



### Dispersion Uncertainty from Meteorological Sources

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#### Background & Motivation

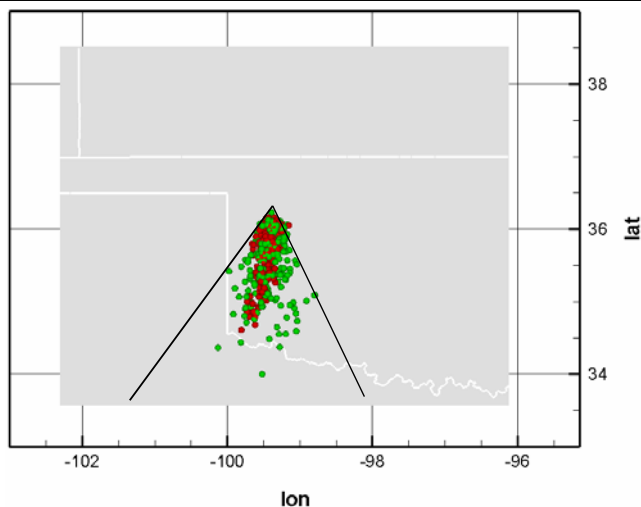
Numerical weather prediction (NWP) wind fields are often used as input to contemporary Atmospheric Transport & Dispersion models. The wind field from a single NWP run represents one member of an ensemble of possibilities. Members differ by imposed initial and boundary conditions and by underlying physics parameterizations. Ensemble uncertainty in the mean wind direction is a primary meteorological source of dispersion uncertainty.

To isolate the effects of wind direction uncertainty from other NWP sources, we contrive a meteorological ensemble from one NWP prediction, our base case, by imposing rotations in the 3-D wind field to emulate wind angle uncertainty. The prescribed variability is from a Gaussian distribution with  $\sigma=20^\circ$  from the base case.

A hypothetical release of  $C_7F_{14}$  is modeled for each ensemble member using SCIPUFF (a second-order closure, Lagrangian puff dispersion model). Statistics are collected for the ensemble of predicted contaminant plumes (dispersion uncertainty) and for the ensemble of wind fields (meteorological uncertainty). The relationship between the plume dispersion uncertainty and wind field uncertainty is studied. SCIPUFF and Lagrangian-particle dispersion model results are presented.

The NWP data represents 11 hours of an MM5 run with output every 15 minutes. The SCIPUFF run represents 6 hrs of a continuous point release using hourly meteorological data from 1700Z to 2300Z on 29 May 2002, centered on OK, KS & TX.

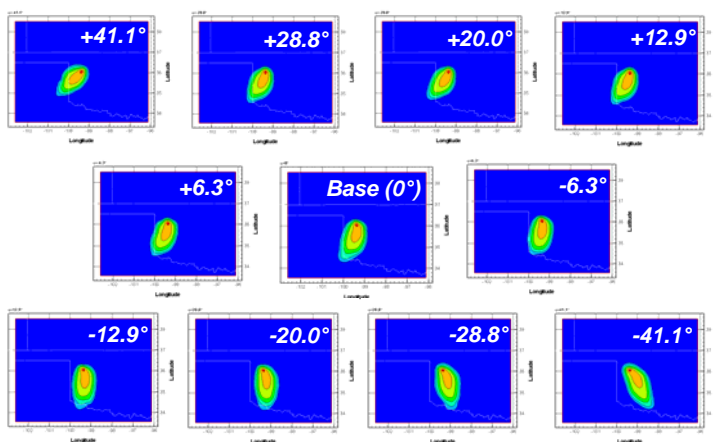
#### Lagrangian Particle Dispersion



Lagrangian particle dispersion using the average wind field **with** & **without** accommodations for wind direction uncertainty. The “without” dispersion aligns with the low-uncertainty core, while the “with” fills in the high-uncertainty fringes (see Plume Unc. figure).

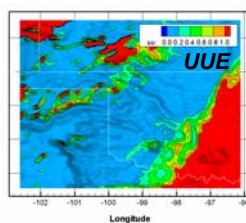
#### Ensemble Variability

##### SCIPUFF Ensemble-Member Contaminant Plumes

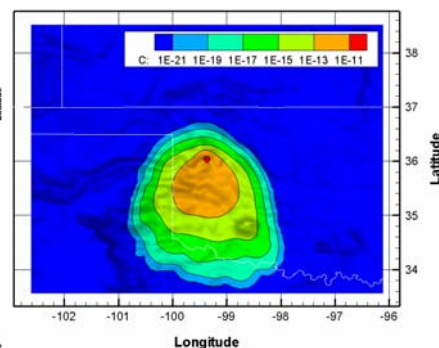


#### Ensemble Statistics (90 m AGL)

##### MM5 Wind Field Uncertainty



##### SCIPUFF Ensemble-Mean Plume



##### SCIPUFF Plume Uncertainty

