

An Improved Approach To Updating Regulatory Dispersion Models

**8th Modeling
Conference
RTP, NC**

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An Improved Approach To Updating Regulatory Dispersion Models

Presenters

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Standard Operating Procedure

- **Implemented when changes are made to a regulatory dispersion model**
- **Completed prior to the release of the updated model**

Objectives

- Identify
- Resolve
- Document

The Analysis Tool

- **Manages the execution of the old and new model components**
- **Takes care of file management**
- **Extracts results from model output files**
- **Identifies differences in model estimates**
- **Creates summary reports**

Resolving Differences

- Expected (unexpected) ?
- Model component ?
- Compiler related ?
- Significance ?
- OK to release/approve update ?

Options for Approval of Update

- **Approve all components**
 - with qualifications
 - without qualifications
- **Approve selected components**
 - with qualifications
 - Without qualifications

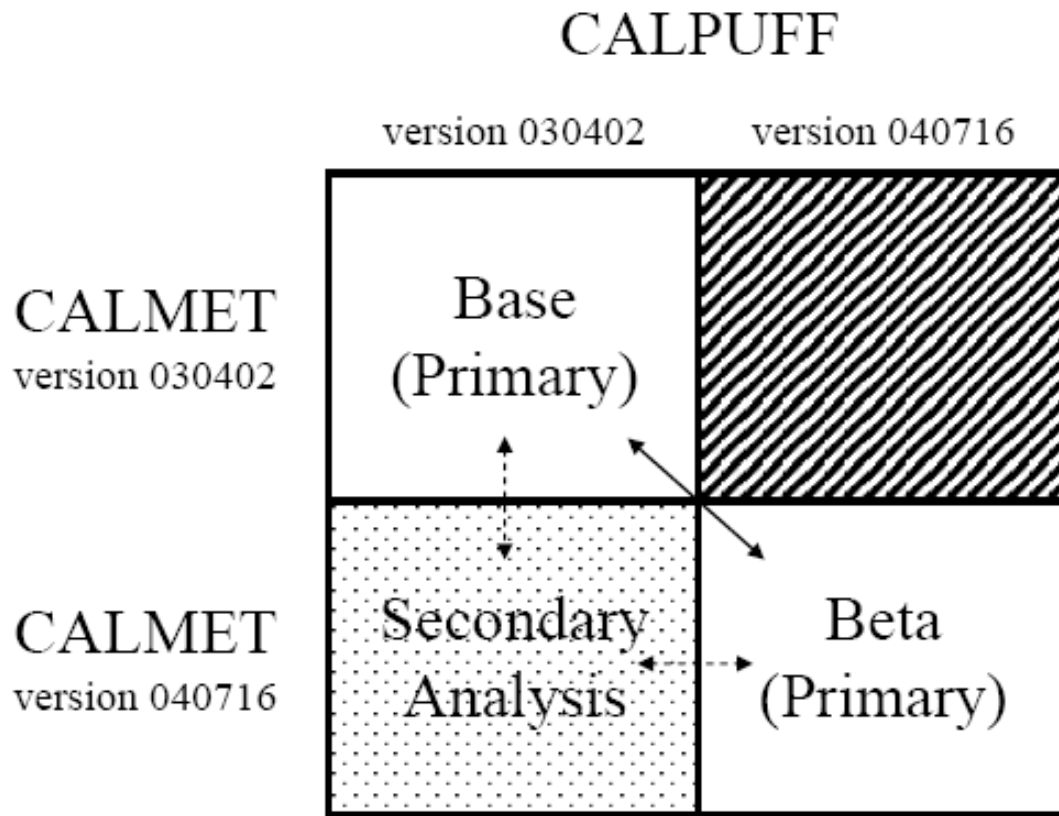
Transparency

- **Results of the analysis will be made available with the release of the update**
- **The analysis tool and all necessary files for running the tool will be made available**

Overview of CALPUFF Test Dataset

- Ten scenarios covering range of source types, modeling domains and meteorology
- Base version of modeling system (April 2003) compared to Beta version (July 2004)
 - *Primary Analysis*
- If differences are found, *Secondary Analysis* can be performed for affected scenarios
- *Secondary Analysis* designed to attribute differences to CALMET, CALPUFF or both

Resolving Differences Model Component ?



Scenario Components

- Sources
- Modeling Domains
- Terrain
- Meteorology
- Dispersion

Description of Scenarios

1. Large-scale domain in Pacific NW - NWS data only
2. Same as 1 with MM5 NOOBS option
3. Medium-scale domain in Pacific NW with MM5/NWS
4. Medium-scale domain near Shenandoah NP
5. Small-scale complex flow with deep valley
6. Idealized hill with steady-state met – similarity
7. Idealized hill with steady-state met – PG
8. Flat terrain with steady-state met – similarity
9. Flat terrain with steady-state met – PG
10. Idealized hill with simulated wind shear

Description of Sources

- **Four core sources included in all scenarios:**
 - Ground-level area source (20m by 200m)
 - 10m volume source
 - 30m non-buoyant point source
 - 65m buoyant point source
- **Two sets of core sources included in Scenarios 1, 2, and 5 at different locations within domain**
- **Scenario 3 also includes 99m buoyant stack near coast**
- **Scenario 4 also includes buoyant area source**
- **Scenarios 6 and 7 also include three PRIME downwash sources (35m buoyant, 35m capped, 50m buoyant)**

PROJECT TITLE:

Scenario 1 - Surface Roughness Length (m)

COMMENTS:

Scenario 1
960x960km Domain
12km Grid Spacing
41.5 & 47.5 Ref
Parallels

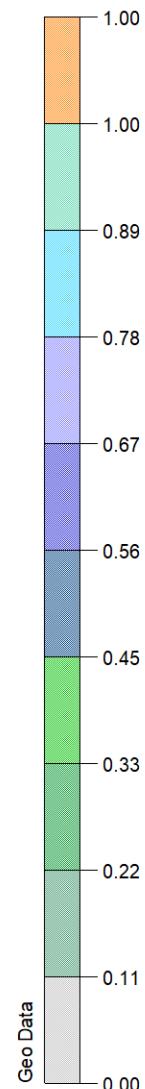
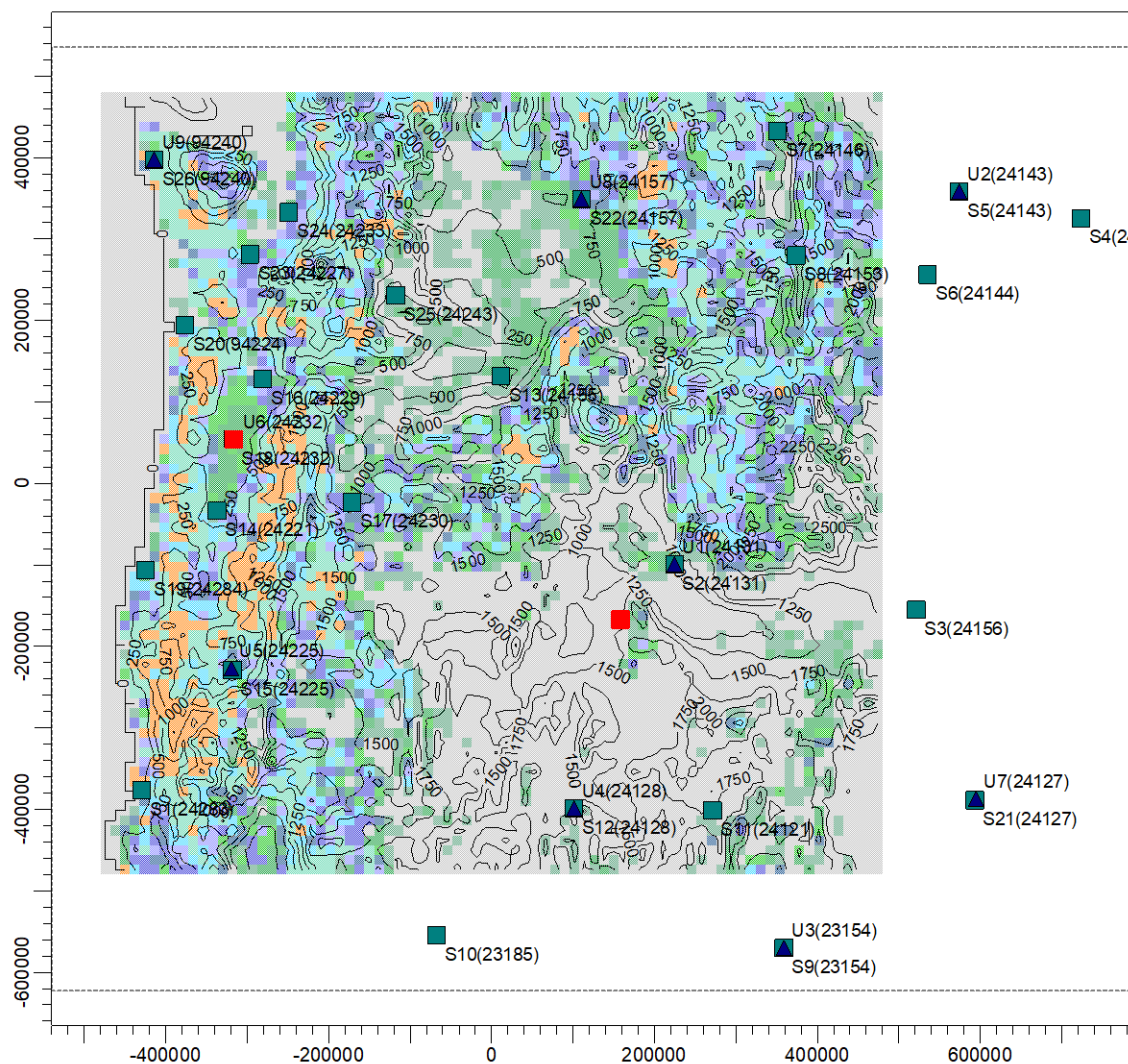
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MODELER:

DATE:

6/27/2004

PROJECT NO.:

G518

0 200 km

PROJECT TITLE:

Scenario 1 - Land Use Data

COMMENTS:

Scenario 1
960x960km Domain
12km Grid Spacing
41.5 & 47.5 Ref
Parallels

COMPANY NAME:

