Using Optimal Interpolation to Assimilate AirNOW Surface Measurement and MODIS AOD into CMAQ for July 2011

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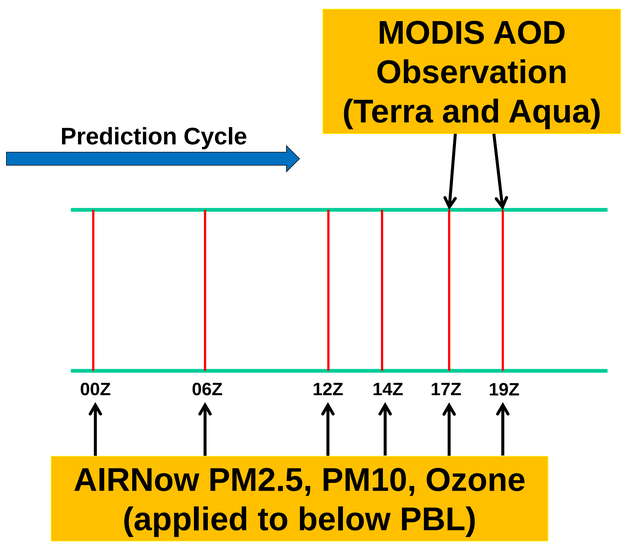


CMAQ base run setting (v5.0.2 cb05tucl_ae5)

- Driven by WRF-ARW 12km CONUS, 42 layers up to 50hPa
- 2008 anthropogenic emission inventory projected to 2011
- NOAA HMS (hazard mapping system) fire emission with Bluesky algorithm
- GOES cloud fraction adjustment provided by U. of Alabama at Huntsville
- RAQMS lateral boundary condition every 6 hours.

Cases of Studies	Assimilation Times	Settings of Uncertainties
OI1 (7x7 OI)	00z, 06Z, 12Z, 18Z for AIRNow data 18Z for MODIS AOD **(+/- one hour)**	0.6 for modeled aerosols 0.4 for modeled O_3
OI2 (7x7 OI)	00Z, 06Z, 12Z, 14Z, 17Z, 19Z for AIRNow 17Z and 19Z for MODIS **(+/- two hours)**	2.0 for modeled aerosols 0.4 for modeled O_3
OI3 (7x7 OI)	00Z, 06Z, 12Z, 14Z for AIRNow 17Z and 19Z for MODIS **(+/- two hours)**	dynamic uncertainties up to 5.0 for modeled PM2.5, and up to 0.6 for modeled O_3.
OI4 (11x11 OI)	00Z, 06Z, 12Z, 14Z, 17Z, 19Z for AIRNow 17Z and 19Z for MODIS**(+/- two hours)**	dynamic uncertainties up to 10.0 for modeled PM2.5, and up to 1.0 for modeled O_3.

Summary

- **The optimal interpolation (OI) assimilation combining AIRNow surface measurements and MODIS AOD (Terra and Aqua) yielded significantly better results than the base case, especially on reducing mean biases, and the OI technique is sensitive to its uncertainty setting.**
- **The assimilation relies on the temporally and spatially available measurement data, which is always limited.**
- **Some of our assumptions, such as the aerosol speciation ratios and vertical distribution, need to be further verified.**

Thank You for Your Attention

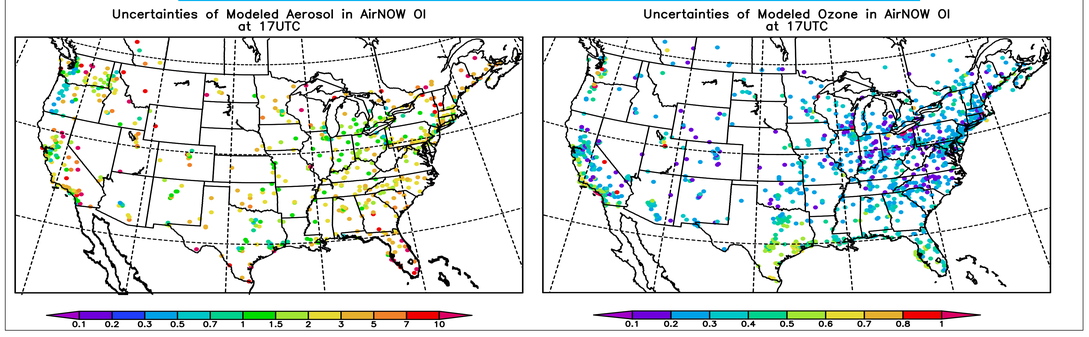
Hourly Statistic Results over CONUS
12Z, 07/06/2011- 12Z, 07/07/2011

