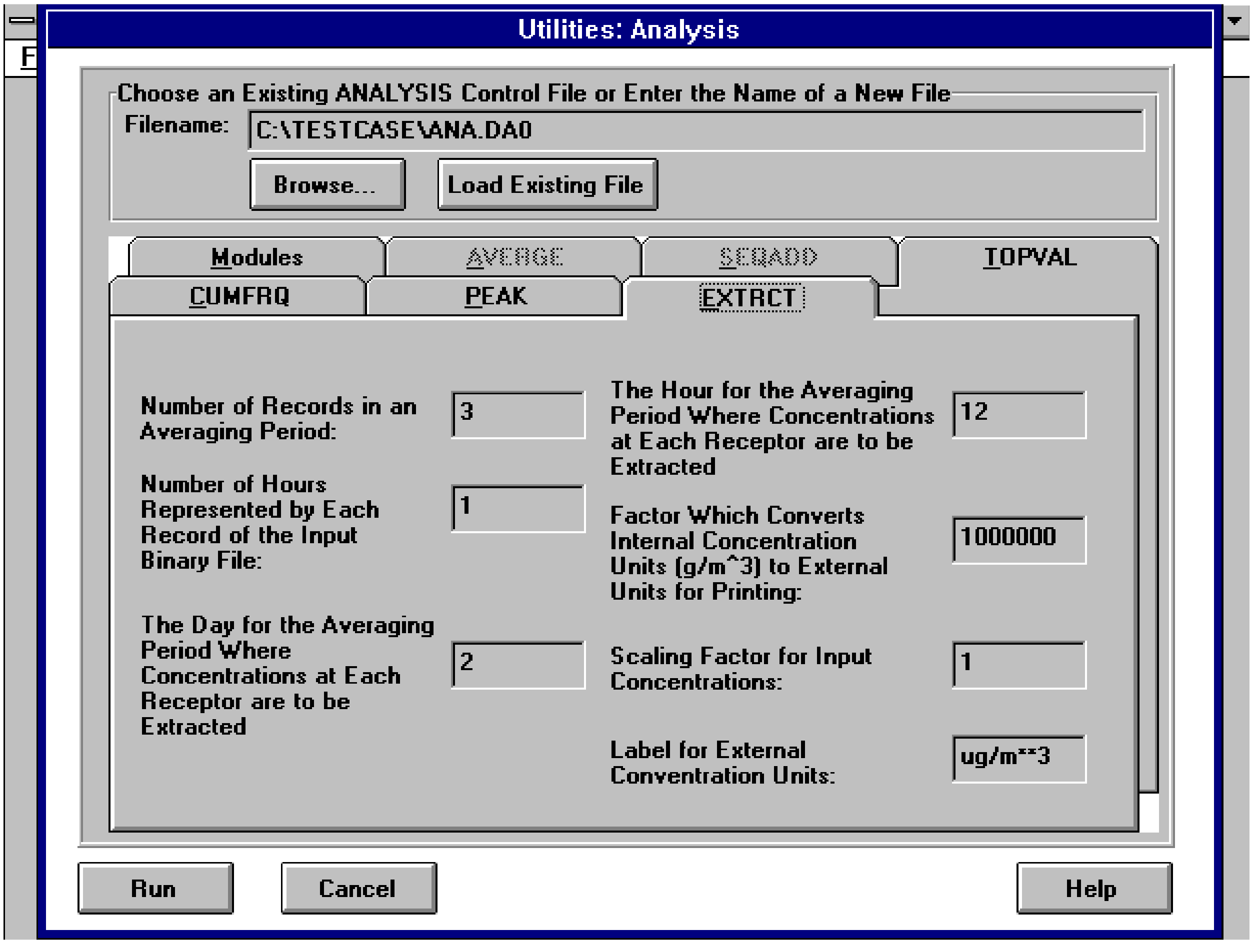


Figure 4-40. An example of the EXTRCT screen for the ANALYSIS postprocessor.

After entering the required data for the modules selected, click <Run>. The GUI prompts for input and output file names depending on the modules selected (see Figure 4-41). The control file name is filled in from the previous data entry screen. For all modules except SEQADD, enter the input binary hourly concentration file. For the SEQADD module, enter the names for the hourly binary concentration files to be merged. The output listing file is always generated regardless of which modules were selected. The top N output file (see Table 3-26 and described below) is generated only if the TOPVAL module was selected. This file is used by the GUI to generate the top concentration map. The exceedance output file (see Table 3-25 and described below) is generated only if the PEAK module was selected. This file is used by the GUI to generate the exceedance map. The plot output file (see Table 3-27), is generated only if the EXTRCT module was selected. This file can be used by an external plotting package to generate concentration contours. The hourly concentration output file is generated only if the SEQADD module was selected. To specify the files, either type the path and file name for each file, or click <Browse...> to select the files.

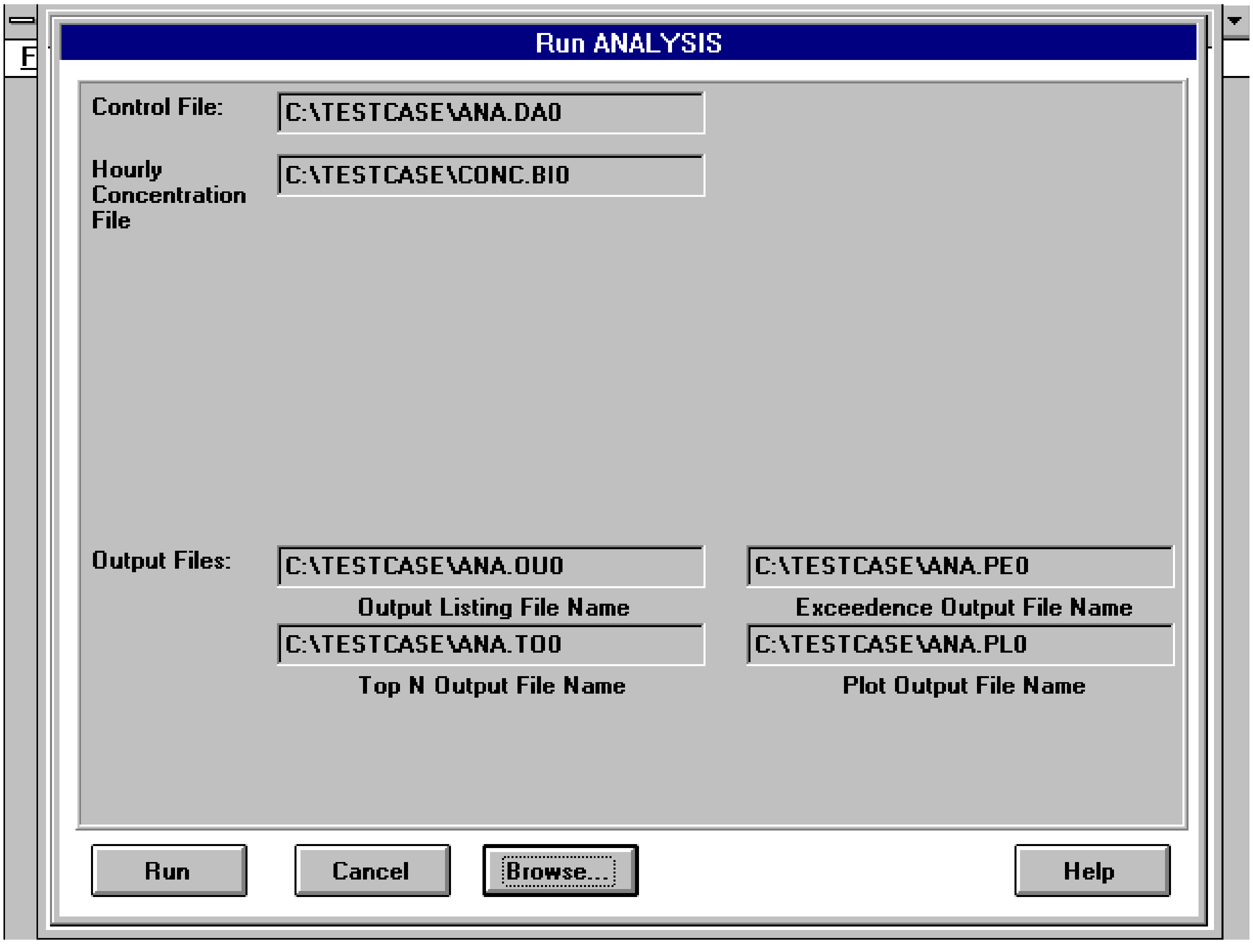


Figure 4-41. An example of the Run ANALYSIS screen.

