Simulating Impacts of Highly Intermittent Sources

Read: NO_2 from backup generators

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Background

- Hard to pass by assuming (unrealistic) worst case emissions
- Clarification memo of 2011
  - Max hourly ER spread over 500/ 8760 hours may still under-estimate impacts
  - With multiple operating modes, hard to know if it is "continuous or frequent enough to contribute to the annual" design value
  - Doesn't exempt planned intermittent emissions like BuG testing.
- Can ***sometimes*** pass by using:
  - 1st highest impacts on 8th highest emitting day
  - 2nd highest impacts on 7th highest emitting day
  - 3rd highest impacts on 6th highest emitting day, etc.

Ecology's alternative pathway: use a stochastic method to account for intermittency

- Pairs emissions with all combinations of meteorology
- Separate 5-year AERMOD run for each operating mode at max hourly ER
  - Use ARM2/ PVMRM… whatever Dfault option
  - Reflect permit conditions (e.g. daytime testing only)
- Output MAXDAILY POST file.

Modus operandi

- Developed R script with parallel processing to:
  - Randomly draw X days for each POSTfile/ SRCGRP combo
    - For monthly tests, selects 1 day from each calendar month
    - For power outages, selects same days at nearby facilities
      - Can allow some neighbors to run on backup power for longer, if desired
    - Allows for emissions that don't happen every year
  - Assign zeros to other days
  - Repeat for all operating modes
  - Line up matrices of days, get 98th %iles at each receptor
  - Repeat 1000 times
  - Median of 98th percentiles → DV
    - Median is ~ stable & repeatable
    - Also show % of exceeding NAAQS
  - Median of 1000 maxima → ASIL compliance

	1-Jan	2-Jan	3-Jan	…	30-Jun	1-Jul	2-Jul	…	29-Dec	30-Dec	31-Dec
Power Outage	0	0	1		0	0	0		0	1	0
Monthly test	0	1	0		1	0	0		1	0	0
Electrical switchgear test	0	1	0		0	0	1		0	0	1
Some geeky engineering test	0	0	0		0	0	1		1	0	0
Daily max of above, µg/m³	**0**	**a**	**b**		**c**	**0**	**d**		**e**	**f**	**g**

- If 1, pull POSTfile conc for that receptor-date, else 0 µg/m³
- Receptor DV from iteration = 98th percentile of daily maxima (**a..g**)

A$k me ni$ely

```
MC_R_script(postfile_days_array_file.csv,
        receptor_file= NULL,
        pollutant = "NO2",
        background=40,
    desired_output_filename="MC_output.csv",
        num_processors= 20,
    PowerSourceGroup= " nolights ",
    MonthlySourceGroup= "maintenance",
srcgrps_not_in_all_years = "commissioning",
        UTMzone= 10)
```

