



Met Office

Validation of the atmospheric dispersion model NAME against long-range tracer release experiments

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NAME

Numerical
Atmospheric-dispersion
Modelling
Environment

- Lagrangian particle dispersion model
- Uses meteorological data on its native grid
- Turbulence and mesoscale motions represented
- Convection scheme off



The experiments

- CAPTEX
 - Sep – Oct 1983
 - Dayton, Ohio & Sudbury, Ontario, Canada
 - PMCH
 - 3 hour releases
 - 3 & 6 hour averages collected
- ANATEX
 - Jan – Mar 1987
 - Glasgow, Montana & St. Cloud, Minnesota
 - PDCH & PTCH
 - 3 hour releases
 - 24 hour averages collected

<http://www.arl.noaa.gov/DATEM.php>

The experiments

CAPTEX

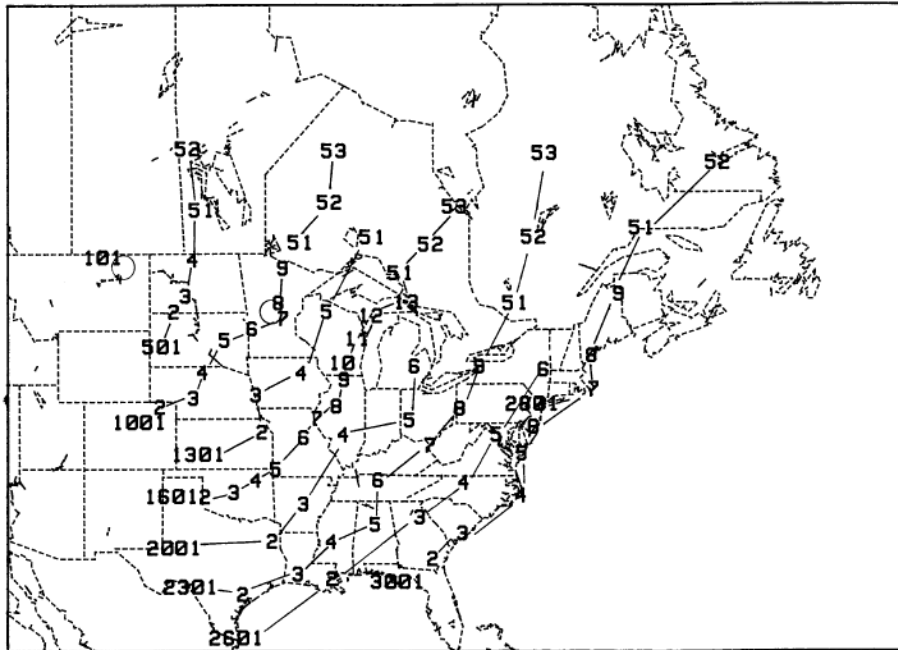


Figure 2-2. Primary ground-level sampling network. Station locations are at the center of each site number. Circles indicate locations of tracer release.