After all of the required file names are specified, click <Run> to run the ANALYSIS postprocessor. The GUI confirms that the input data files exist, checks that default file names are not used, and verifies that output files do not exist. If an input file does not exist, the GUI informs the user and the program can not be run. If a default file name is used, the GUI warns the user. If an output file exists, the GUI prompts the user whether to overwrite the file. Click <Yes> to overwrite the file, or <No> to return to the previous screen and enter a new file name.

Once all errors are corrected, the GUI copies the user-specified input files to the default names (see Section 3.3) required by the ANALYSIS postprocessor and then runs the program. The program displays whether the modules ran successfully or errors were encountered, and waits for the user to press any key to return to the GUI. After ANALYSIS has been run, the user may view the top N and exceedence maps (see below).

4.6.8 Display Top N Map Submenu

To view the top N map, select the Utilities/Display Top N Map submenu. If there is no shoreline geometry defined, the GUI displays the message “You must define shoreline geometry BEFORE viewing the map!”. Load an appropriate OCD control file so that the shoreline geometry is properly defined. Note that the OCD control file must be consistent with the binary concentration file used to run the ANALYSIS postprocessor, where the top N output file is subsequently generated. This is because user coordinates are only locally valid within a control file. If an incorrect control file was used, then all sources and receptors will be misplaced on the map.

Next, the GUI displays a files dialog box (see Section 4.1.1). Select the top N output file created by the ANALYSIS postprocessor and click <OK>. The GUI reads the file and displays a list box of all the days and hours where data can be plotted (see Figure 4-42). Note that if a one-year OCD simulation was made, and an eight-hour averaging period is desired, then the list box will display 1095 (8760/8) combinations of days and hours. In this case, scroll bars can be used to view all the possible choices. Select one combination of day and hour of interest and click <Map> to generate the map.

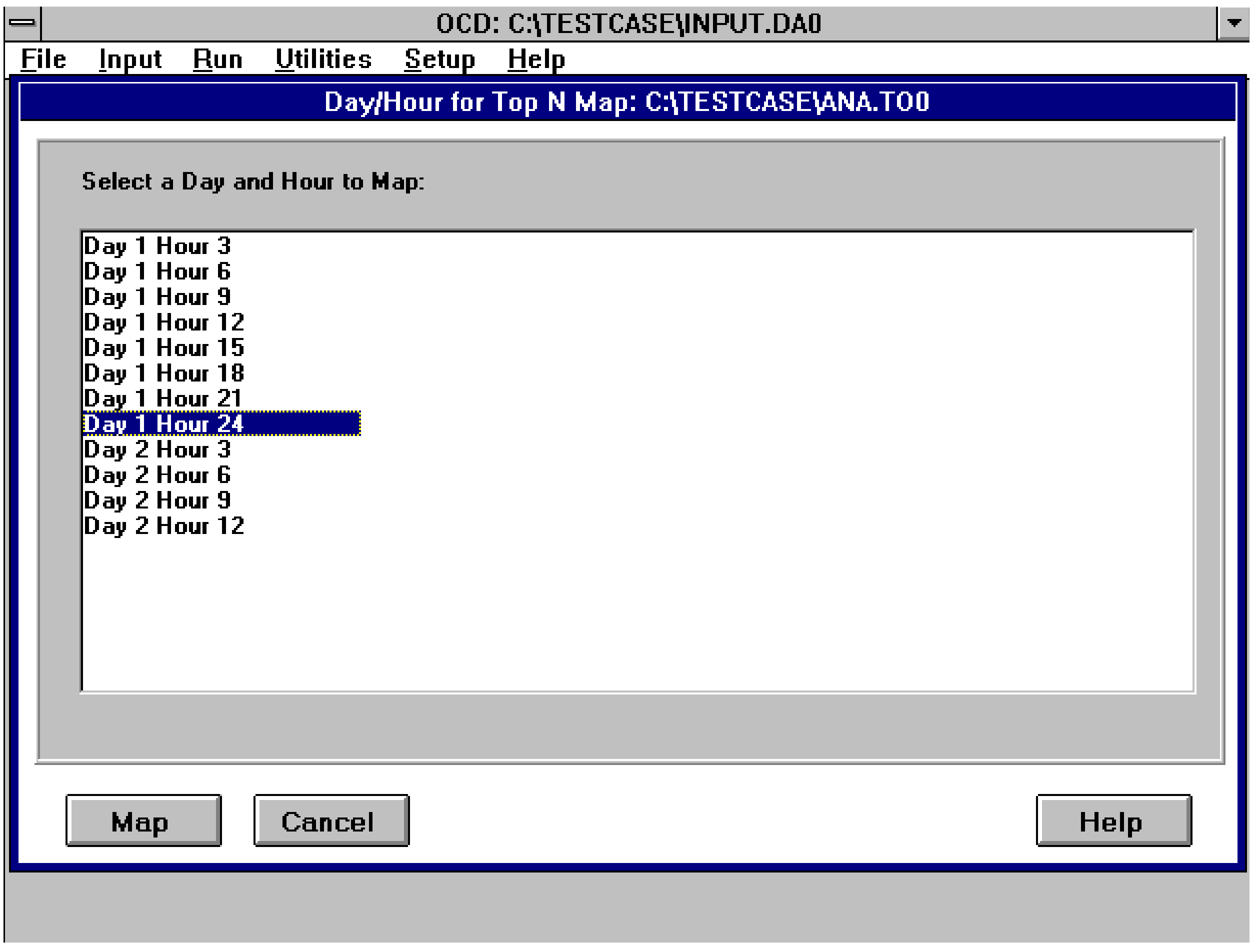


Figure 4-42. An example of the Top N Map Day/Hour Selection screen.

On a top N map generated by the GUI (see Figure 4-43), the shoreline geometry is shown by colored blocks of green for water, and blue for land. The source locations are depicted by Sn, where n is the source number. The values of the top N concentrations are plotted at their corresponding receptor locations on the map. The map also displays the user coordinate system and the corresponding meteorological conditions. Note that the meaning of the meteorological conditions for an averaging period becomes less significant as the length of the averaging period increases.