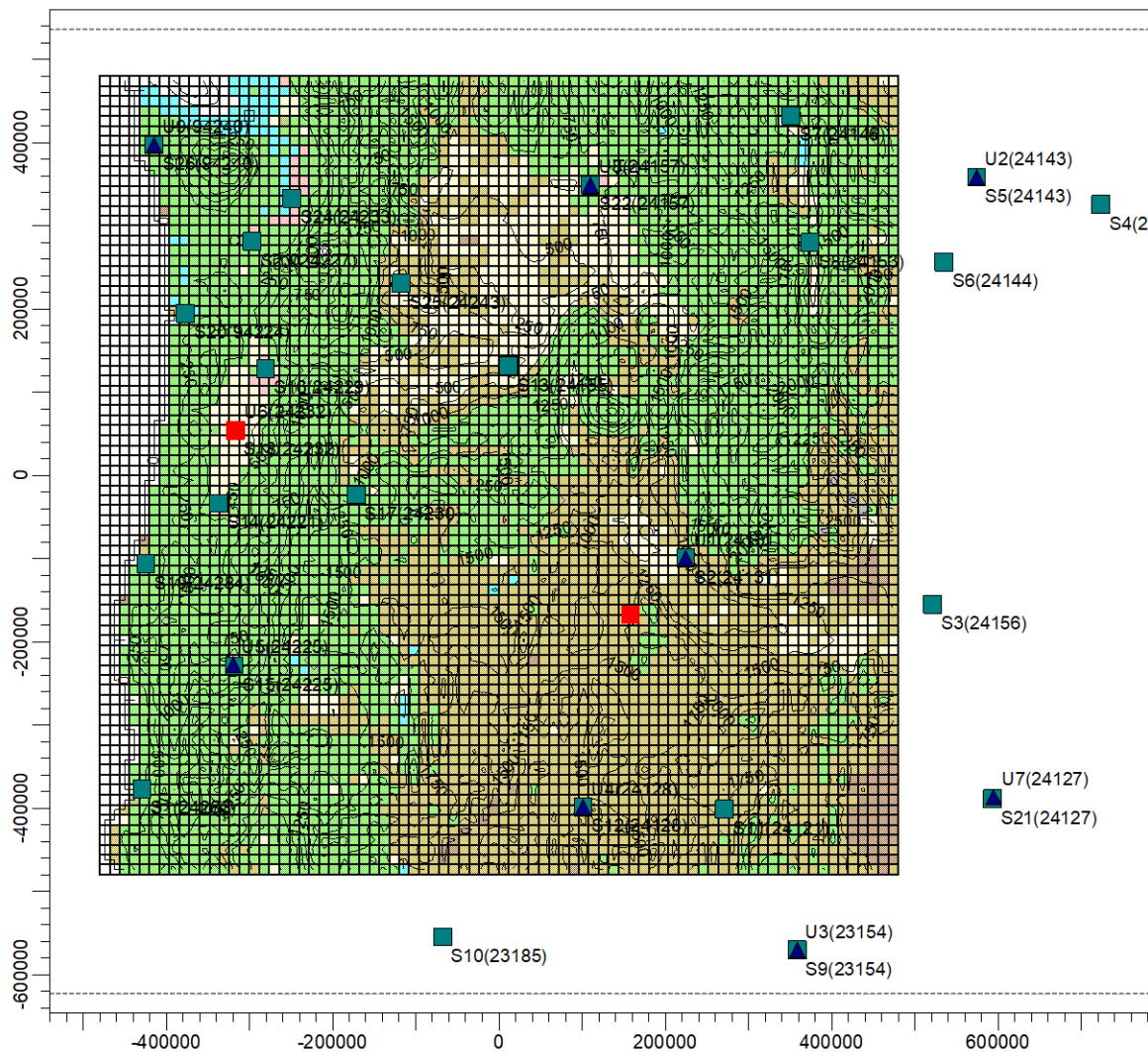
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DATE:

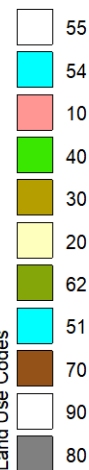
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0 200 km

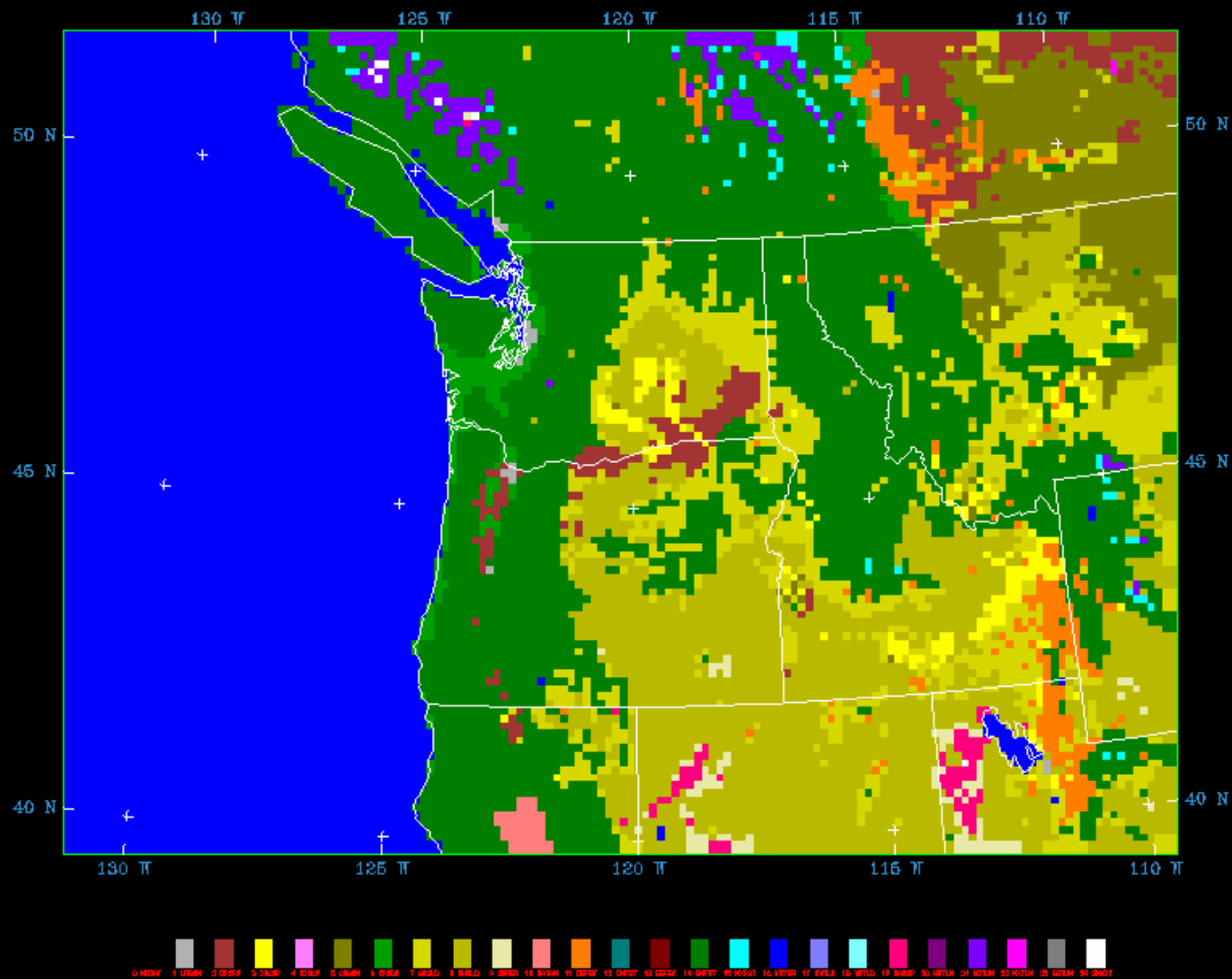
PROJECT NO.:

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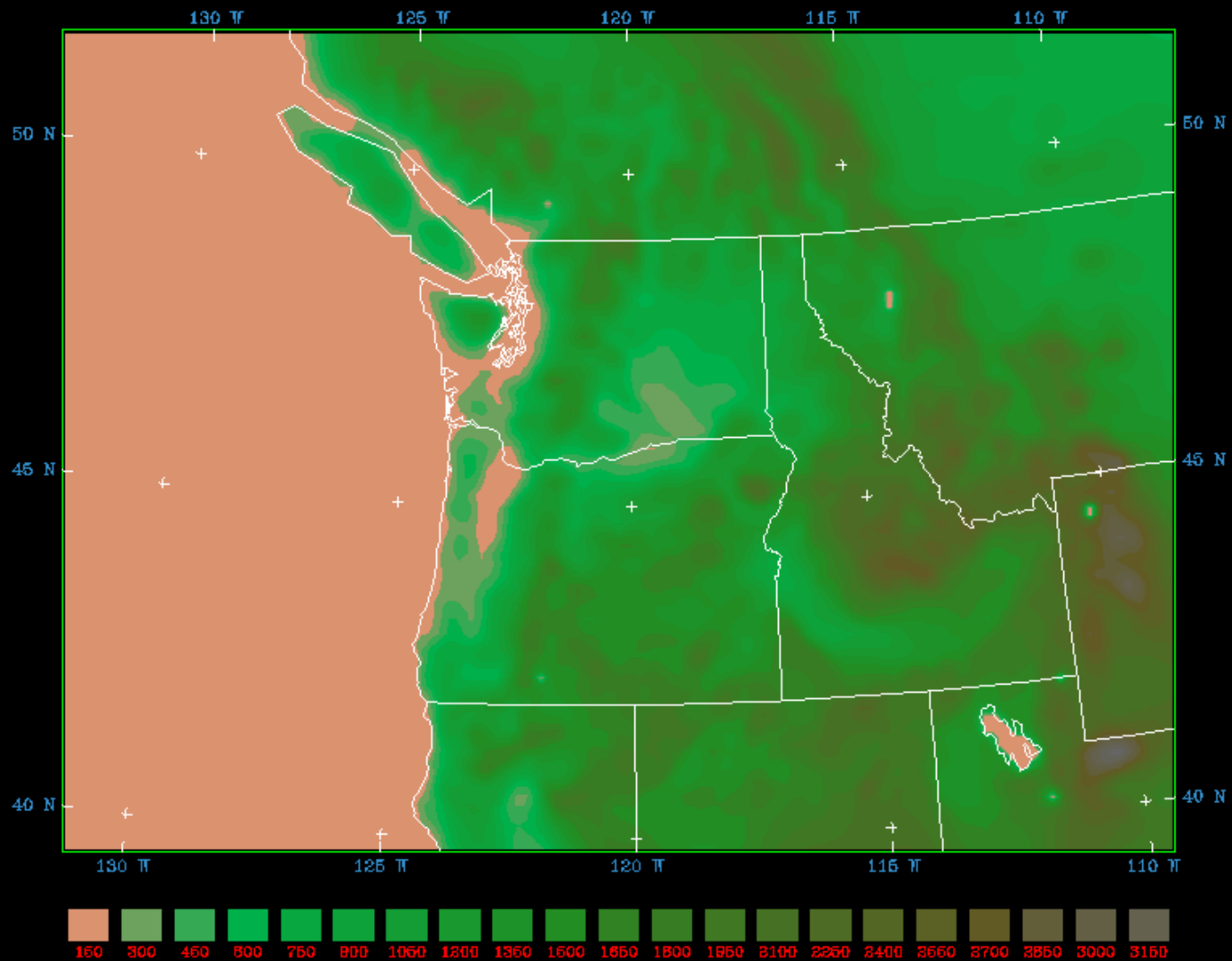
Land Use Codes



DOMINANT VEGECAT/NEW LANDUSE TYPE



TERRAIN HEIGHT IN COLOR



PROJECT TITLE:

Scenario 4 - Surface Roughness Length (m)

COMMENTS:

Scenario 4
200x200km Domain
2km Grid Spacing

COMPANY NAME:

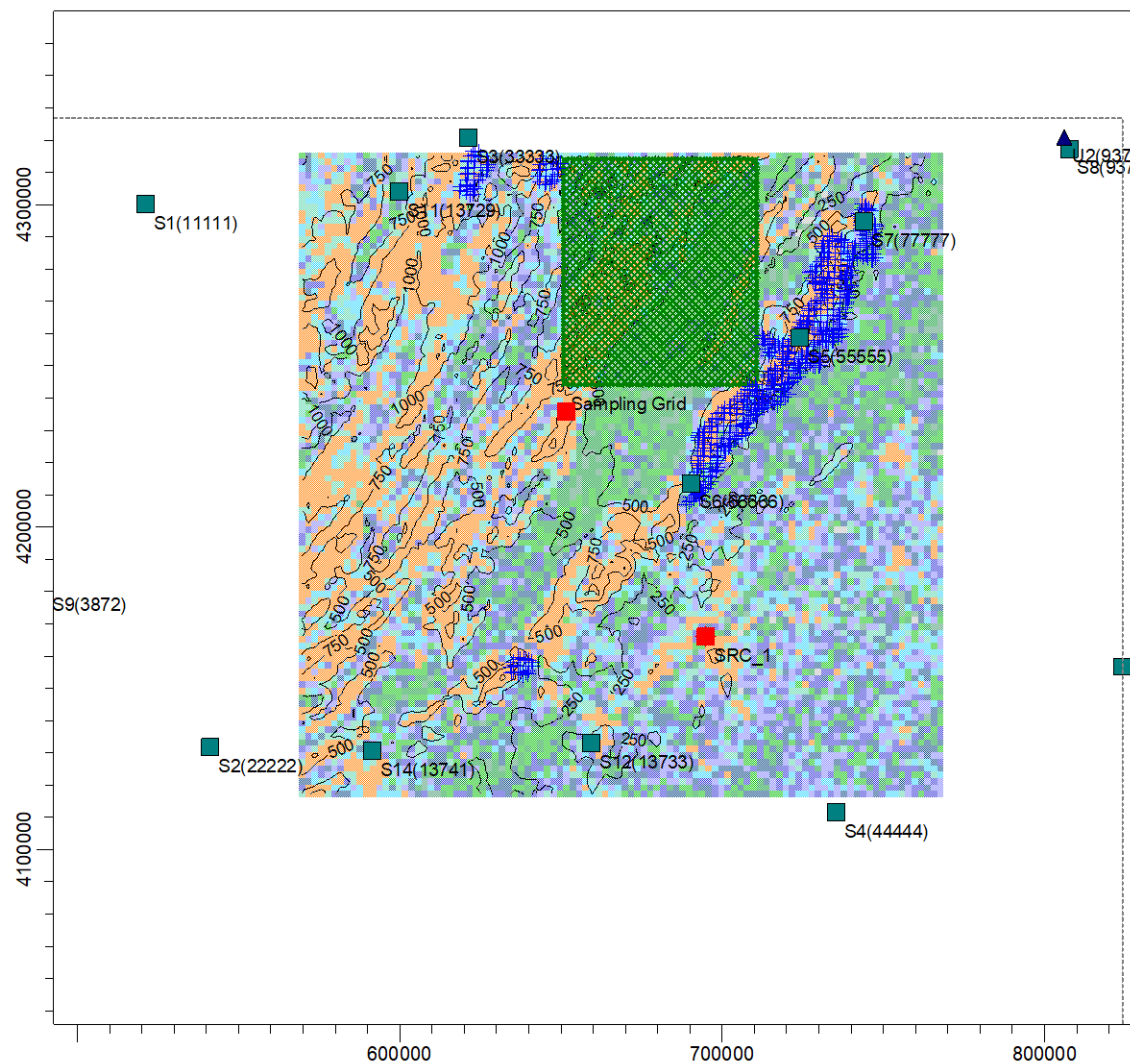
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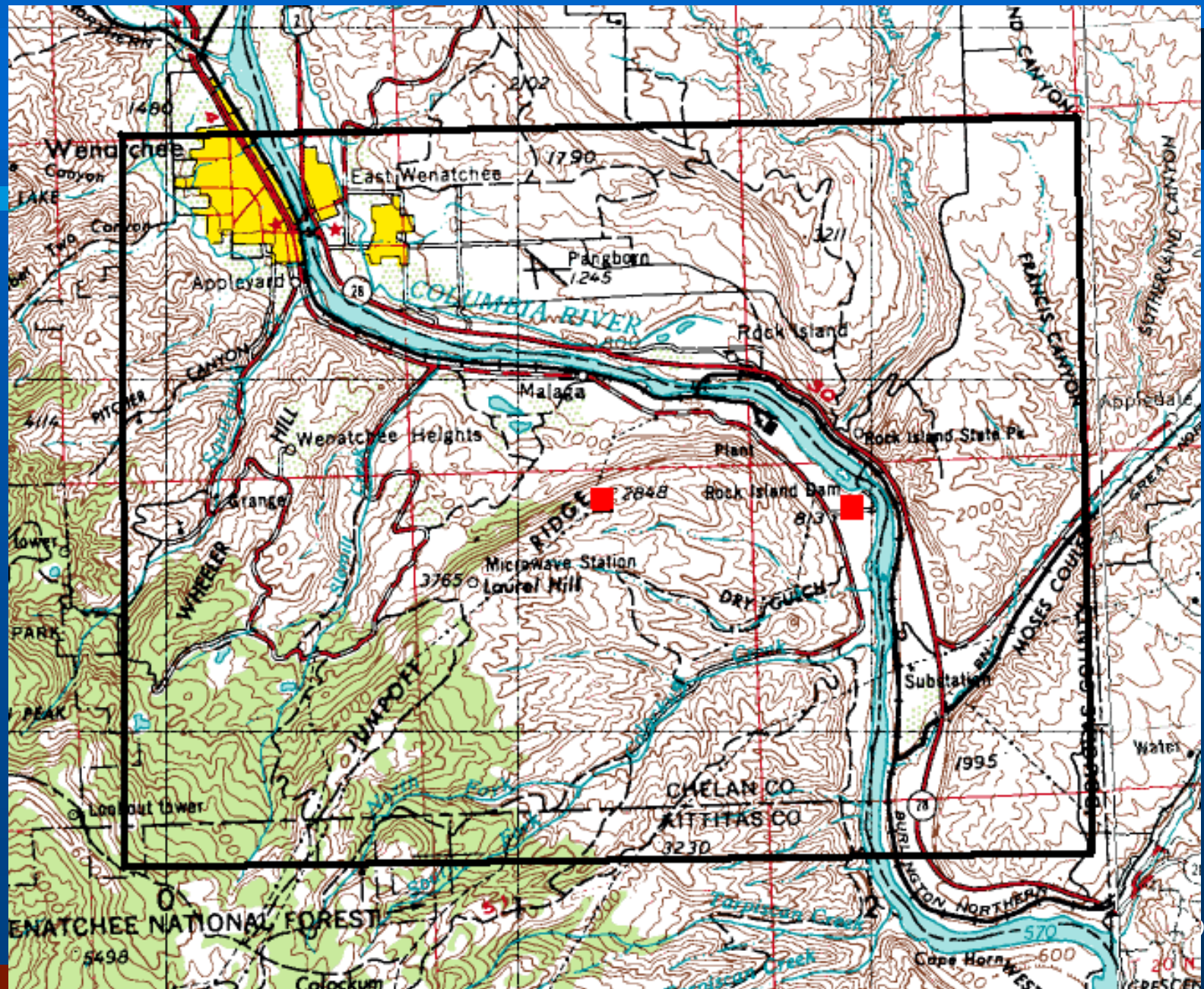
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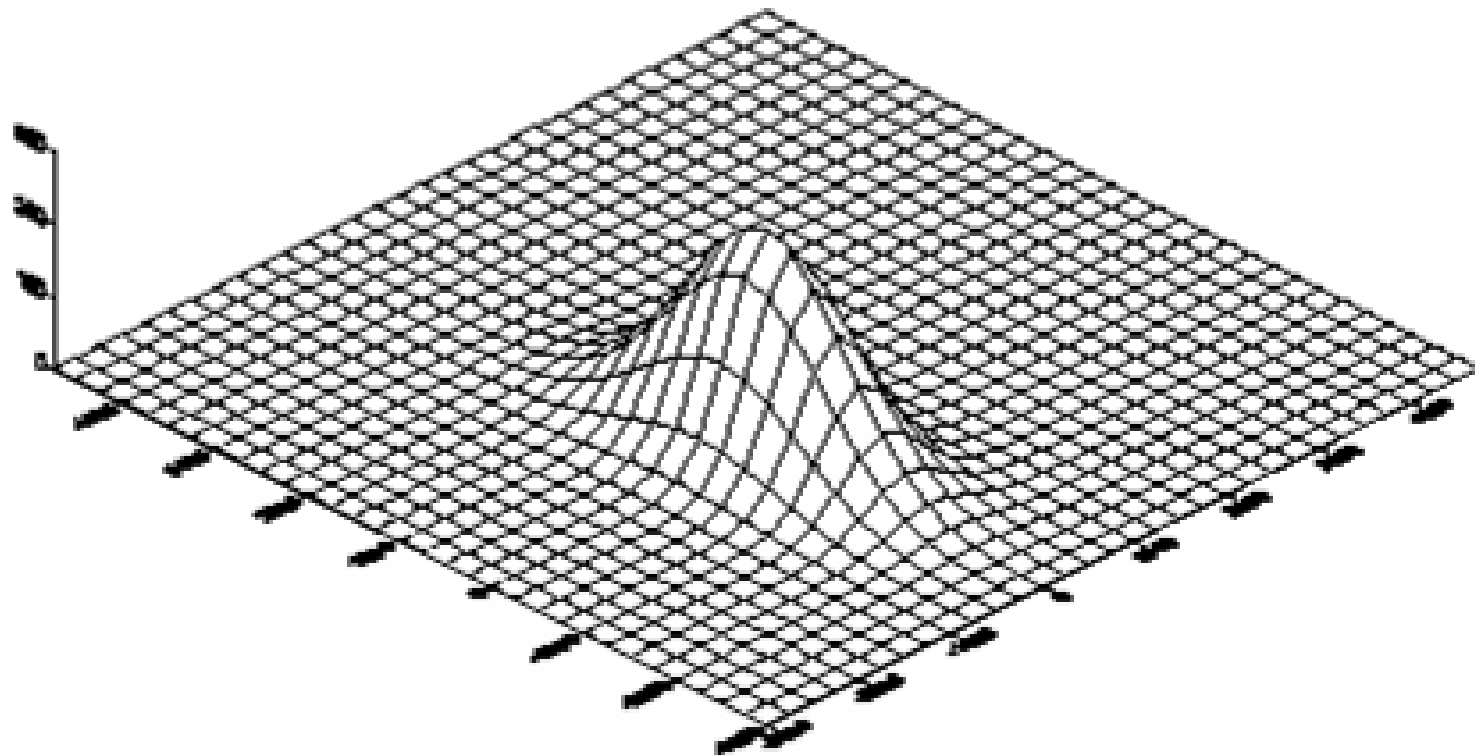
Geo Data

100



Idealized Scenario 6

- Scenario 6 includes idealized 300m hill at center of 10km by 10km domain
- Sources located at left edge of domain, upwind of hill
- Simulated steady-state meteorology:
 - 6 hours of stable
 - 6 hours of near-neutral
 - 6 hours of convective
- Uses dispersion based on similarity theory



Gaussian hill

Idealized Scenarios 7, 8 & 9

- Scenario 7 is same as Scenario 6, except for use of PG-based dispersion
- Scenario 8 is same as Scenario 6, except for use of flat terrain
- Scenario 9 is same as Scenario 8, except for use of PG-based dispersion