ANATEX

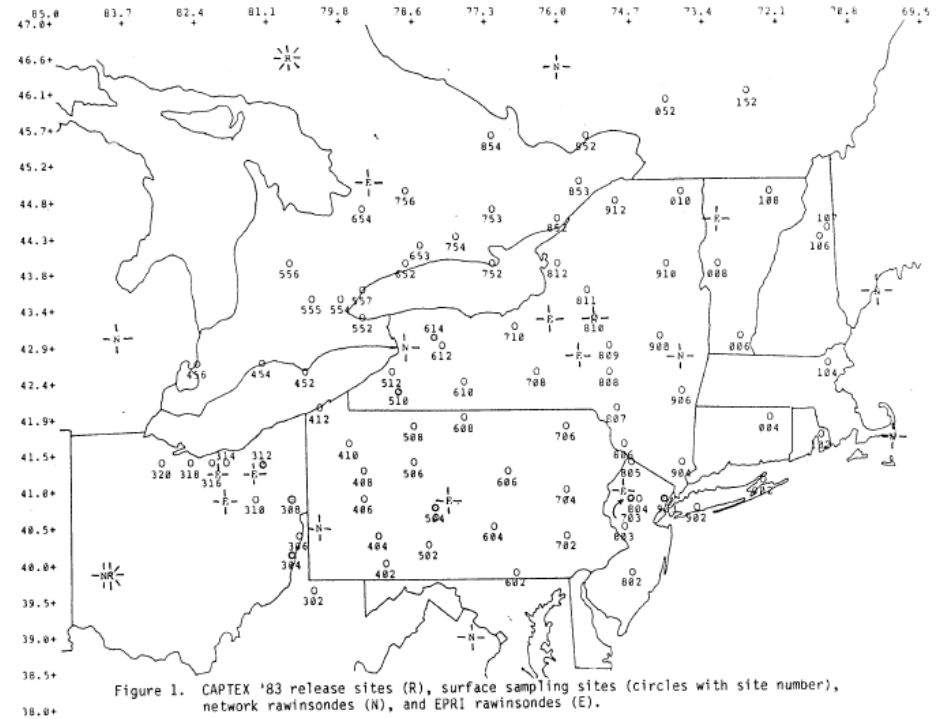
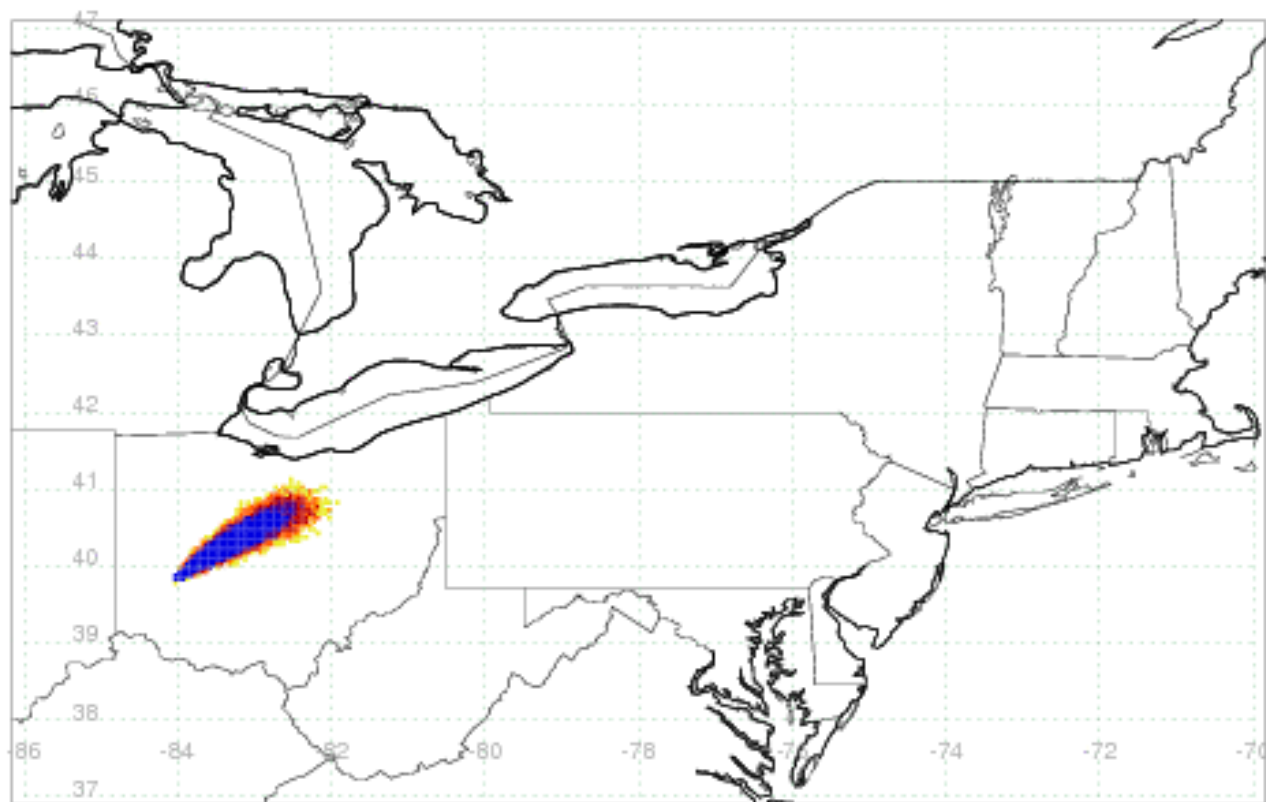