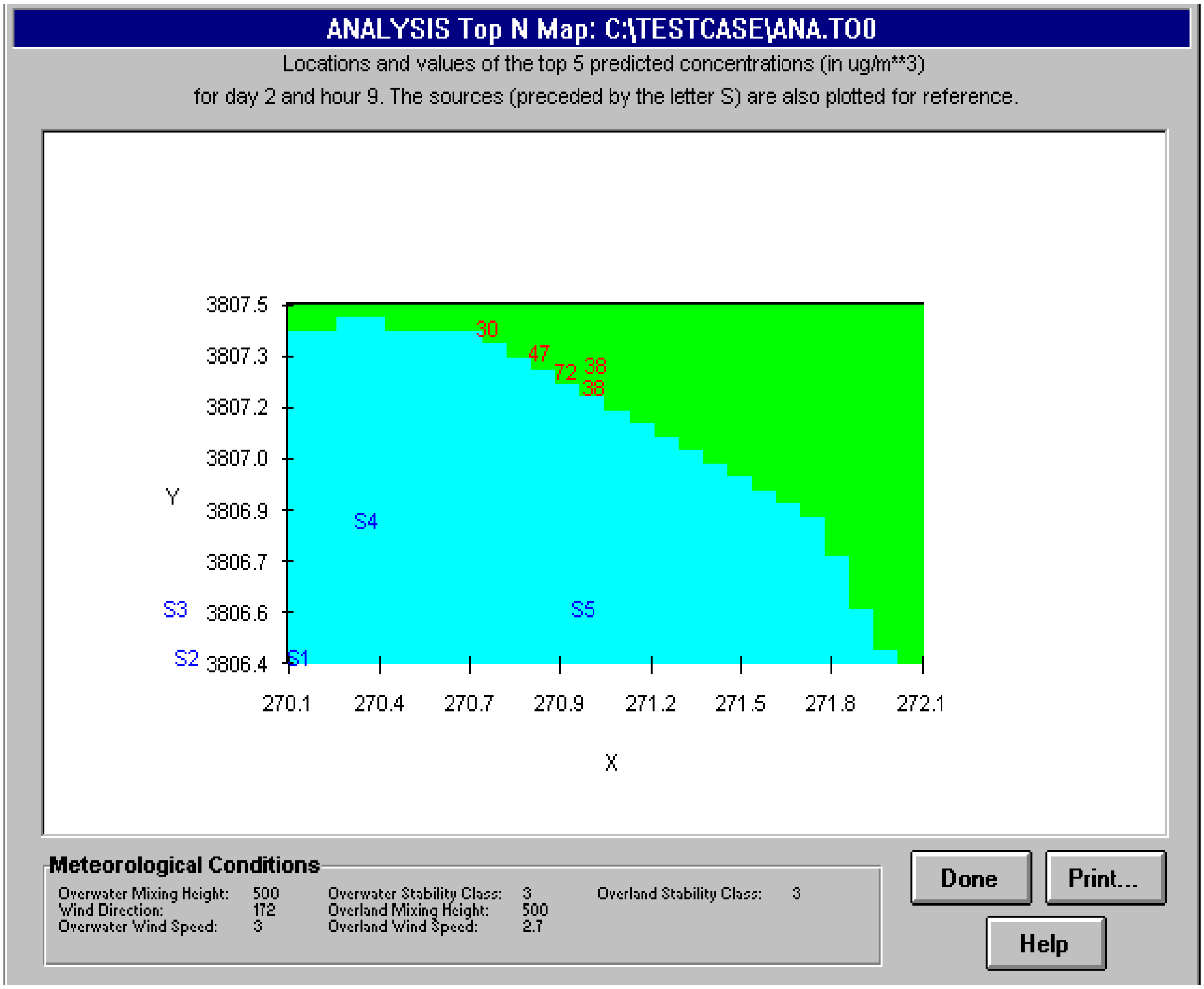


Figure 4-43. An example of the Top N Map screen, where the top N predicted concentration values are displayed. The sources, labeled as S1, S2, etc., are also displayed.

When the <Print...> button is pressed, a pop-up box appears prompting the user to select whether to print the map, or save the map to a Windows bitmapped (BMP) file. If the print option is chosen, the entire map (including legend) is printed. If the file option is chosen, a files dialog box is displayed prompting the user for a file name. The file extension must be BMP. The plot, but not the legend due to software limitations, is saved to the file.

Click the <Done> button when finished viewing the map, and the day/hour list box is re-displayed. Choose another combination of day and hour to map, or click <Cancel> to return to the Main Menu.

4.6.9 Display Exceedence Map Submenu

To view the exceedence map, select the Utilities/Display Exceedence Map submenu. If there is no shoreline geometry defined, the GUI displays the message "You must define shoreline geometry BEFORE viewing the map!". Load an appropriate OCD control file so that the shoreline geometry is properly defined. Note that the OCD control file must be consistent with the binary concentration file used to run the ANALYSIS postprocessor, where the exceedance output file is subsequently generated. This is because user coordinates are only locally valid within a control file. If an incorrect control file was used, then all sources and receptors will be misplaced on the map.

Next the GUI displays a files dialog box (see Section 4.1.1). Select the exceedence output file created by the ANALYSIS postprocessor and click <OK>. The GUI reads the file and displays a list box of days and hours where exceedances were predicted and where data can be plotted (see Figure 4-44). If the number of time periods where exceedances were predicted is large enough, scroll bars can be used to view all the possible choices. Select one combination of day and hour of interest to map and click <Map> to generate the map.

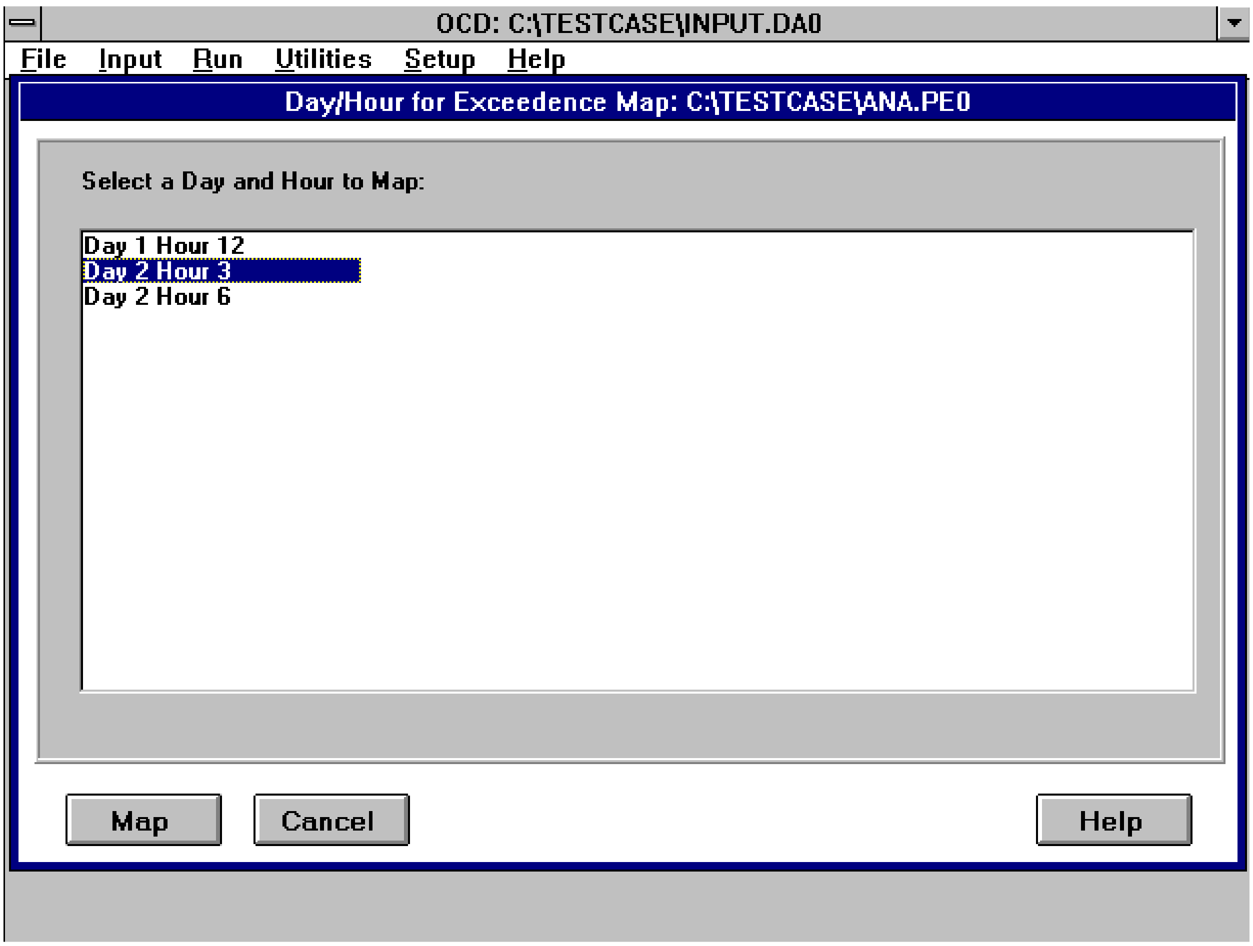


Figure 4-44. An example of the Exceedence Map Day/Hour Selection screen.

On an exceedance map generated by the GUI (see Figure 4-45), the shoreline geometry is shown by colored blocks of green for water, and blue for land. The source locations are depicted by Sn, where n is the source number. The values of exceedances are plotted at their corresponding receptor locations on the map. The map also displays the user coordinate system and the corresponding meteorological conditions. Note that the meaning of the meteorological conditions for an averaging period becomes less significant as the length of the averaging period increases.