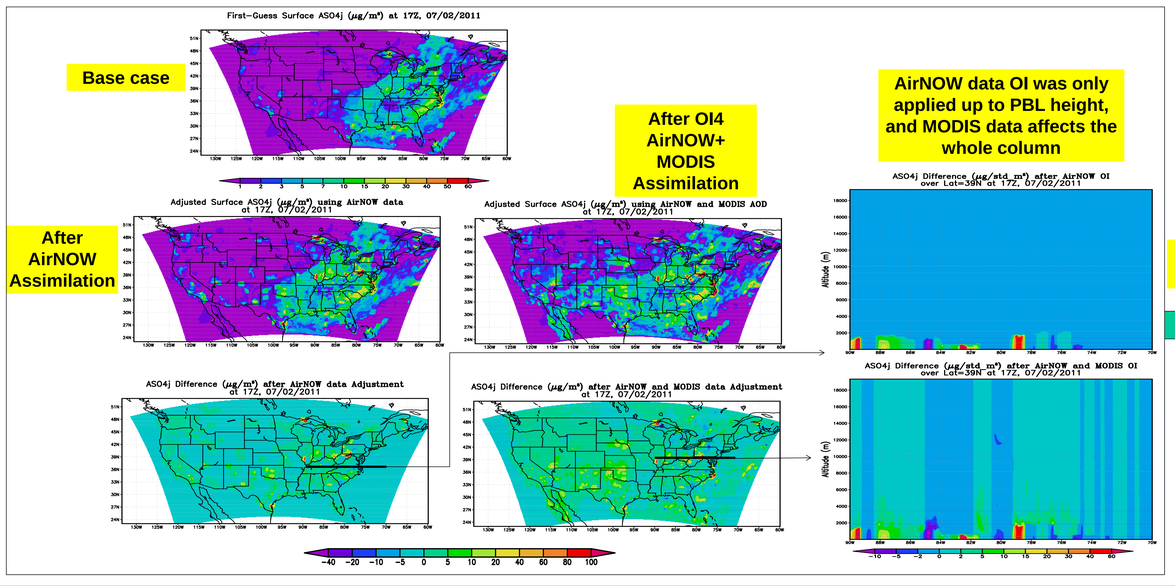
Cases of Studies	O_3 (ppbV)	PM2.5 (µg/m^3)
Base case	R=0.53 MB=2.54	R=0.23 MB= -7.14
OI1	R=0.56 MB=2.36	R=0.24 MB= -2.63
OI2	R=0.58 MB=1.06	R=0.39 MB= -1.33
OI3	R=0.52 MB=2.08	R=0.36 MB= -1.89
OI4	R=0.56 MB=1.55	R=0.40 MB= -0.11

Hourly Statistic Results over Southeast
12Z, 07/06/2011- 12Z, 07/07/2011

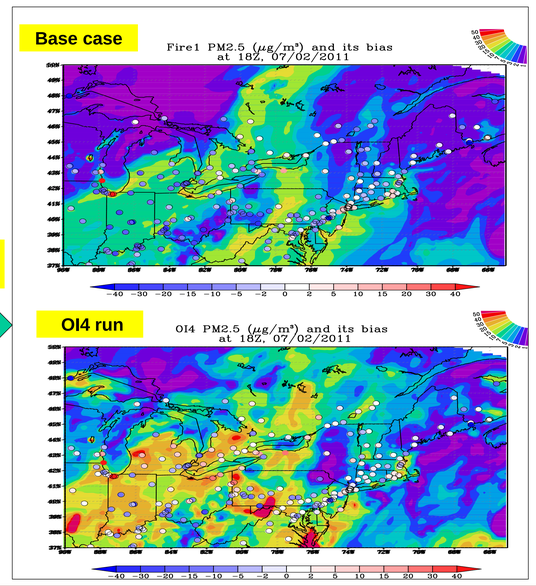
Cases of Studies	O_3 (ppbV)	PM2.5 (µg/m^3)
Base case	R=0.55 MB=0.22	R=0.10 MB= -9.90
OI1	R=0.58 MB=0.43	R=0.14 MB= -5.89
OI2	R=0.61 MB= -0.85	R=0.22 MB= -3.30
OI3	R=0.58 MB= -1.40	R=0.22 MB= -4.50
OI4	R=0.60 MB= -0.59	R=0.21 MB= -1.16

Time-dependent Assimilation Uncertainty Setting in the OI4 run





After 1 hour



The OI assimilation help reduce the PM2.5 daytime underprediction, but sometimes causes the nighttime overprediction. Its impact on ozone is not as significant as that on PM2.5 due to the relatively small ozone biases in the base case.