Figure 1. CAPTEX '83 release sites (R), surface sampling sites (circles with site number), network rawinsondes (N), and EPRI rawinsondes (E).



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Maximum value = 4.67×10^5 pg / m³



Statistical evaluation

- Same ranking system used by Hegarty et al. (2013)
- Ranges from 0 – 4, consists of 4 parameters
 - Correlation coefficient (R)
 - Fractional bias (FB)
 - Figure of merit in space (FMS)
 - Kolmogorov-Smirnov parameter (KSP)

$$\text{Rank} = R^2 + 1 - |\text{FB}/2| + \text{FMS}/100 + (1 + \text{KSP}/100)$$



Meteorological data

- ECMWF

- ERA-Interim Reanalysis
- ~80km resolution
- 60 vertical levels
- 3 hourly output

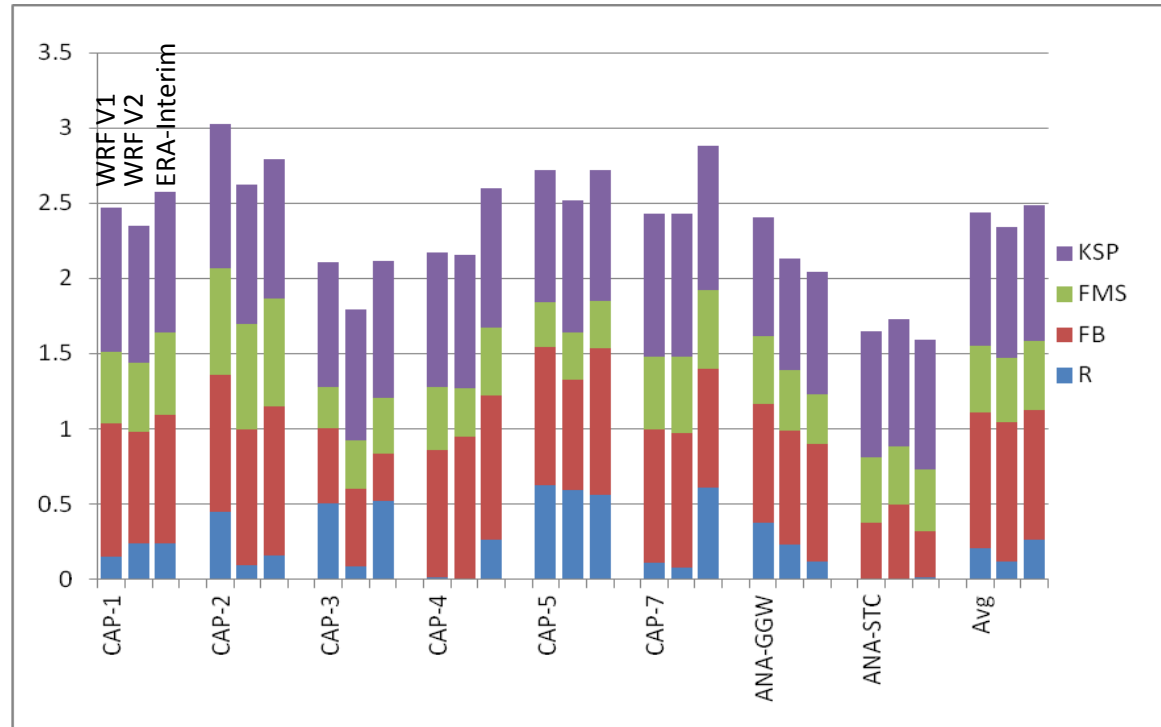
- WRF

- Advanced Research version (ARW)
- 10km and 30km resolution
- 43 vertical levels
- Boundary conditions from NARR
- Wind nudging on and off
- 3 hourly output