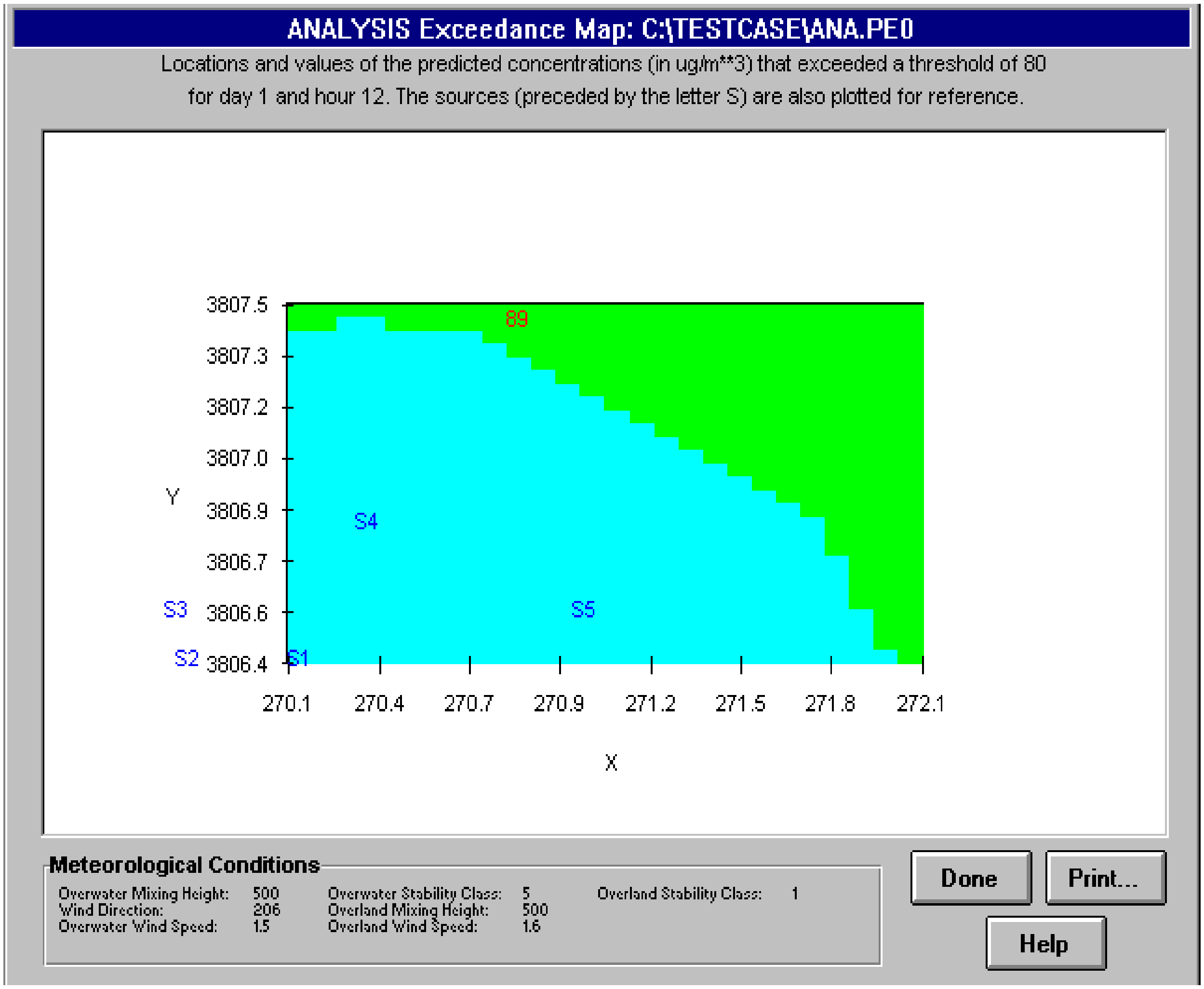


Figure 4-45. An example of the Exceedence Map screen, where all predicted concentration values exceeding a user-specified value are displayed. The sources, labeled as S1, S2, etc., are also displayed.

When the <Print...> button is pressed, a pop-up box appears prompting the user to select whether to print the map, or save the map to a Windows bitmapped (BMP) file. If the print option is chosen, the entire map (including legend) is printed. If the file option is chosen, a files dialog box is displayed prompting the user for a file name. The file extension must be BMP. The plot, but not the legend due to software limitations, is saved to the file.

Click the <Done> button when finished viewing the map, and the day/hour list box is re-displayed. Choose another combination of day and hour to map, or click <Cancel> to return to the Main Menu.

4.7 Setup Menu

The Setup Menu (see Figure 4-46) allows the user to customize the editor to be used by the GUI.

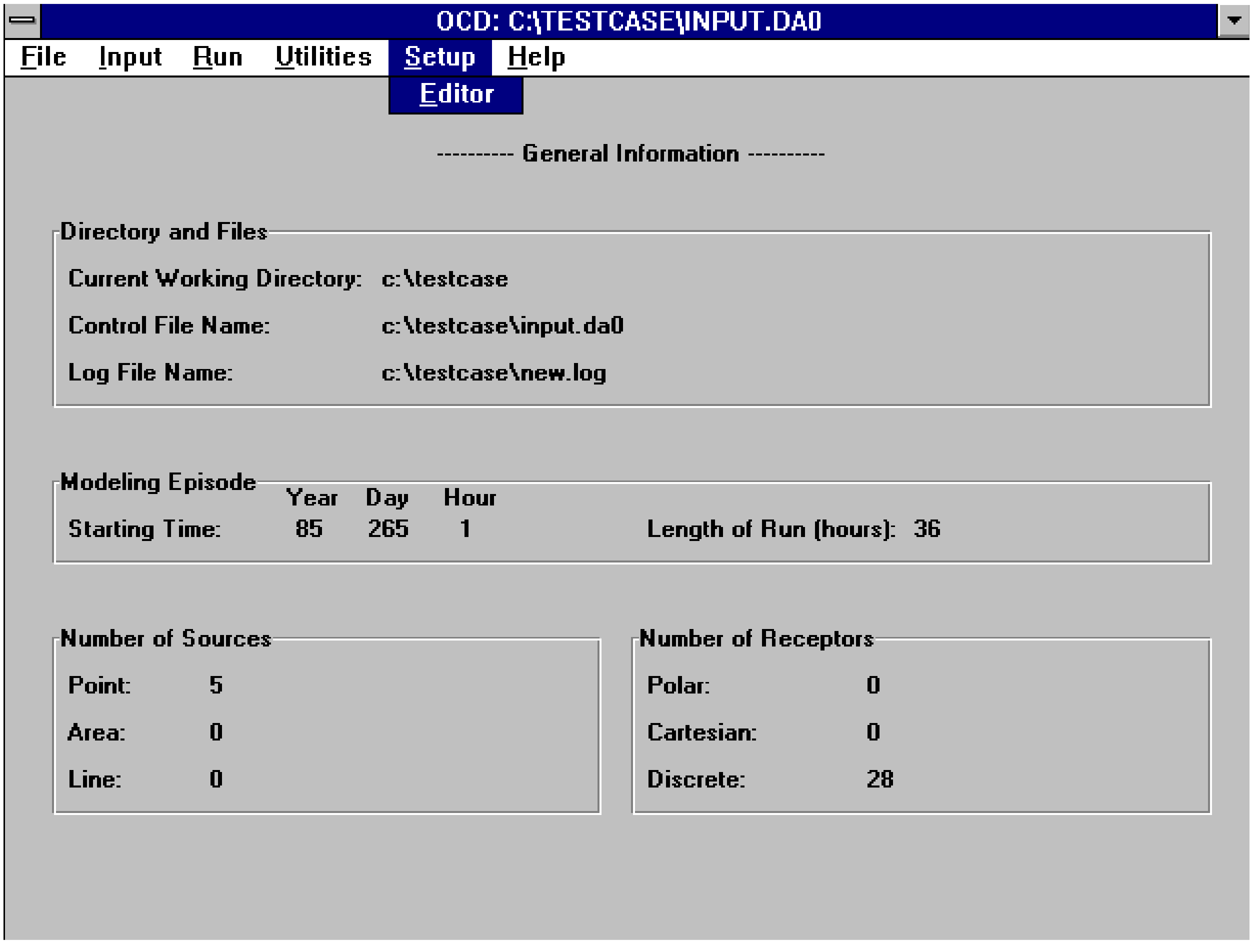


Figure 4-46. An example of the Setup Menu.

4.7.1 Editor Submenu

The Setup/Editor submenu (see Figure 4-47) allows the user to specify the editor used by the GUI in the Utilities/Edit File submenu (see section 4.6.4). Use the drop-down list box to select the desired editor and click <OK>. To abort any changes, click <Cancel>. To add another editor to the list, click <Add...>. A files dialog box is displayed. Select the executable file for an editor to add to the list. Click <OK> and the new editor is added to the bottom of the drop-down list box. To remove an editor from the list, select the editor to remove from the drop-down list box and click <Remove>. The editor is then removed from the list.