Runtime scales with # of processors

30K receptors, 15 op. modes, 12 processors → ~ 2 hrs runtime

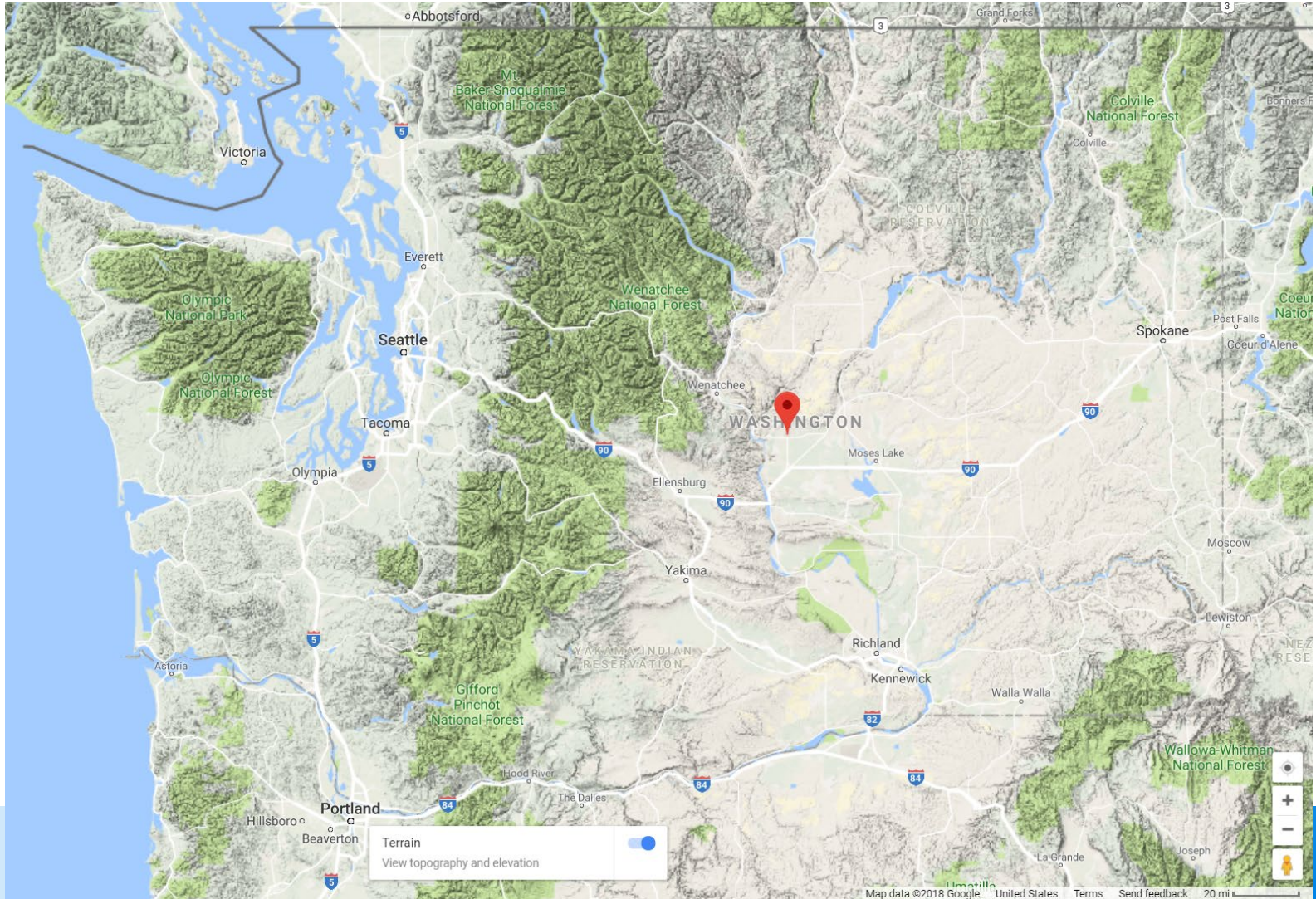
Maxdaily_POSTfile_name	Source_Group	Num_operating_days_per_yr
MAXDAILY_AL_pt_SO2.DAT	No_power	8
MAXDAILY_AL_BL_SO2.DAT	AL_month	12
MAXDAILY_BPLANT_SO2.DAT	BPLANT	35
MAXDAILY_PS_SO2.DAT	PS	10

Outputs DV table for each receptor & interactive map

Where is it used?

Prime example: NOCs in Quincy, WA data centers

- **Quincy population: ~ 7500**
- **Most agricultural area**
- **Reliable, cheap hydroelectric power**
- **Well-developed Internet fiber infrastructure**



	# Engines permitted (as of early 2021)
Microsoft Columbia	40
Microsoft MWH	105
NTT (formerly Dell)	5
CyrusOne	42
West Quincy Total	**192**

	# Engines permitted(as of early 2021)
H5 (formerly Intuit)	6 + 12
Orth (formerly Yahoo)	48
Sabey	69 + 40
Vantage	17
East Quincy Total	**140 + 52**