NAME with ECMWF and WRF

Experiment	WRF V1	WRF V2	ERA-Interim
CAPTEX-1	2.47	2.35	2.58
CAPTEX-2	3.02	2.63	2.79
CAPTEX-3	2.11	1.79	2.12
CAPTEX-4	2.17	2.15	2.60
CAPTEX-5	2.73	2.51	2.72
CAPTEX-7	2.43	2.43	2.89
ANATEX-GGW	2.40	2.12	2.04
ANATEX-STC	1.65	1.73	1.59
Avg	2.37	2.21	2.42

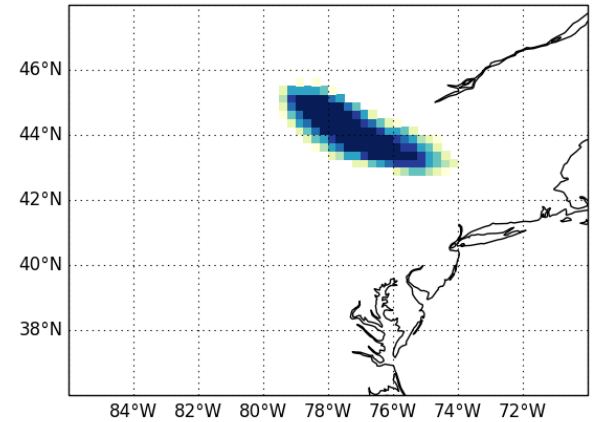




CAPTEX 5

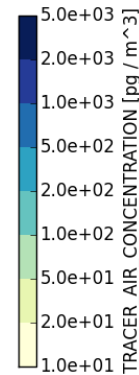
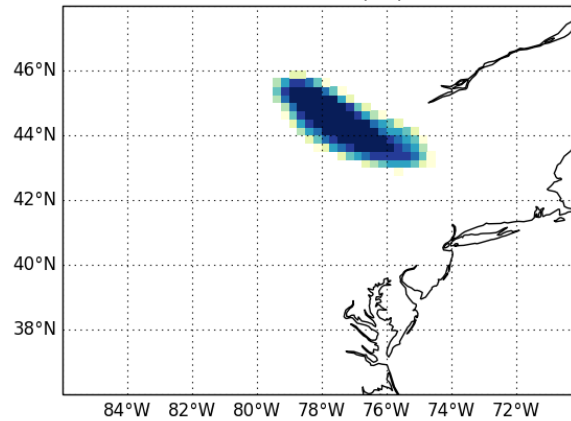
ECMWF