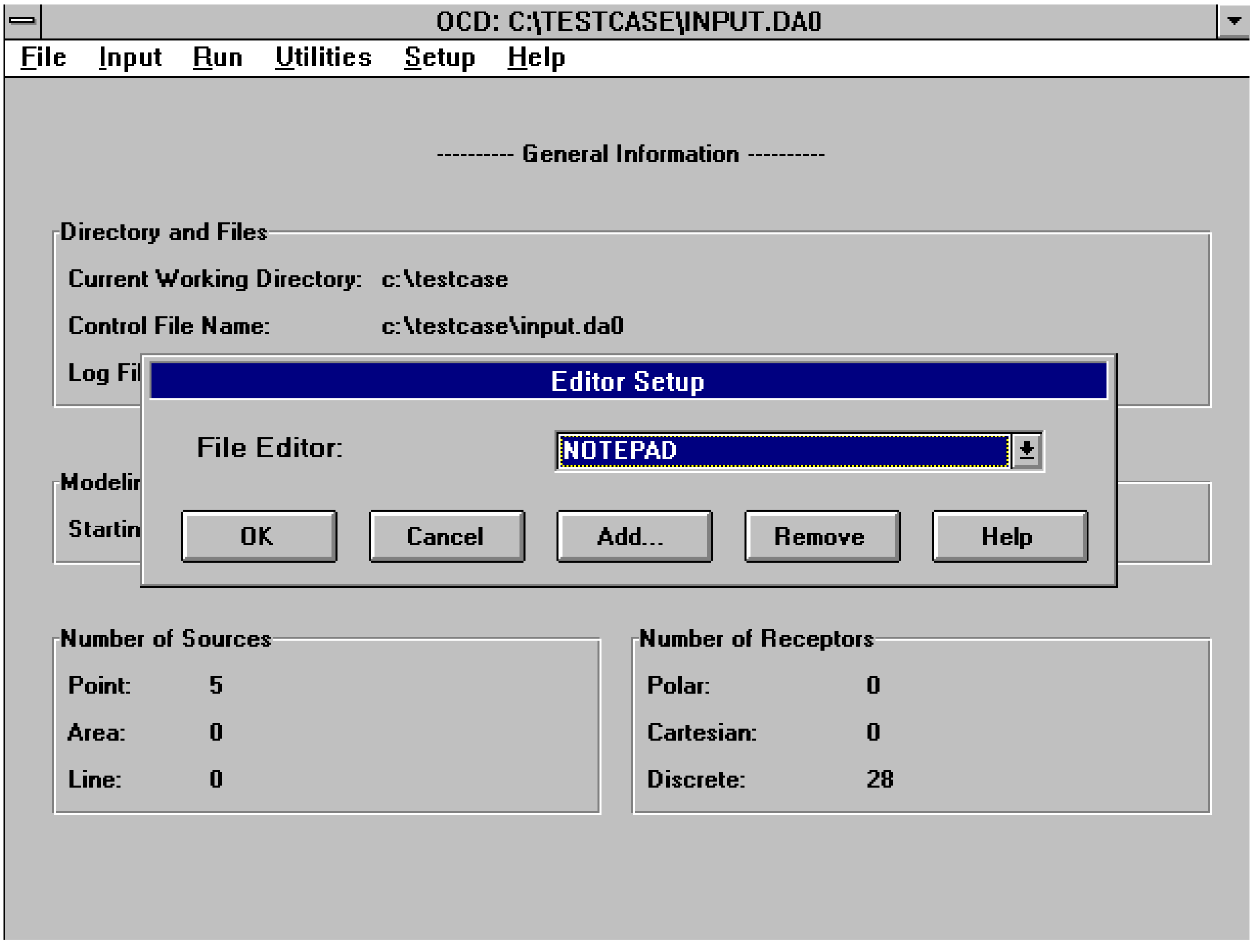


Figure 4-47. An example of the Setup Editor screen.

4.8 Help Menu

On-line help (see Figure 4-48) is implemented in the GUI in four ways: (1) each screen contains a Help button that displays the help information for that screen; (2) the Help/Contents submenu (see Section 4.8.1) displays the table of contents for the on-line help system; (3) the Help/Search submenu (see Section 4.8.2) allows the user to look up a text string to find the associated help information; and (4) the About OCD menu displays a screen containing the general information about the OCD model and the GUI.

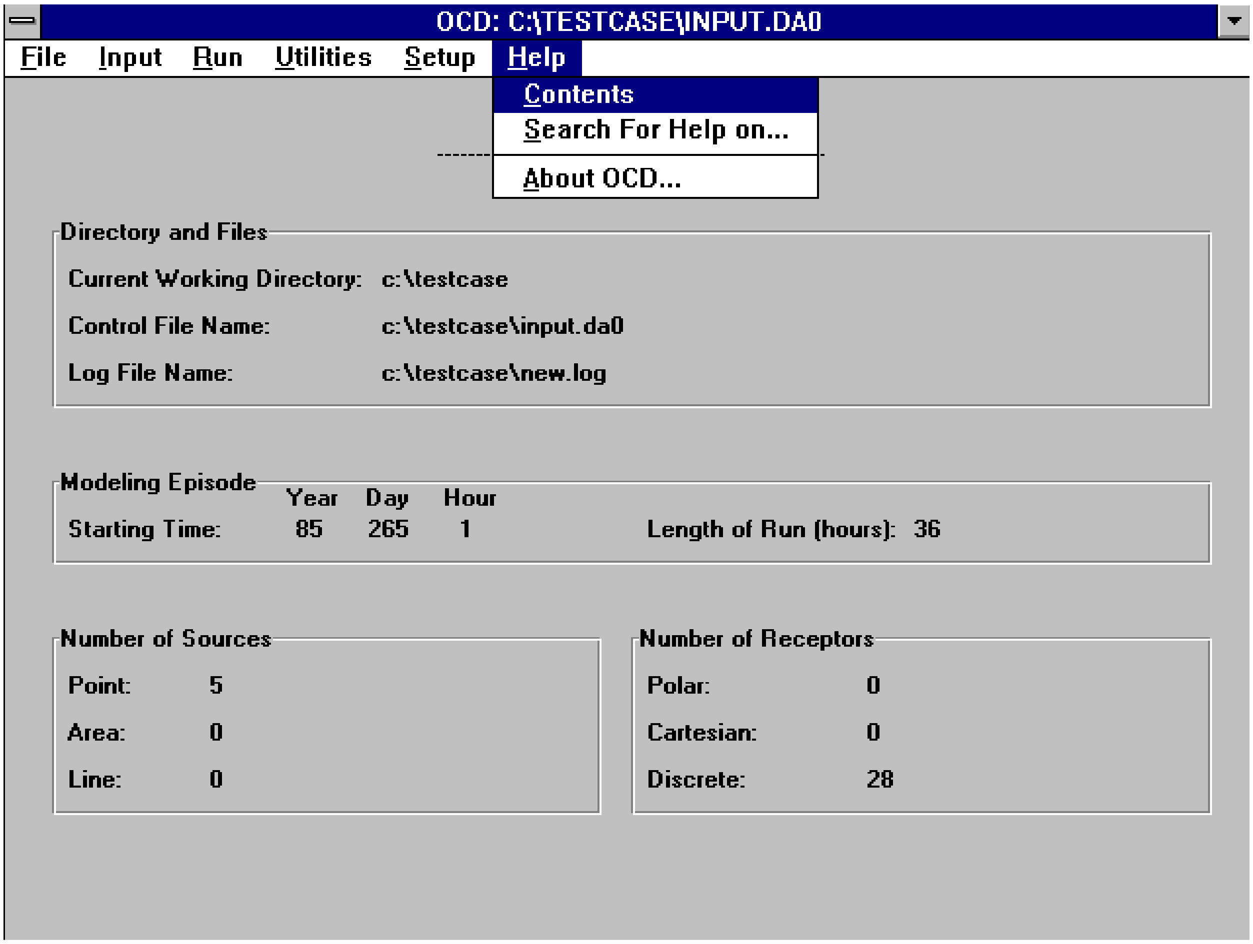


Figure 4-48. An example of the Help Menu.

4.8.1 Contents Submenu

The Help/Contents submenu (see Figure 4-49) displays the table of contents for the on-line help system of the GUI. The Topics are arranged in a hierarchial fashion. The user can select a topic of interest to view.