Idealized Scenario 10

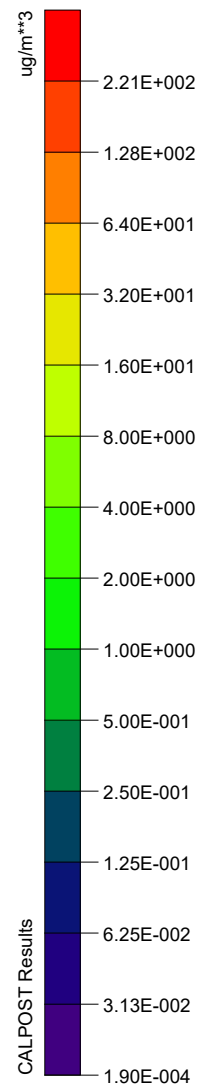
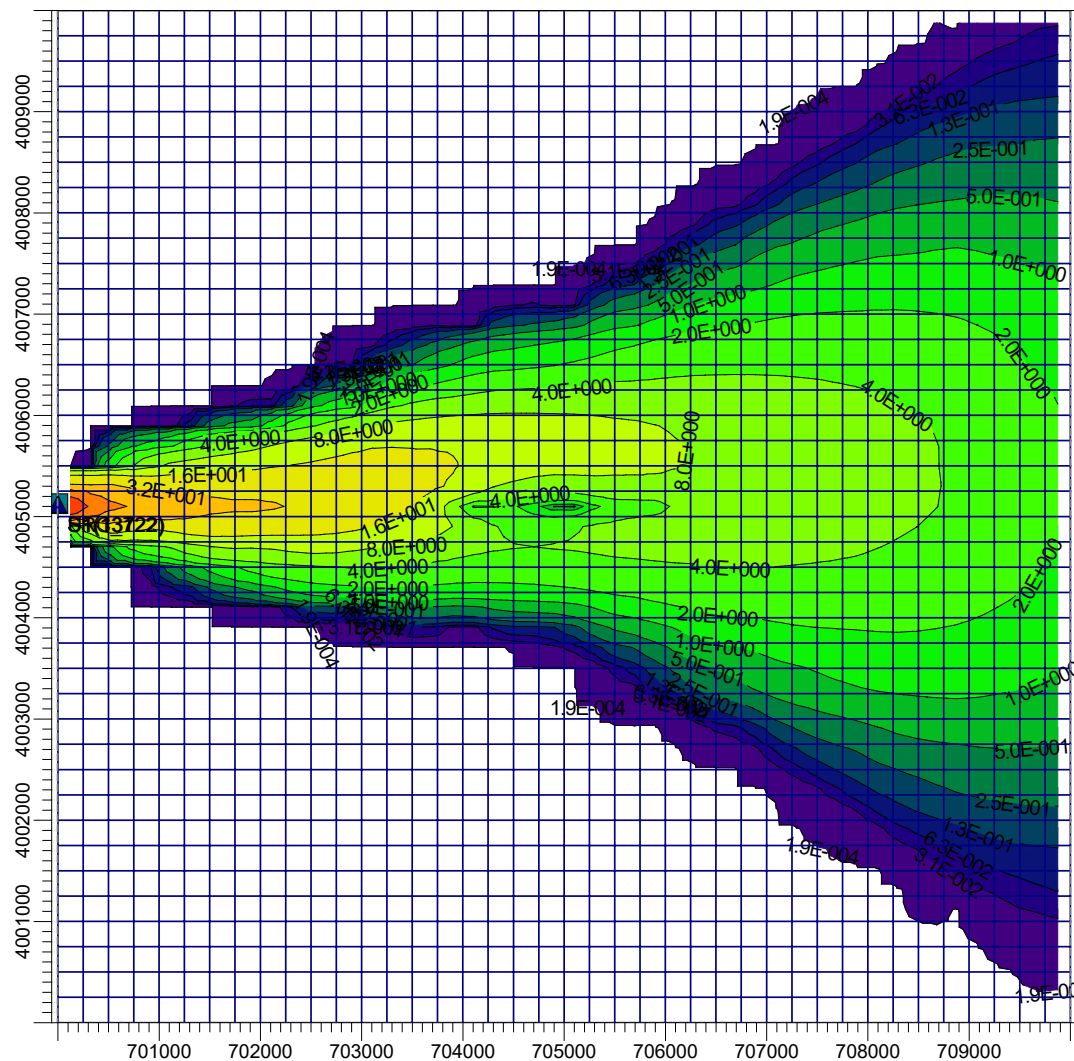
- Uses same idealized hill as Scenario 6
- Sources located near southwest edge of domain, “upwind” of hill
- Simulated steady-state meteorology, with WS and WD shear; using CTDM Profile
 - 6 hours of stable
 - 6 hours of near-neutral
- Uses dispersion based on similarity theory

PROJECT TITLE:

Scenario 6 - 10m Volume Source - Stable Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing
300m Idealized Hill



COMPANY NAME:

MODELER:

DATE:

6/29/2004

0 1 km

PROJECT NO.:

G518

PROJECT TITLE:

Scenario 6 - 30m Non-buoyant Point Source - Stable Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing
Idealize 300m Hill

COMPANY NAME:

MODELER:

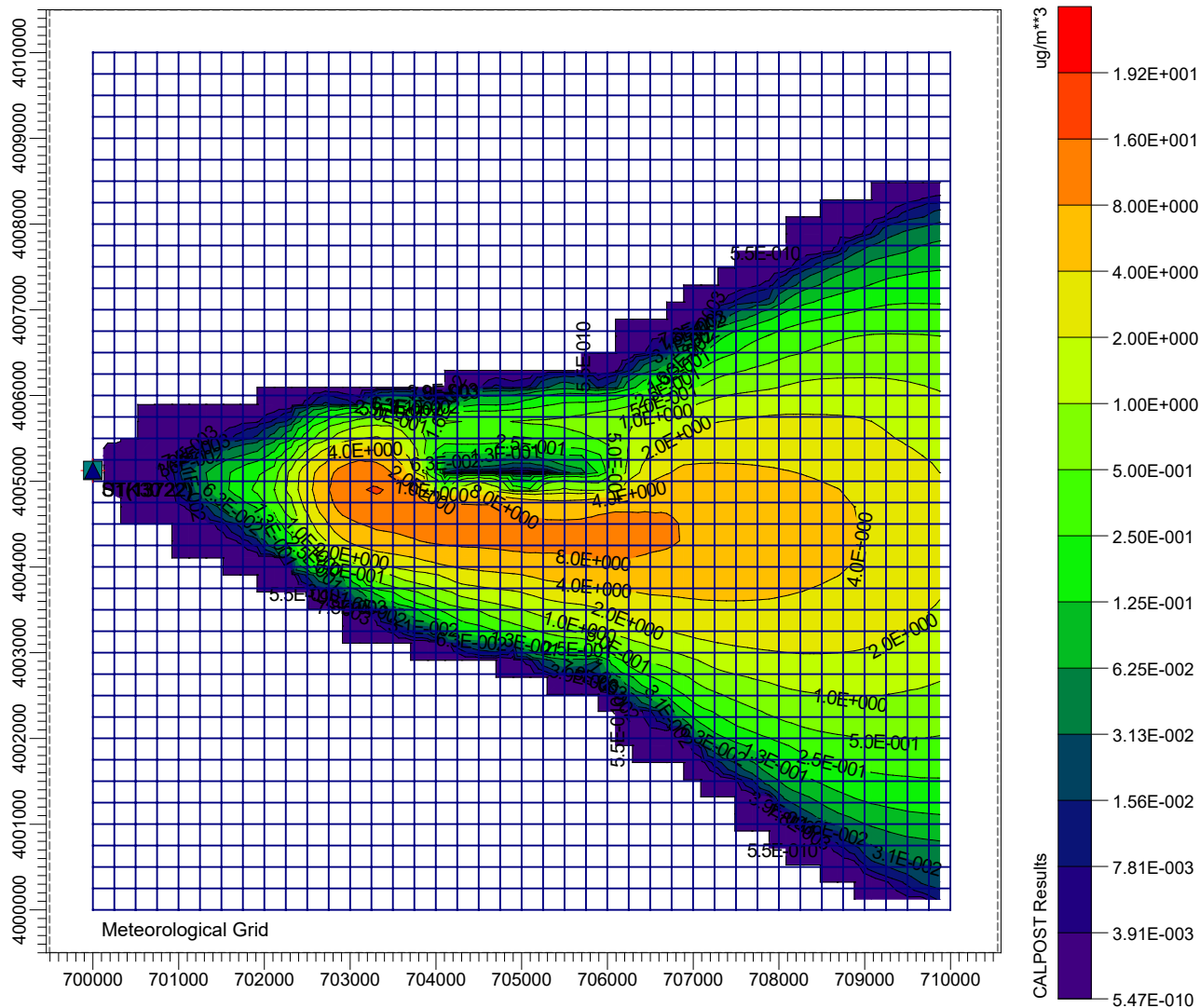
DATE:

6/28/2004

0 1 km

PROJECT NO.:

G518



PROJECT TITLE:

Scenario 6 - 65m Buoyant Point Source - Stable Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing
Idealize 300m Hill

COMPANY NAME:

MODELER:

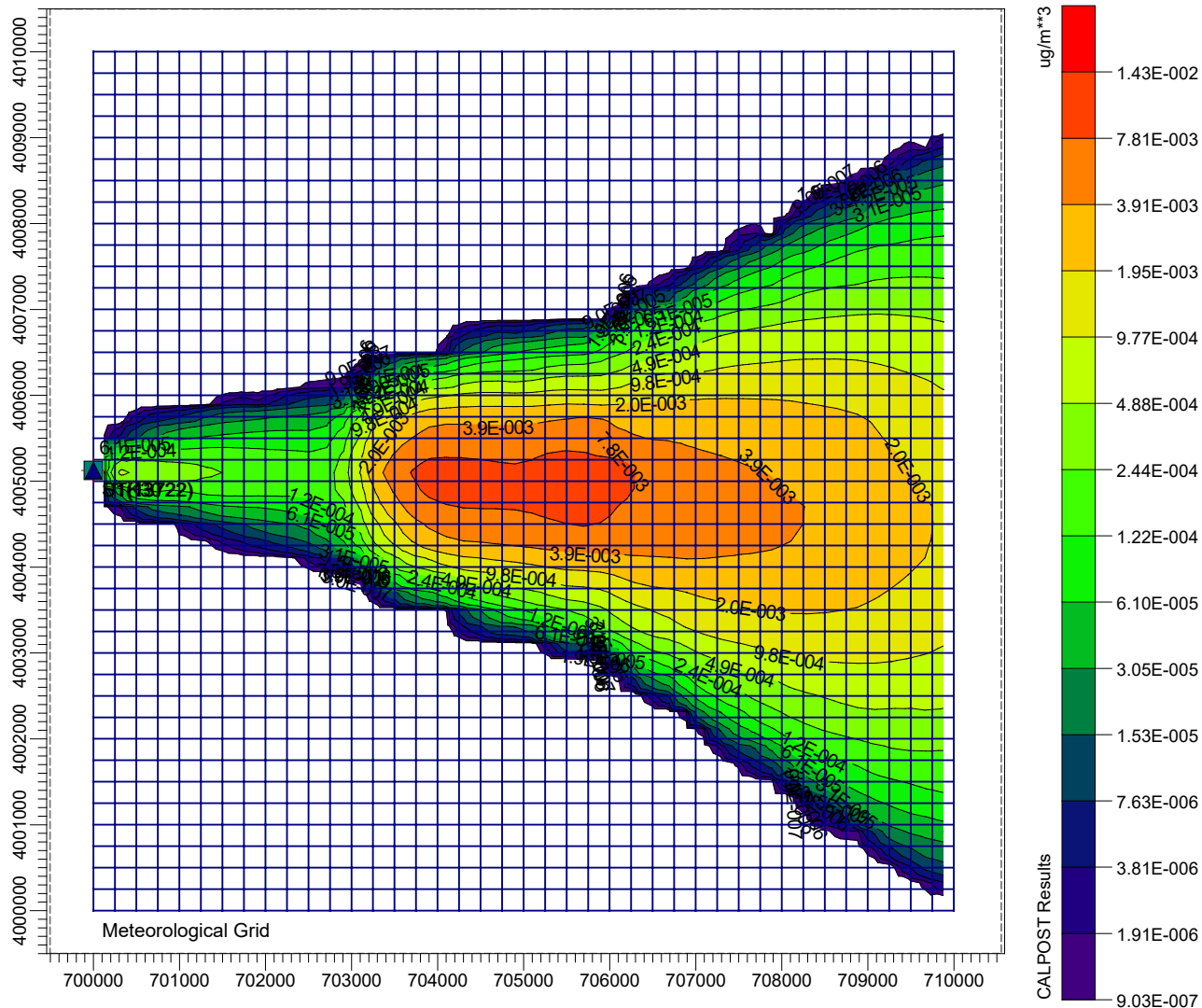
DATE:

6/28/2004

0 1 km

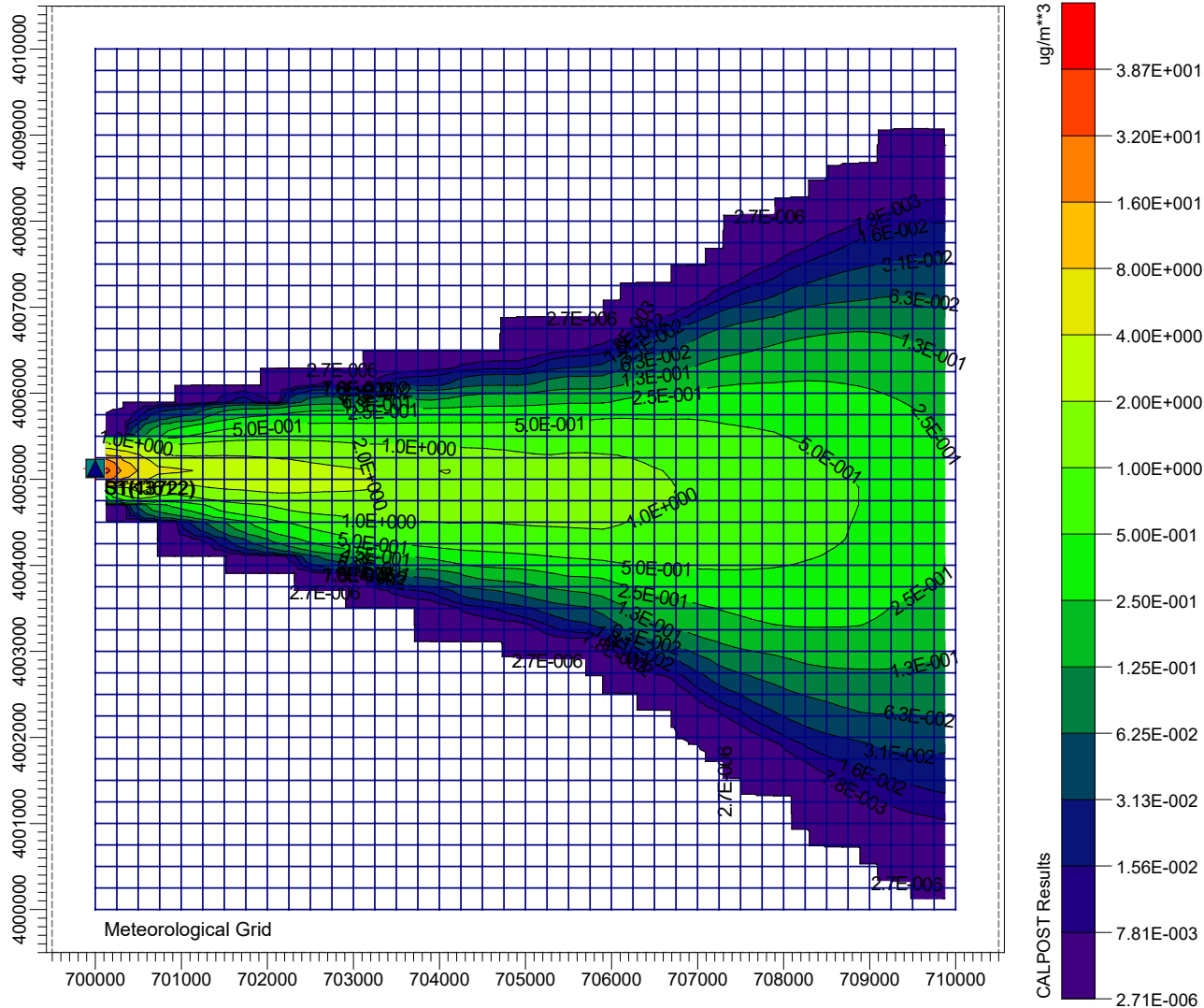
PROJECT NO.:

G518



Scenario 6 - 35m Point Source With Downwash (FMFAC = 0) - Stable Conditions

10km by 10km Domain
250m Grid Spacing
300m Idealized Hill



G518

PROJECT TITLE:

Scenario 6 - 35m Point Source With Downwash (FMFAC = 1) - Stable Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing
300m Idealized Hill

COMPANY NAME:

MODELER:

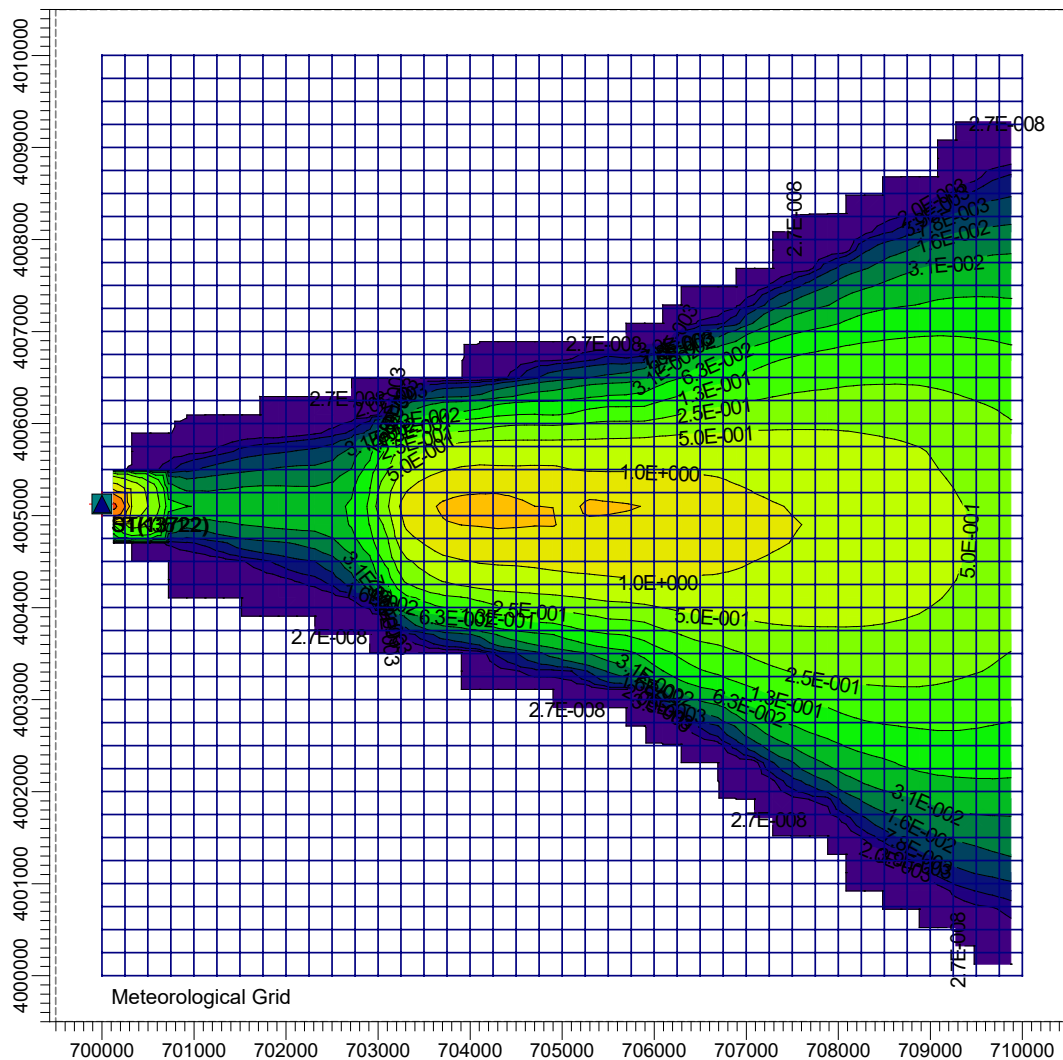
DATE:

6/29/2004

0 1 km

PROJECT NO.:

G518



PROJECT TITLE:

Scenario 6 - 50m Point Source With Downwash (FMFAC = 1) - Stable Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing
300m Idealized Hill

COMPANY NAME:

MODELER:

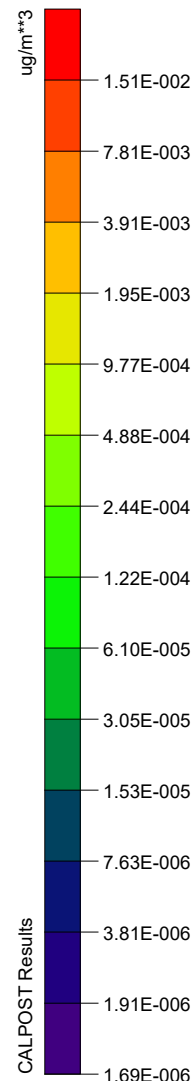
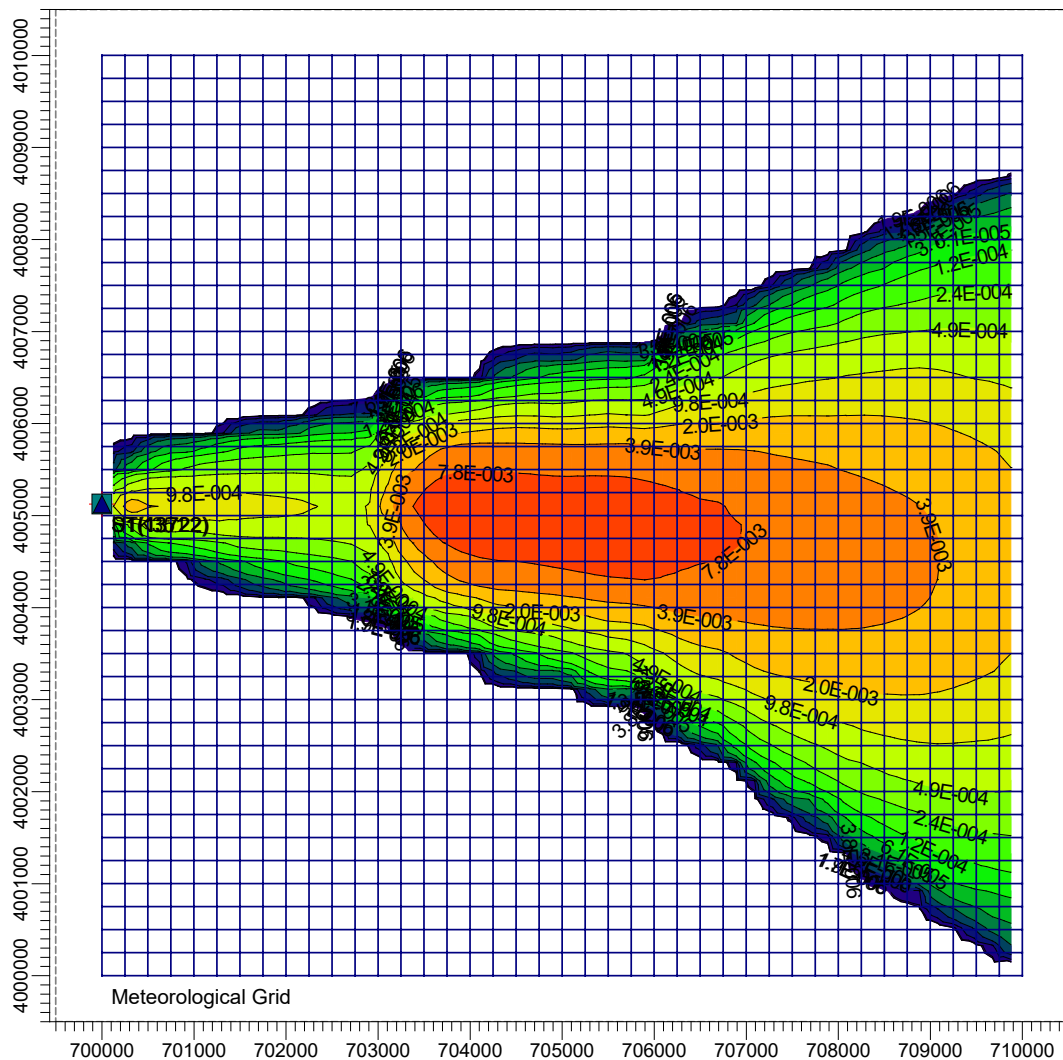
DATE:

6/29/2004

0 1 km

PROJECT NO.:

G518



PROJECT TITLE:

Scenario 10 - 10m Volume Source - Stable Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing

COMPANY NAME:

MODELER:

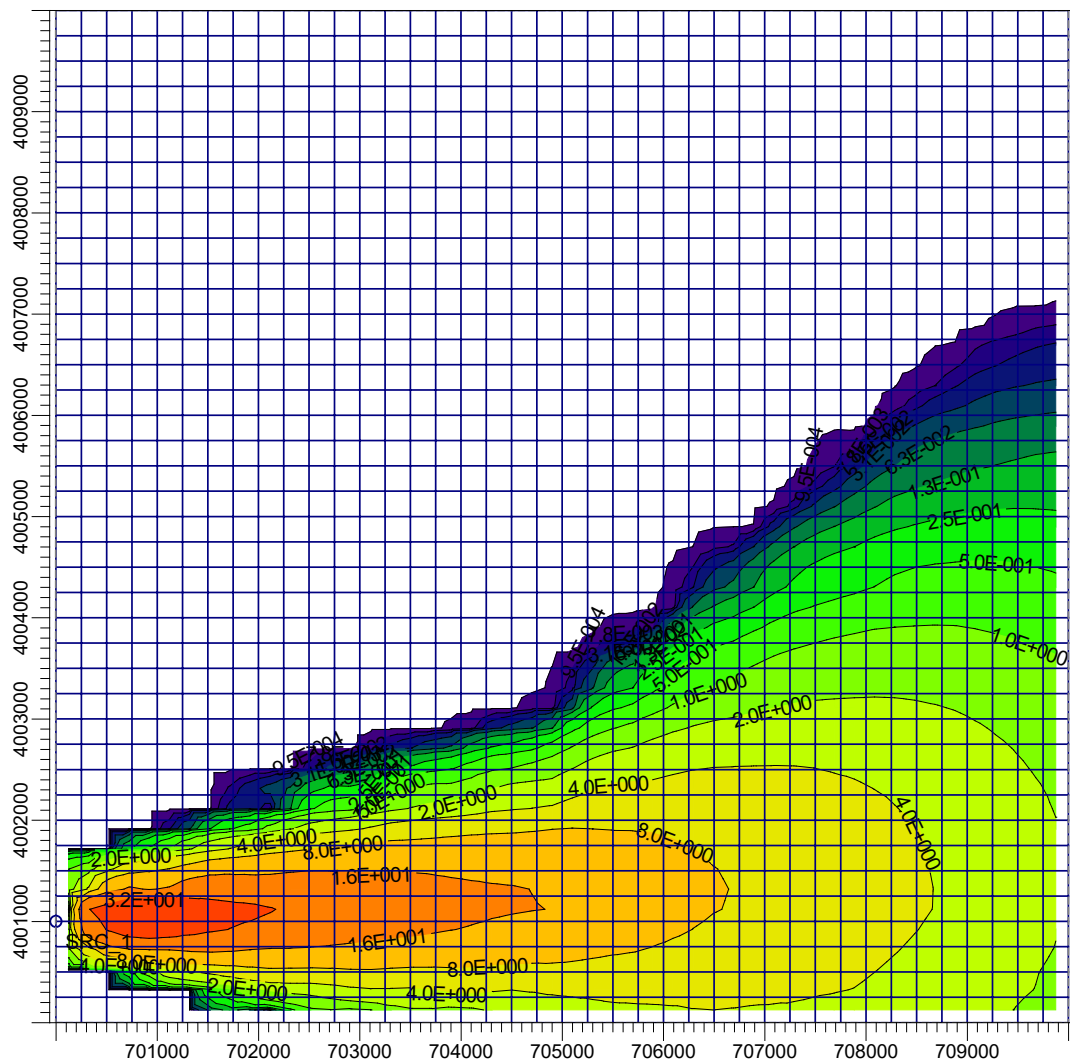
DATE:

6/28/2004

0 1 km

PROJECT NO.:

G518



PROJECT TITLE:

Scenario 10 - 10m Volume Source - Neutral Conditions

COMMENTS:

10km by 10km Domain
250m Grid Spacing

COMPANY NAME:

MODELER:

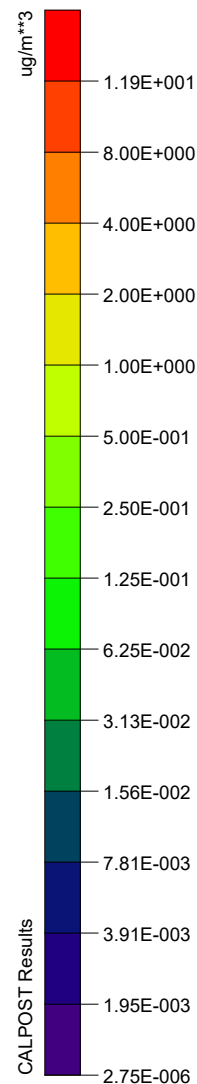
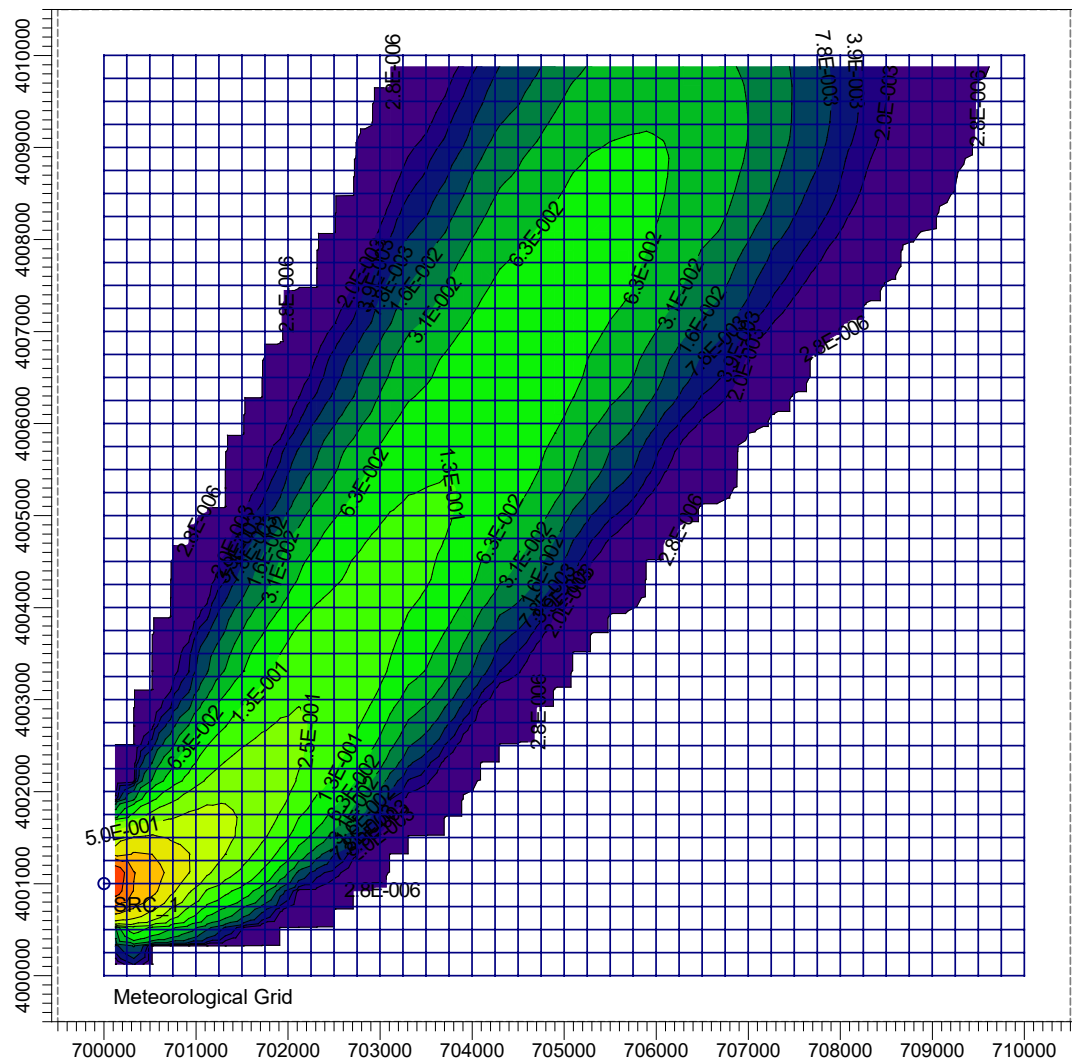
DATE:

6/29/2004

0 1 km

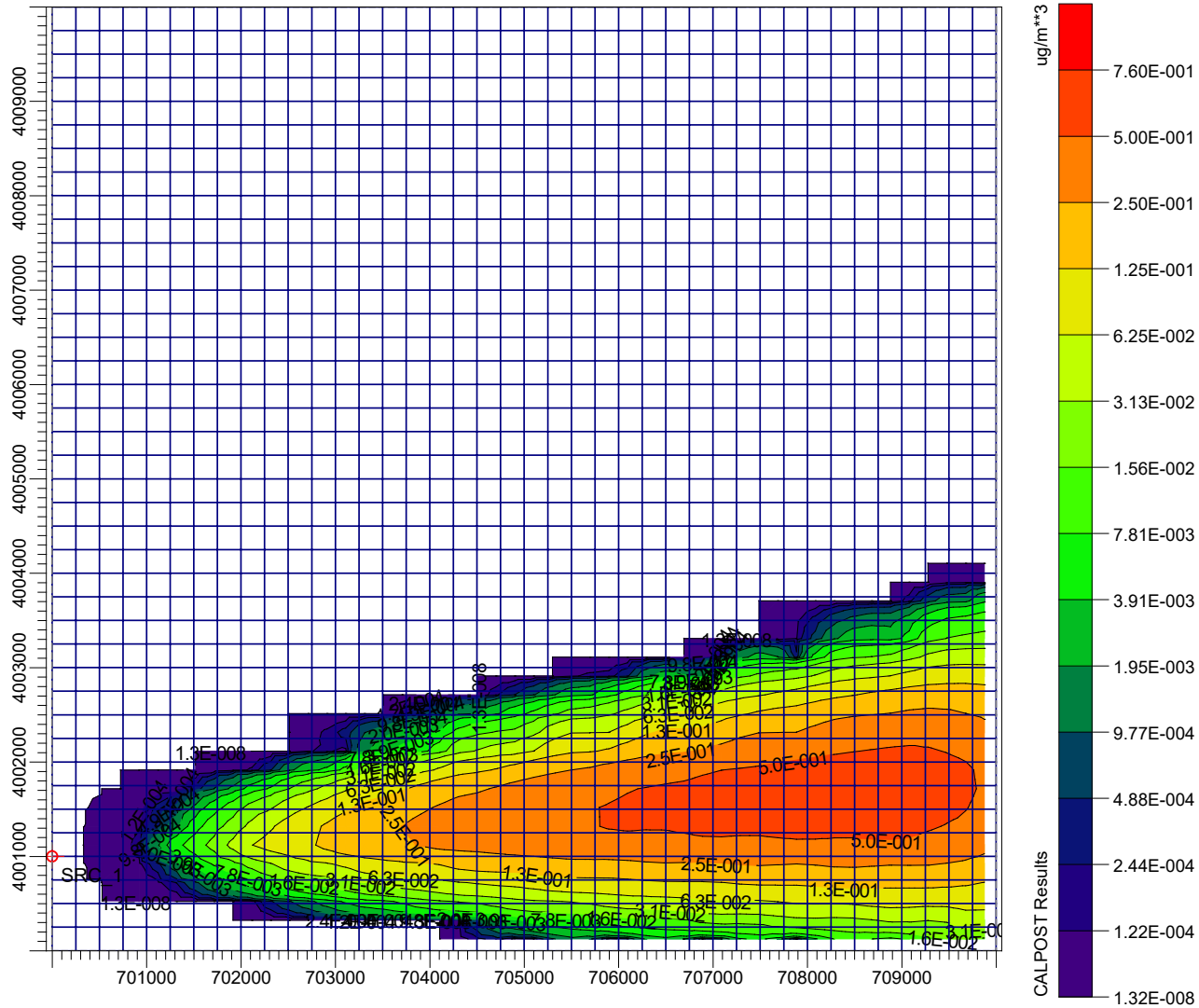
PROJECT NO.:

G518



Scenario 10 - 30m Non-buoyant Point Source - Stable Conditions

10km by 10km Domain
250m Grid Spacing

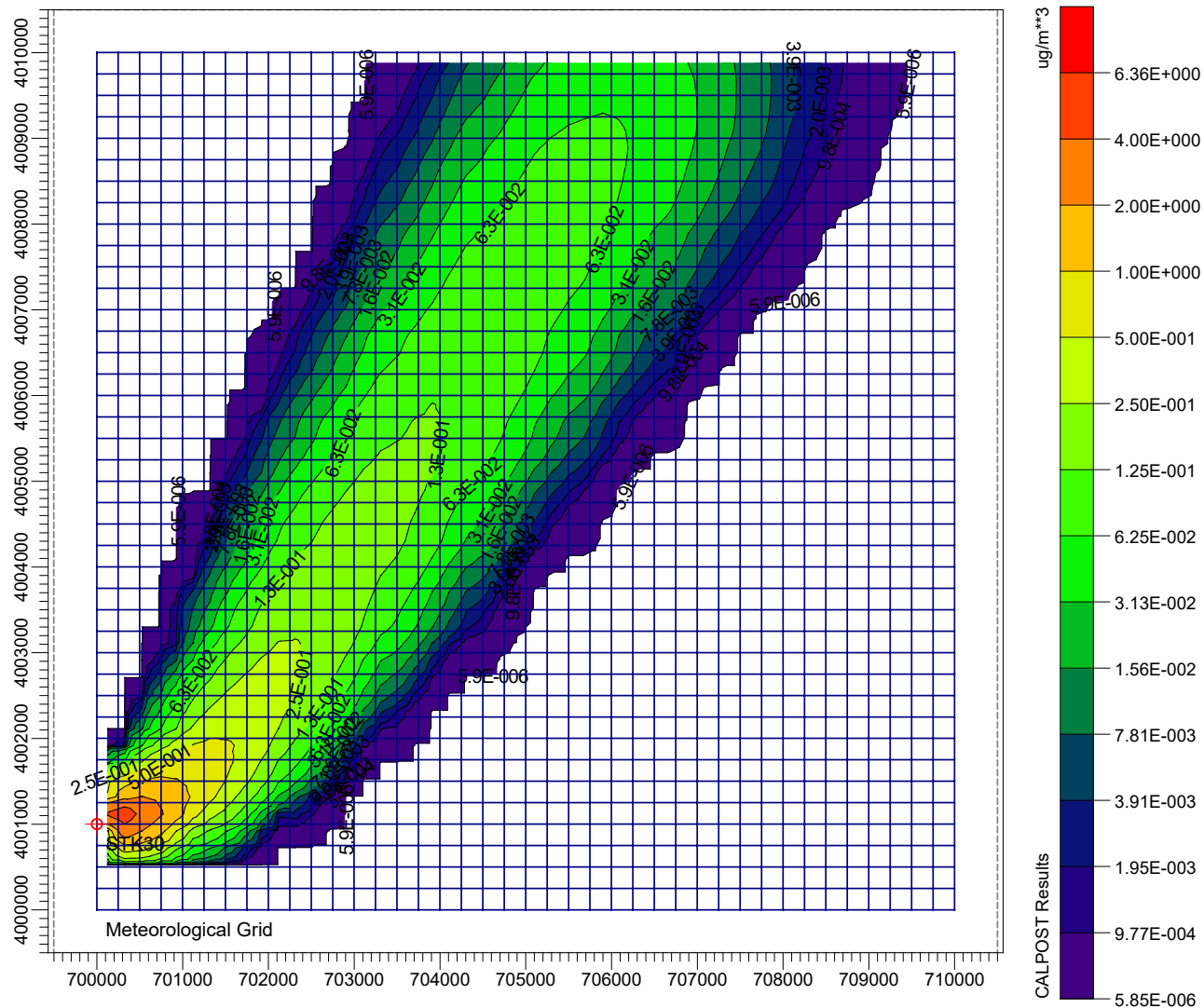


0 1 km

G518

Scenario 10 - 30m Non-buoyant Point Source - Neutral Conditions

10km by 10km Domain
250m Grid Spacing



0 1 km

PROJECT NO.:

G518

PROJECT TITLE:
Scenario 10 - 65m Buoyant Point Source - Stable Conditions

COMMENTS:

10km by 10km Domain
 250m Grid Spacing

COMPANY NAME:

MODELER:

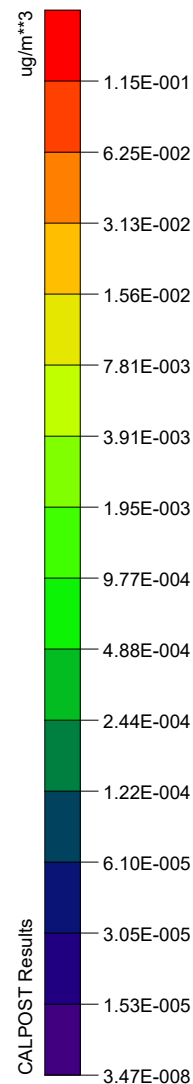
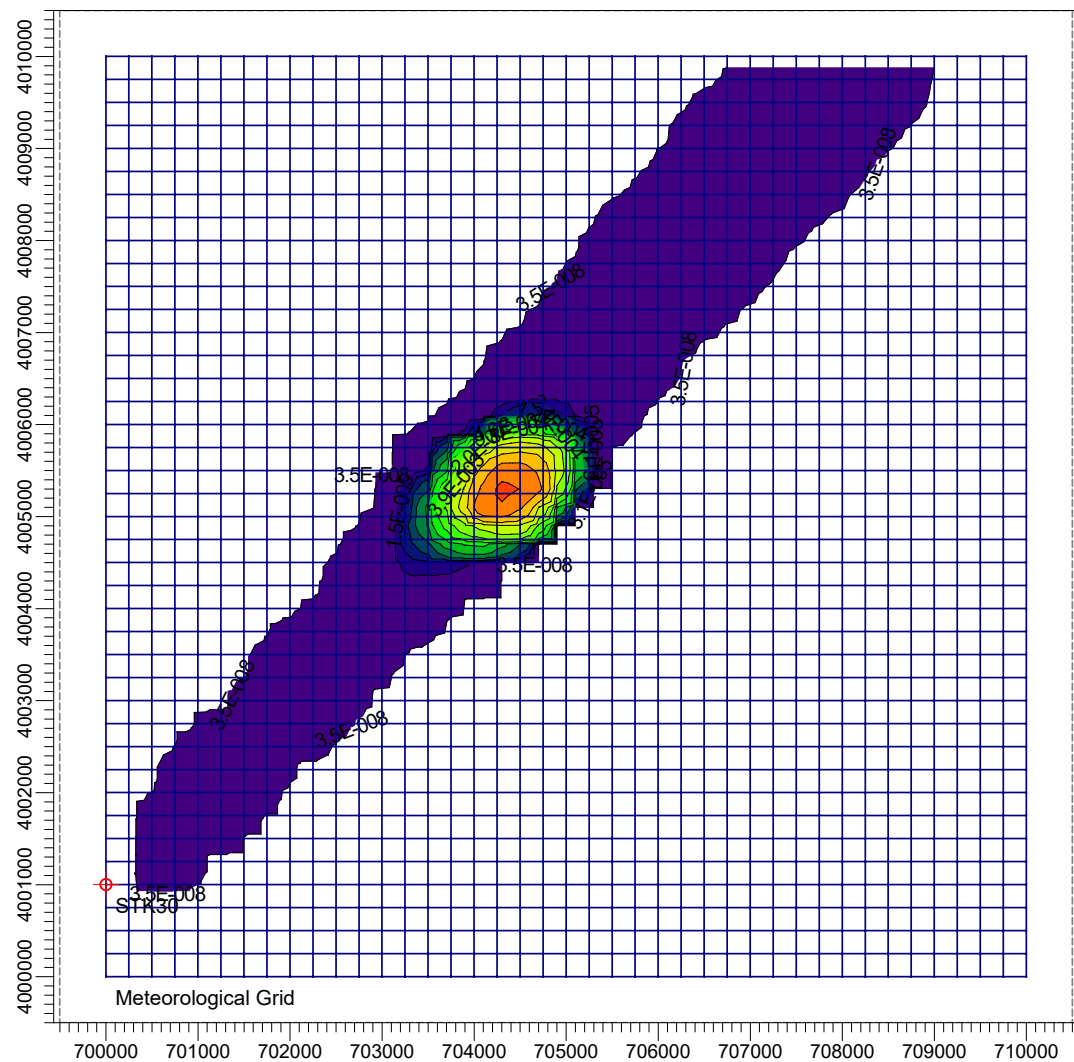
DATE:

6/29/2004

0 1 km

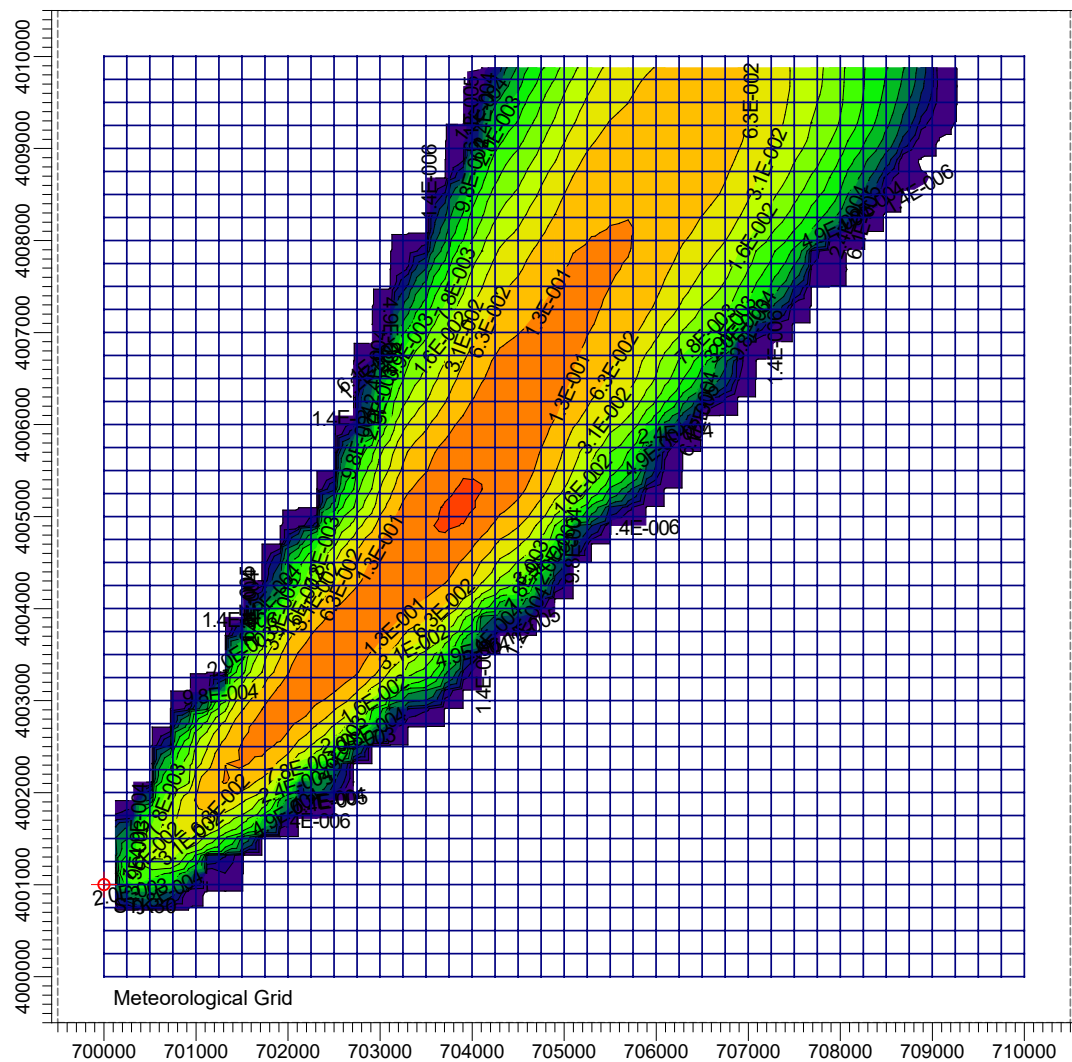
PROJECT NO.:

G518



Scenario 10 - 65m Buoyant Point Source - Neutral Conditions

10km by 10km Domain
250m Grid Spacing



CALPOST Results

Color	Concentration Range (ug/m ³)
Red	2.92E-001
Orange	2.50E-001
Yellow	1.25E-001
Light Yellow	6.25E-002
Yellow-Green	3.13E-002
Green	1.56E-002
Light Green	7.81E-003
Medium Green	3.91E-003
Dark Green	1.95E-003
Teal	9.77E-004
Dark Teal	4.88E-004
Dark Blue	2.44E-004
Medium Blue	1.22E-004
Light Blue	6.10E-005
Dark Blue	1.40E-006

0 1 km

PROJECT NO.:

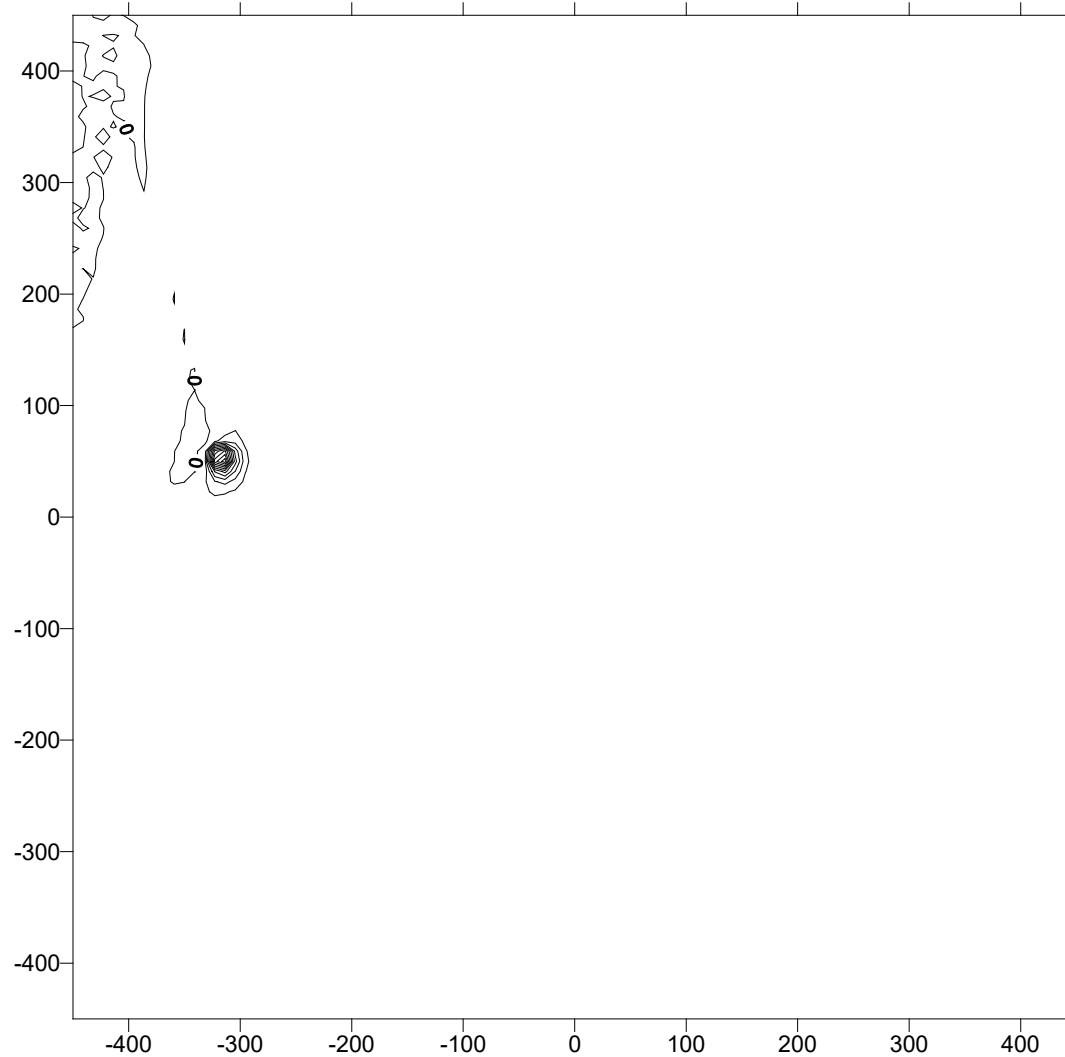
G518

Summary of Results

- **Mostly minor differences in all Scenarios, except for Scenario 10 – all differences attributable to CALMET**
- **Maximum difference for ranked high value of 5.2% occurred for volume source in Scenario 4**
- **Maximum differences in ranked high values were generally less than about 0.3%**
- **No consistent trend in terms of bias of differences**

Scenario 02 - Volume Source 1 (Salem) Period Average Conc - Base Model

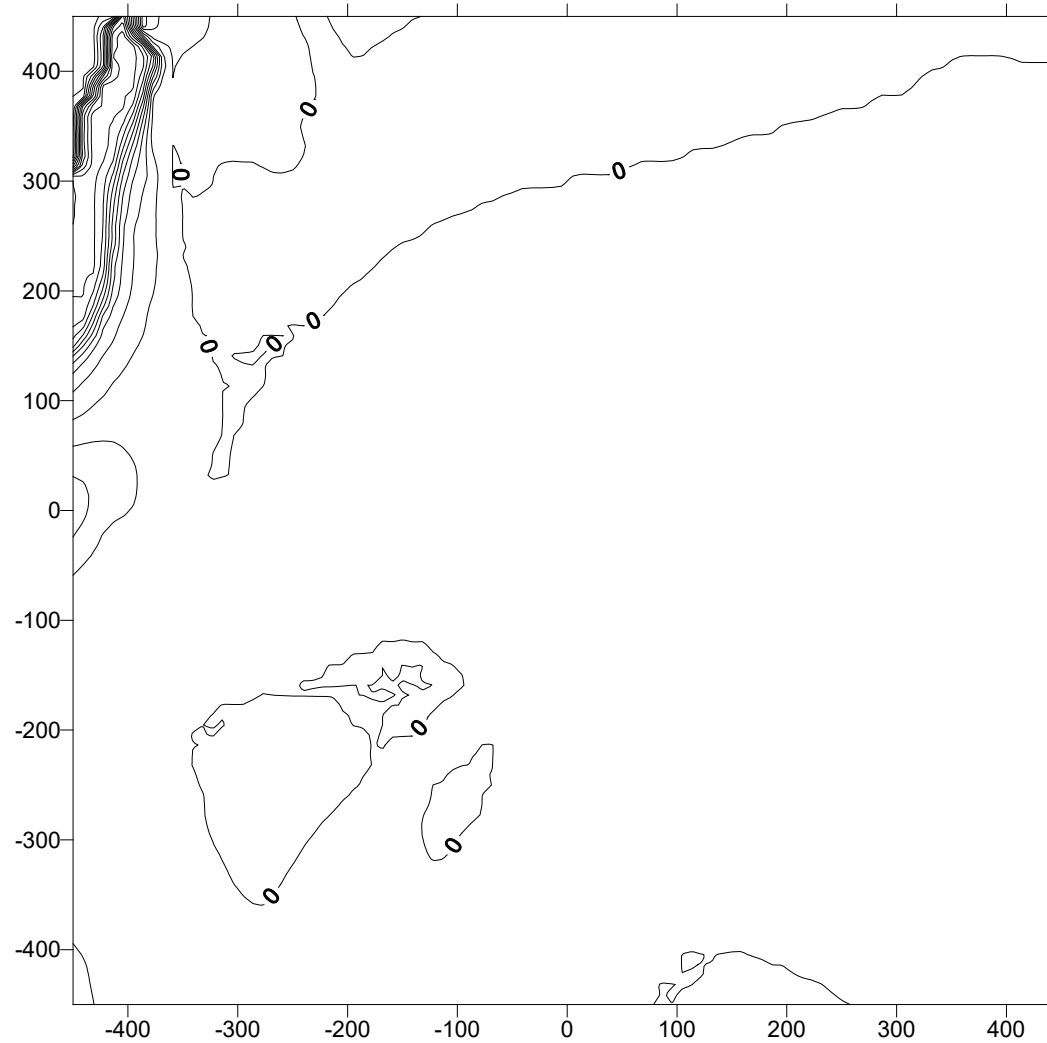
Y-Coordinate (km)



X-Coordinate (km)

Scenario 02 - Salem Volume Source - Fractional Biases

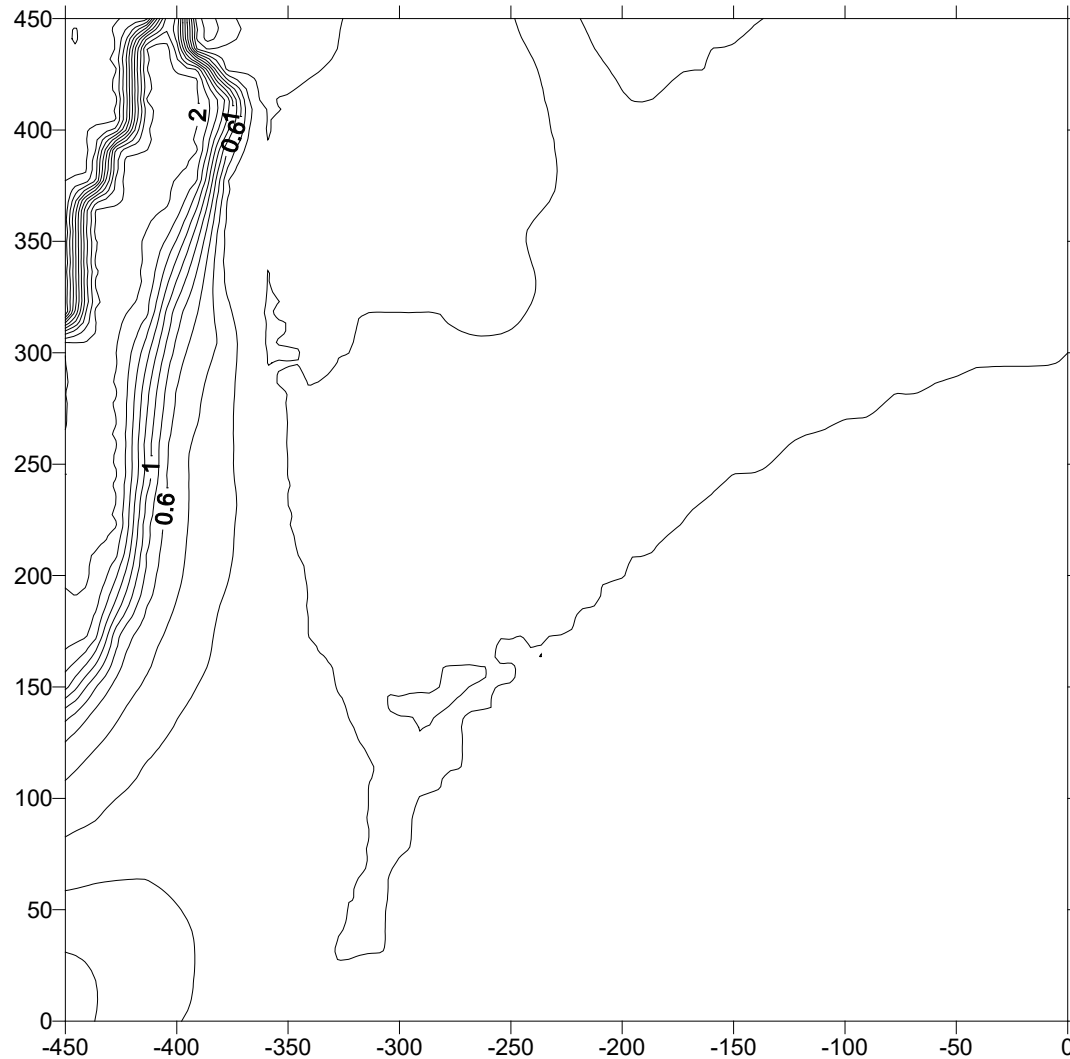
Y-Coordinate (km)



X-Coordinate (km)

Scenario 02 - Volume Source 1 - Fractional Biases Northwest Quadrant

Y-Coordinate (km)



X-Coordinate (km)

Issues/Lessons Learned

- **Base versions of CALMET and CALPUFF do not support Lambert Conformal (LCC) option**
- **Guidance for reference latitudes for LCC option**
- **No source grouping available in CALPUFF/ CALPOST – separate runs for each source**
- **Fixed array limits – recompilation issues**
 - **Prognostic data limits do not match CALMET grid limits**
 - **Limit on DEM files for TERREL in Scenarios 1 and 2**
- **No slug option for PRIME sources**
- **Unsupported NWS met data formats (ISHWO)**