Valid at 21:00 26/10/1983



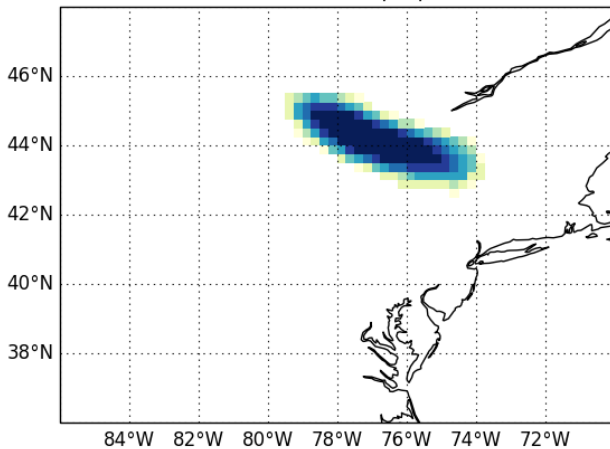
WRF V2

Valid at 21:00 26/10/1983



WRF V1

Valid at 21:00 26/10/1983

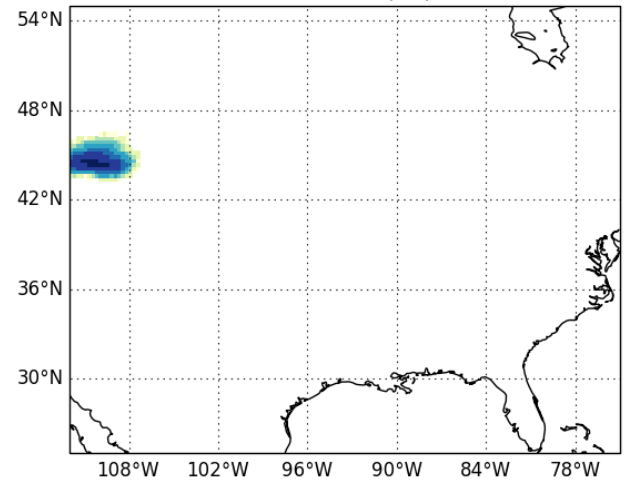




ANATEX-GGW

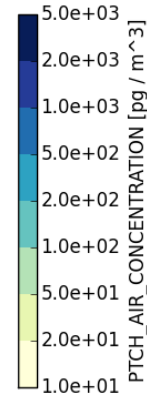
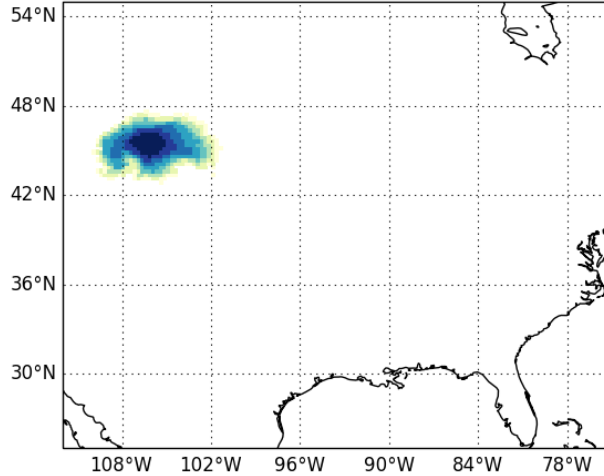
ECMWF