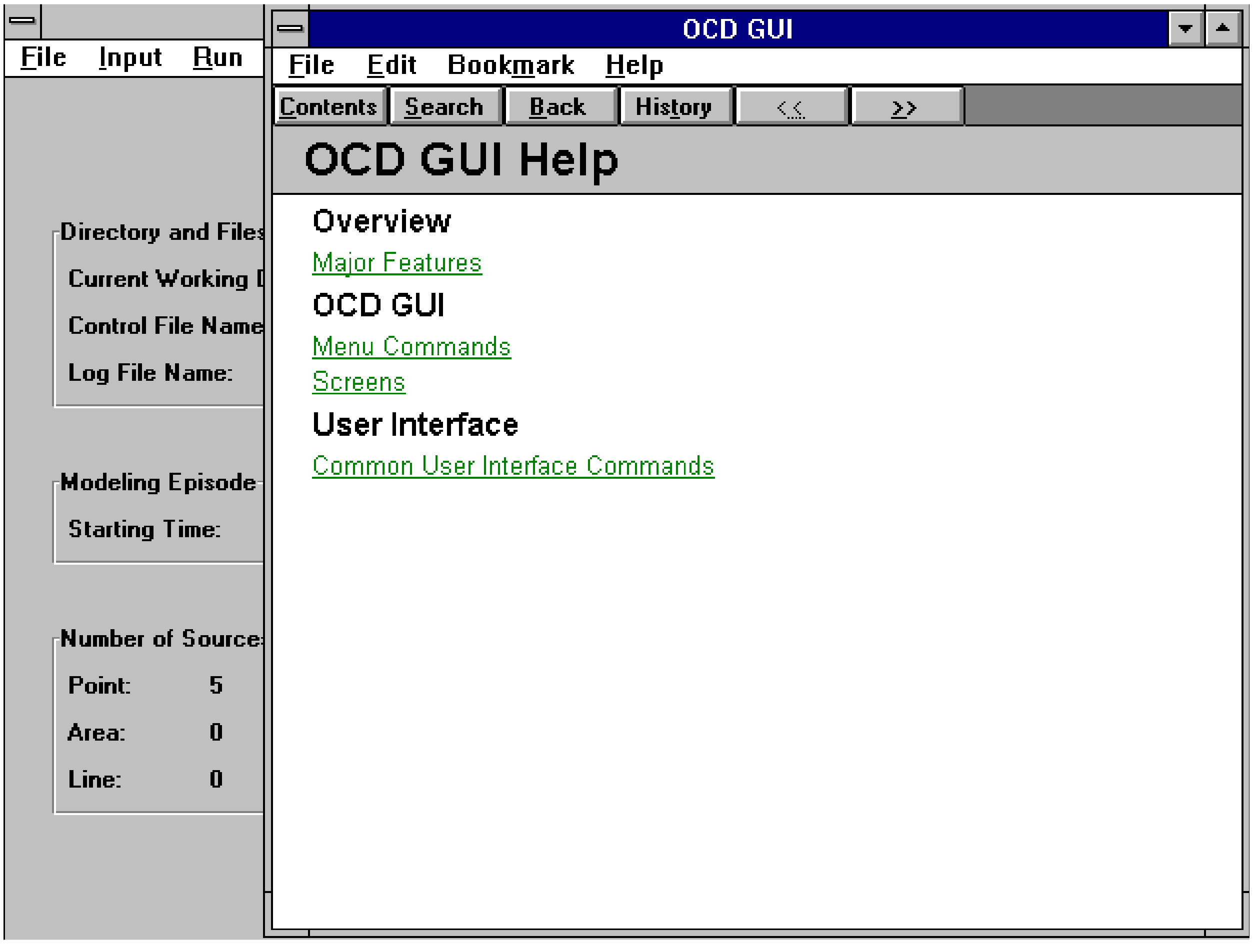


Figure 4-49. An example of the Help Contents screen.

4.8.2 Search Submenu

The Help/Search submenu displays a dialog box (see Figure 4-50) where the user may enter the text string to search for in the help system. As the user types, the topics list box displays similar text strings. To select a topic to view, click on the topic in the list box and click <Show Topics>. The list box at the bottom of the screen will display related help topics for that text string. Select a help topic and click <Go To>. The new help topic is then displayed.

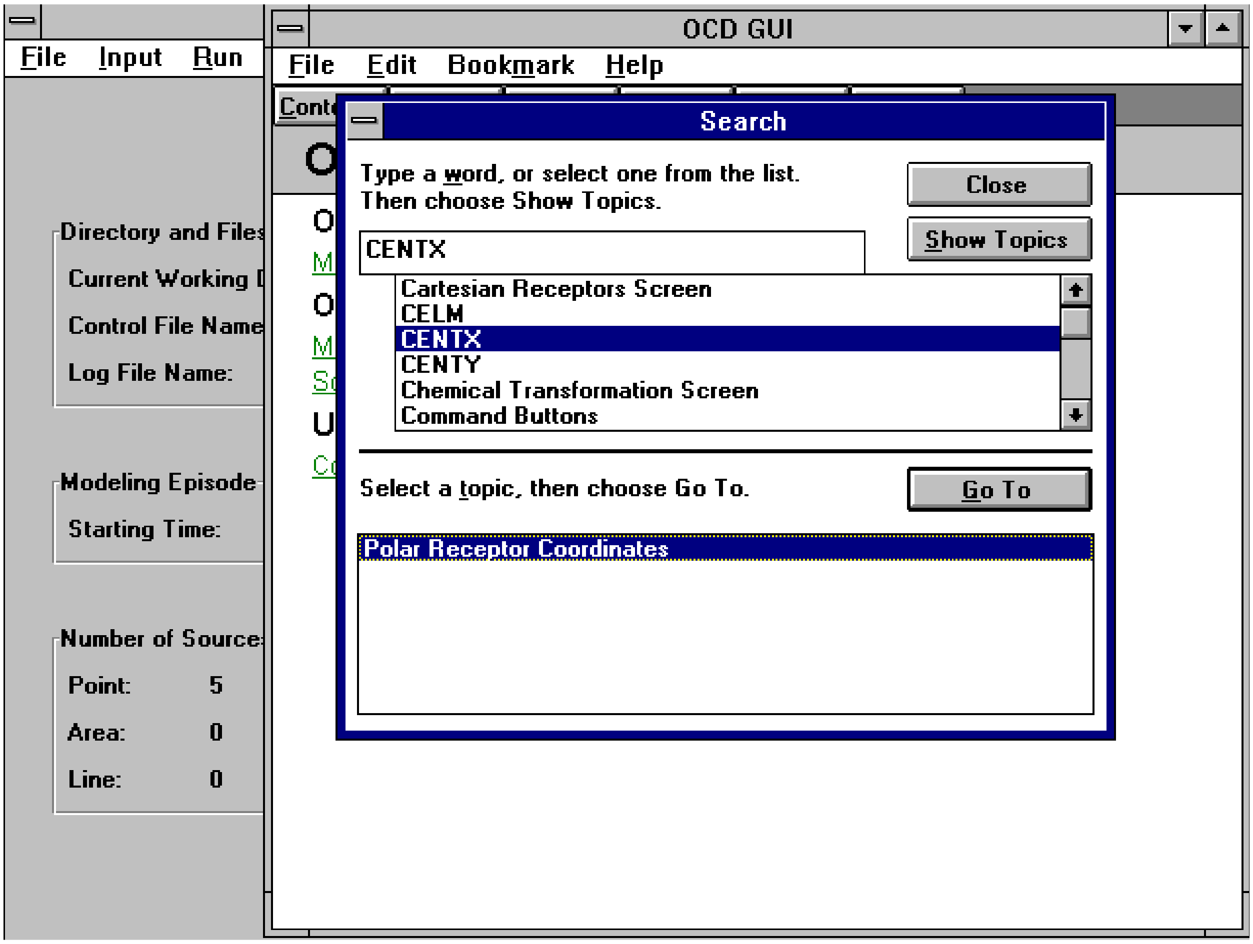


Figure 4-50. An example of the Help Search screen.

4.8.3 About OCD

The Help/About OCD submenu displays a text box (see Figure 4-51) showing general information about the OCD model and the GUI.

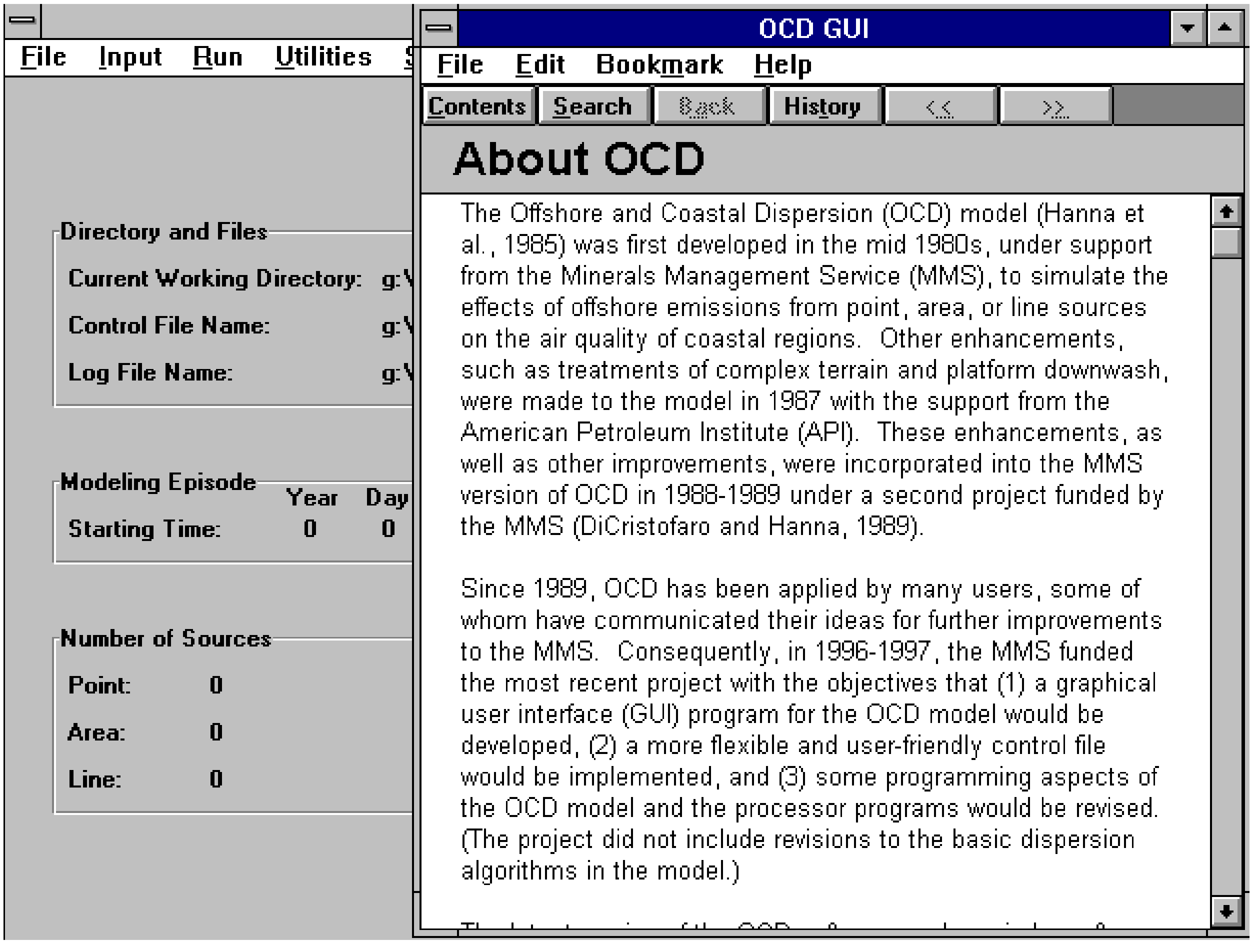


Figure 4-51. An example of the About OCD screen

5. Enhancements Made to OCD

In addition to the development of the GUI program, the current project also includes the following enhancements to the OCD model.

As mentioned above, the control file for the original OCD model (OCD/4) has a rigid file structure, where the locations of various input parameters in the control file must be precise. As long as the GUI is used, the user does not have to be concerned with the control file structure at all. However, the OCD model is sometimes run on other computer platforms, such as UNIX, where the GUI program does not function. In order to further increase the user-friendliness of the OCD model, it was decided that a control file similar to that for the CALPUFF model (Scire et al., 1995) should be used. The format for the new control file is flexible in that there are no requirements on the exact placement of input parameters in the control file. Only the information enclosed by special delimiters, i.e., "!", will be retrieved by the reader program. Therefore, comments can be freely included in the control file. The reader is referred to Table 3-10 for a sample control file.

In the OCD/4 model, the READ statements for the control file were scattered in nine subroutines. In the new OCD model (OCD/5), the READ statements for the control file have been consolidated into a single reader subroutine called *readcf2* for easier code maintenance in the future. If any modifications, such as inclusion of additional inputs, are required for the OCD/5 model, then the user has to edit only the *readcf2* subroutine.

The CHARACTER variables were not used in the OCD/4 model. All variables that are character strings in nature were always declared as REAL variables. This approach is outmoded, and in the OCD/5 model all the character variables are now declared as CHARACTER.

The OCD/5 model now also supports a Cartesian network of receptors. The default (prepared by the MAKEGEO processor, see Section 3.1.3) is to generate $20 \times 20 = 400$ receptors that cover the entire model domain previously defined by the user.

The meteorological data files, in both ASCII (formatted) and binary (unformatted) formats, generated by EPA's PCRAMMET preprocessor (USEPA, 1995) are acceptable to the new OCD model.

A "test run" feature has been added to the OCD model, where the program will go through all the user inputs specified in the control file, and flag all errors, if any. No dispersion calculations will be performed when the model is applied in the "test run" mode.

The format for the binary concentration file, *conc.bin*, generated by the OCD/5 model was changed so that data such as receptor locations and overland meteorological conditions are also included.

In the OCD/4 model, the limits on the numbers of sources, receptors, and grid cells used to represent the shoreline geometry were all "hardwired" in the code. In the OCD/5 model, these limits were replaced by FORTRAN PARAMETER statements in an INCLUDE file called *params.cmn* (see Section 6.1 for more details). If, for example, the user decides to increase the number of receptors allowed by the model, then all that is required is to change one line of code and recompile the program.

Better error-checking has also been implemented in the OCD/5 code. The new model now generates roughly 70 error messages, versus less than 20 error messages generated by the OCD/4 model. Furthermore, the error messages are now written to a separate file, *error.out*, in addition to screen. This facilitates the passing of the error messages between the OCD model and the GUI program.

The routines that are used to follow the plume trajectory as the plume travels between water and land were made more robust. In particular, some calculations are now performed with double precision to avoid the potential problem described below. The UTM coordinates (x and y), generally in the order of 1000 km, are often directly used as the user coordinates for an OCD run. As the plume travels in the north-south or east-west direction, the x- or y-component of the incremental plume travel distance (∂x or ∂y) can become quite small (e.g., less than one meter). In this case, the ratio of $\partial x/x$ or $\partial y/y$ can be smaller than 10^{-7}, which is beyond regular machine accuracy, and which can only be adequately handled with double precision.

Some minor coding errors were identified in the OCD/4 model. For example, it did not correctly (1) detect a leap year, (2) implement some error-checking statements, and (3) initialize a small number of working arrays. There errors were corrected in the OCD/5 model. It is noted that these errors did not affect the model predictions that were previously obtained, since the errors would have caused the model to “crash”, thus not yielding any results.

6. Programmer's Notes

6.1 FORTRAN Codes for OCD and Processors

The OCD model, together with the OCD4TO5, OCDPRO, MAKEGEO, MAKEUTM, and ANALYSIS processors were all developed using the Lahey F77L-EM/32 FORTRAN compiler, version 5.0.1. Since standard FORTRAN 77 language plus some commonly used FORTRAN 90 language features, including in-line comments and DO/ENDDO construct, were used, the programs should be easily recompiled with other FORTRAN compilers with minimum code changes, if any. However, the FORTRAN codes should not be compiled using outmoded 16-bit compilers, where the size for an executable file is limited to 640 KB. Although the majority of input and output files (see Table 3-31) are ASCII, there are still some data files that are binary (or unformatted). Therefore, it is crucial that the executable codes and the binary files are consistent. For example, if the user wants to use a binary PCRAMMET meteorological data file created with the Microsoft FORTRAN compiler, then the OCD model must also be compiled with the same compiler.

The OCD/5 code includes 14 separate FORTRAN INCLUDE files with a *cmn* file extension. The OCD4TO5, OCDPRO, MAKEGEO, MAKEUTM, and ANALYSIS codes are all self-contained programs.

The four binary geographical database files, *west.bin*, *gom.bin*, *east.bin*, and *alaska.bin*, used by the MAKEGEO shoreline data processor (see Section 3.1.3) were converted from the four ASCII files, *west.me*, *gom.me*, *east.me*, and *alaska.me*, respectively. The conversion was done by a utility program called *me2bin.for* developed by the MMS. The four binary geographical database files and included in the OCD installation package (see Chapter 2). The *me2bin.for* utility program and the four ASCII geographical database files are included in a separate package called ME.

The model version number, 5.0, for the OCD model is defined in an INCLUDE file called *version.cmn*. The version number is printed at the beginning of the OCD output listing file, *ocd.out*.

All major program limits used in the OCD/5 model and the processors are specified using FORTRAN PARAMETER statements. For the OCD/5 model, these PARAMETER statements are collected in a single INCLUDE file called *params.cmn*, shown in Table 6-1. In particular, the following five parameters are used:

Table 6-1.