Valid at 14:00 07/01/1987



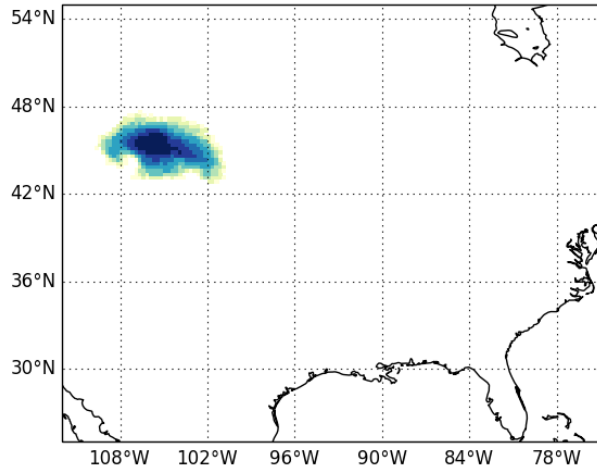
WRF V2

Valid at 14:00 07/01/1987



WRF V1

Valid at 14:00 07/01/1987

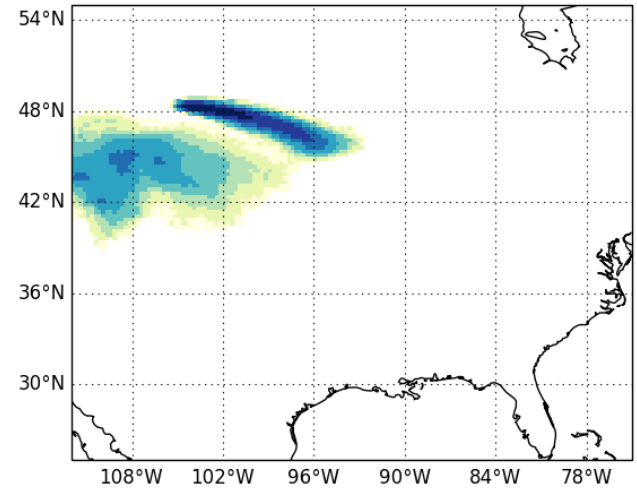




ANATEX-GGW

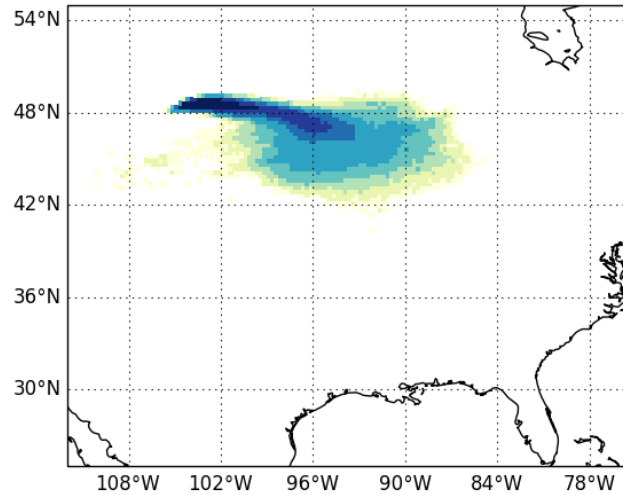
ECMWF

Valid at 14:00 09/01/1987



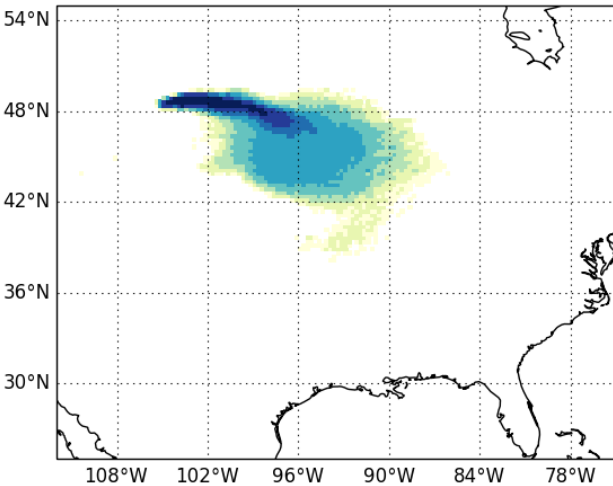
WRF V2

Valid at 14:00 09/01/1987



WRF V1

Valid at 14:00 09/01/1987





Dispersion models

HYSPLIT

- Same horizontal grid as met
- Terrain following vertical coordinate
- Lat-long output