The *params.cmn* Include File Where Various Program Limits for OCD are Defined

```
c  PARAMS Include File
c
c  Parameters for modeling: (Can be changed if necessary)
c  ------------------------
c     maxrec:   Maximum number of receptors
c     maxp:     Maximum number of point sources
c     maxmap:   Maximum no. of grids, in x- and y-directions, to
c               represent shoreline geometry (recommended value=120)
c     maxring:  Maximum number of rings for polar receptors
c     maxcar:   Maximum number of Cartesian receptors along
c               the x- and y-axis
c
c  Parameters for control file reader: (Normally do not change)
c  -----------------------------------
c     maxvar:   Maximum number of variables in each input group
c     maxgrp:   Maximum number of data groups
c     mxcol:    Maximum length (bytes) of a control file input record
c
      parameter (maxrec=3000)
      parameter (maxp=8500)
      parameter (maxmap=120)
      parameter (maxring=20)
      parameter (maxcar=40)
c
      parameter (maxvar=60)
      parameter (maxgrp=30)
      parameter (mxcol=132)
c
      parameter (max2  =5*maxrec)
      parameter (maxmap2=maxmap*maxmap)
      parameter (maxtmp=10000)    ! See notes below
c
c *** Note that MAXTMP must be at least equal to the larger of MAXREC
c     and MAXP.
C
```

MAXREC — The maximum number of receptors (including discrete, polar and Cartesian) allowed. MAXREC should be at least equal to the sum of MAXRING×36 and MAXCAR×MAXCAR (see below). Currently, MAXREC = 3000.

MAXP — The maximum number of point sources allowed. Note that OCD allows only up to five area sources and one line source. Currently, MAXP = 8500.

MAXMAP — The maximum number of grid rectangles in the x- and y-directions used to represent the shoreline geometry. That is, up to MAXMAP×MAXMAP grid rectangles can be used to provide digitized information for the land/water interface. Currently, MAXMAP = 120.

MAXRING — The maximum number of rings allowed for the polar receptor network. That is, the maximum number of polar receptors is MAXRING×36. Currently, MAXRING = 20.

MAXCAR — The maximum number of receptors in the x- and y-directions for the Cartesian receptor network. That is, the maximum number of Cartesian receptors is MAXCAR×MAXCAR. Currently, MAXCAR = 40.

For the ANALYSIS postprocessor, all PARAMETER statements are embedded in the FORTRAN code, *analysis.for*. In particular, the following two parameters are used:

MAXREC — The maximum number of receptors allowed. Note that as far as the ANALYSIS postprocessor is concerned, there is no difference among discrete, polar, and Cartesian receptors, and all receptors are treated as discrete. Currently, MAXREC = 3000.

MAXPROD — The maximum value allowed for the product of the number of receptors and the number of top concentration levels desired for the TOPVAL module. For example, if there are 500 receptors included in the current run and MAXPROD = 50000, then the TOPVAL module can display up to top 100 (= 50000/500) concentrations at each receptor. Currently, MAXPROD = 50000.

If there is a need to relax the program limits for the OCD model or the ANALYSIS postprocessor, all the user has to do is to modify the appropriate PARAMETER statements and recompile the code.

All FORTRAN source codes mentioned above are included in a separate package called OCDFOR (see Chapter 2).

6.2 Visual Basic Codes for GUI

The GUI program for the OCD model was developed using Microsoft’s Visual Basic Professional Edition Version 4.0 (16 bit version), APEX Software Corporation’s True DBGrid OLE Control Version 4.0 (16 bit version), and WinWare Inc.’s Visual Help Pro Version 3.1e.

This environment must be used to modify the GUI program. The reason why the 16-bit versions of tools were was used is to make the GUI program backward compatible with the Windows 3.1 environment.

7. Summary

The Offshore and Coastal Dispersion (OCD) model (Hanna et al., 1985; DiCristofaro and Hanna, 1989) was first developed in the 1980s to simulate the effects of offshore emissions from point, area, or line sources on the air quality of coastal regions. The model includes special algorithms that account for:

- overwater plume transport and dispersion,
- changes that take place as the plume crosses the shoreline,
- evolution of the thermal internal boundary layer (TIBL),
- plume fumigation (i.e., vertical plume dispersion after the plume passes through the TIBL),
- parameterizations of the overwater surface boundary layer, and
- treatments of plume dispersion over complex terrain and platform downwash.

Under the current project sponsored by the Minerals Management Service (MMS), the OCD model was upgraded from Version 4 (OCD/4) to Version 5 (OCD/5). The upgrade was mainly to increase the functionality and user-friendliness of the model. The basic dispersion algorithms used in the OCD model remain the same.

The source codes for the OCD model and existing processor programs were revised. For the OCD/5 model, a new control file is now used. It is designed to be flexible and self-documenting, where the exact placement of various input parameters in the file is not required, and where an unlimited amount of comments can be included in the file. Because of the latter, the new control file can be treated as an abbreviated version of the User's Guide. The OCD/5 model has better error-checking, supports more meteorological data formats, and allows for a Cartesian receptor network. Hardwired array limits used in the old code were replaced by PARAMETER statements in the new code, to allow easy customization in the future. Legacy FORTRAN statements and some minor programming errors in OCD/4 were removed and corrected, respectively, in OCD/5.

New processor programs were developed for the OCD/5 model, in order to further assist the user in setting up model runs in a more efficient manner. In particular, the preparation of the shoreline geometry data can now be automated, as long as the model domain is in the continental U.S.

A user-friendly graphical user interface (GUI) program was developed, where the user can prepare, execute, and analyze an OCD application in a menu-driven environment. The OCD/5 model and all processor programs can be easily accessed through the GUI. Extensive error-checking is performed by the GUI. On-line help is also provided through the GUI. The user can locate the help information about a certain topic through the search function of the on-line help system. Various related help topics are connected through "hyperlinks", so that the user can quickly display pertinent help information on screen. The GUI also includes a map display function that shows the distributions of the shoreline, sources and receptors. This allows the user to quickly inspect the accuracy of the input data specified in the control file. Locations and values of high concentrations of interest, either the top N values or the exceedances, can also be displayed through the map display.

The OCD software package was designed for personal computers that are running under the Windows, Windows 95, or Windows NT operating systems. The OCD/5 model and the processor programs can be ported to other computer platforms, such as UNIX, as long as all FORTRAN codes are recompiled. The GUI program does not function on other computer platforms.

8. References

Briggs, G.A., 1973: *Diffusion Estimates for Small Emissions.* ATDL Cont. 79, ATDL, P.O. Box E, Oak Ridge, TN.

Brutsaert, W., 1975: Comments on surface roughness parameters and the height of dense vegetation. *J. Met. Soc. Japan,* **53**, 96-97.

Counihan, J., 1975: Adiabatic atmospheric boundary layers, a review and analysis of data from the period 1880-1972. *Atmos. Environ.*, **9**, 871-906

DiCristofaro, D.C., and S.R. Hanna, 1989: *OCD: The Offshore and Coastal Dispersion Model.* Two volumes. EARTH TECH Report No. A085-1, prepared for Minerals Management Service, U.S. Department of the Interior, 381 Elden Street, Herndon, VA 22070-4817, under contract no. 14-12-0001-30396.

Hanna, S.R., L.L. Schulman, R.J. Paine, J.E. Pleim, and M. Baer, 1985: Development and evaluation of the Offshore Coastal Dispersion Model. *J. Air Poll. Control Assoc.*, **35**, 1039-1047.

Hess, S.L., 1959: *Introduction to Theoretical Meteorology*. Holt, Rinehart and Winston, New York, p. 277.

Hsu, S.A., 1981: Models for estimating offshore winds from onshore meteorological measurements. *Bound. Layer Meteorol.*, **20**, 341-353.

Priestley, C., 1959: *Turbulent Transfer in the Lower Atmosphere*. The University of Chicago Press, Chicago, p. 21.

Scire, J.S., D.G. Strimaitis, R.J. Yamartino, and X. Zhang, 1995: *A User's Guide for the CALPUFF Dispersion Model,* prepared by EARTH TECH, 196 Baker Avenue, Concord, MA 01742, for the USDA Forest Service, Cadillac, MI 49601.

Stull, R.B. 1989: *An Introduction to Boundary Layer Meteorology.* Kluwer Academic Publishers, p. 380.

U.S. Environmental Protection Agency, 1995: *PCRAMMET User's Guide*, U.S. EPA, Research Triangle Park, NC 27711.