STILT

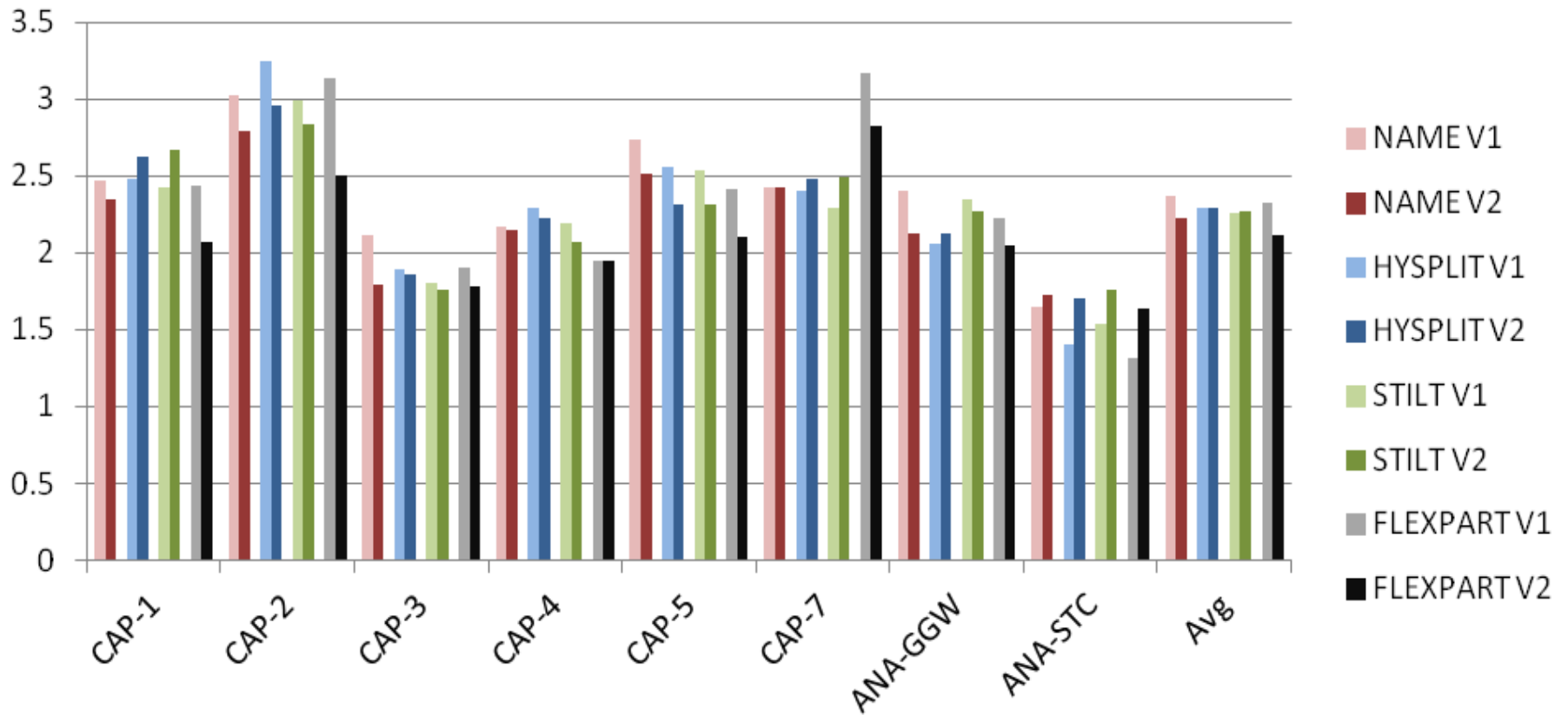
- Built upon HYSPLIT model
- Simulates turbulence differently

FLEXPART

- Modified to use WRF met
- Output on same grid as met



NAME, HYSPLIT, STILT and FLEXPART with WRF



CAPTEX 2

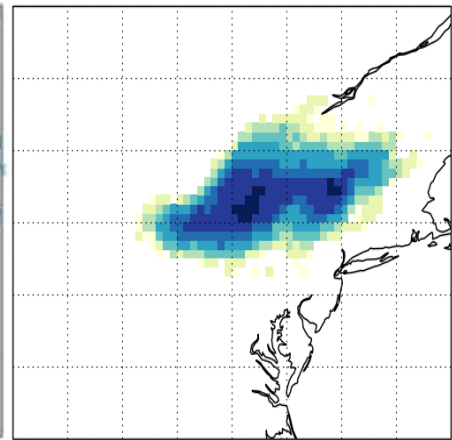
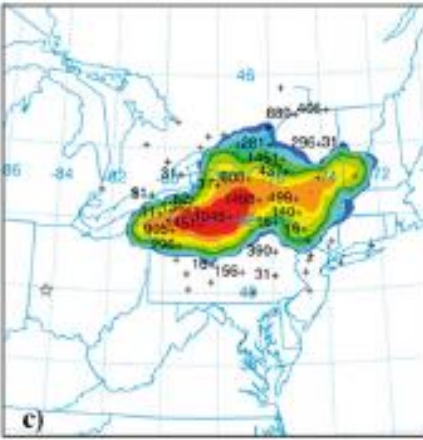
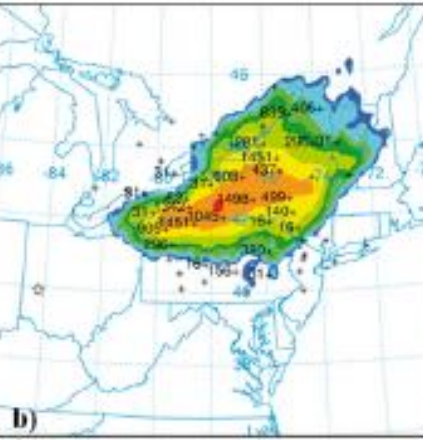
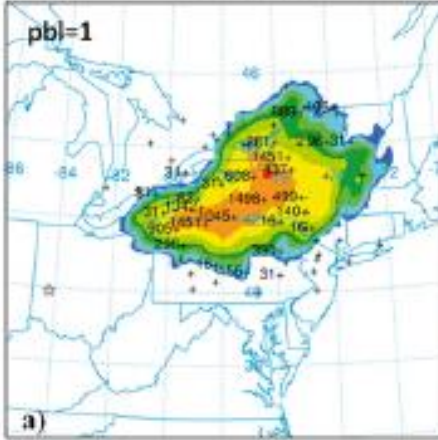
HYSPLIT

STILT

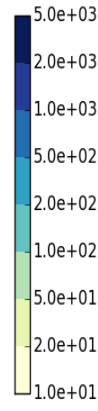
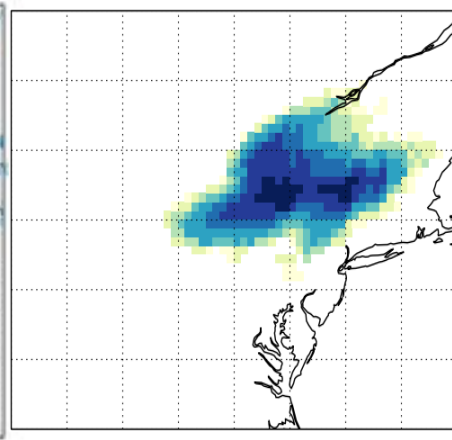
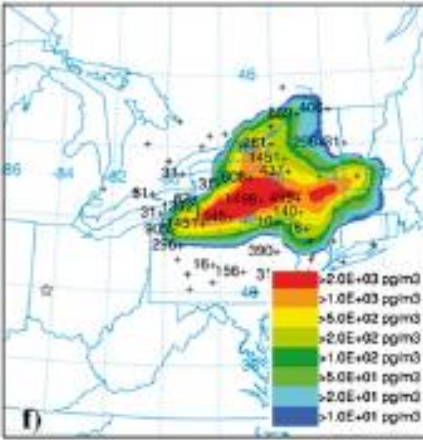
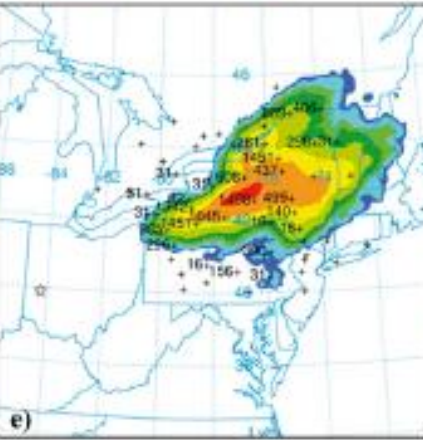
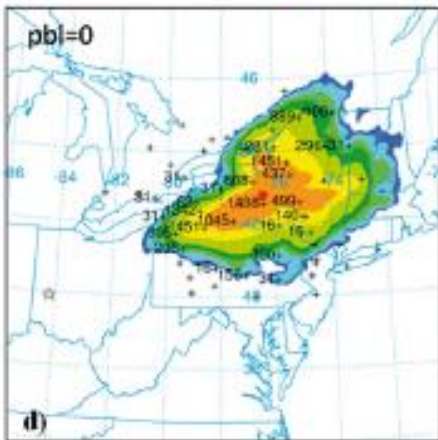
FLEXPART

NAME

pbl=1



pbl=0



Summary

- NAME driven by various meteorology show similar performance
- Some visual differences
- Different models driven by WRF show similar performance overall