PACE MISSION APPLICATIONS – AIR QUALITY

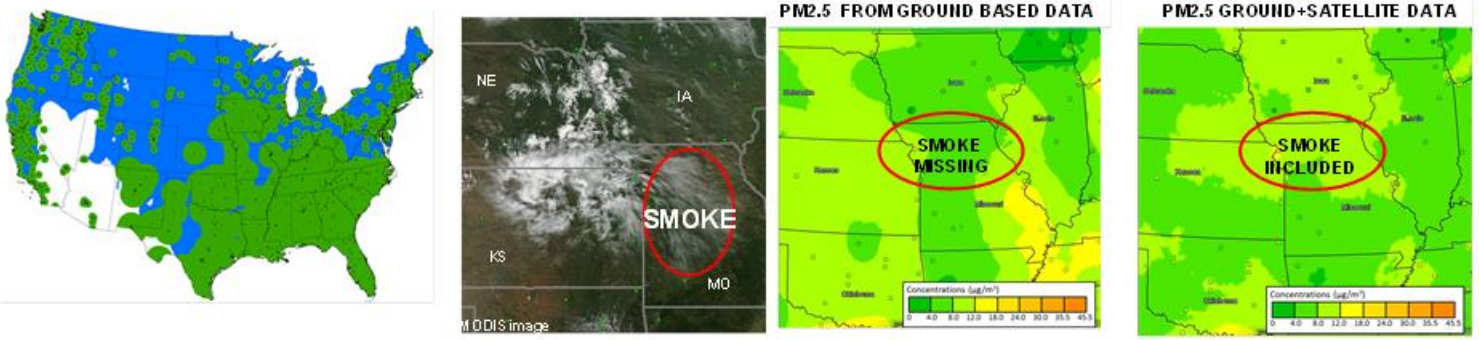

Figure 1. Ground monitors (denoted by small dots) for measuring the concentration of particulate material (PM). Without satellite data, the area of coverage would be limited only to the areas shaded green. The MODIS Satellite data is used to fill most of the gaps (but not all). The next columns show MODIS image of a typical air quality situation resulting from fires, the nominal solution (PM2.5 from ground based data), and NASA's contribution (PM2.5 from Ground + Satellite Data). In the nominal solution because the ground monitors in this region are very few, the interpolated PM2.5 data shows relatively good Air Quality (AQI of 0 – 4). The addition of satellite data shows that the Air Quality as a result of the fires is poorer at AQI = 4-8.0. Satellite data has real value in producing an Air Quality Index that actually protects the public from harm. If the satellite data were not there, there would be no indication of this poorer air quality (Images courtesy of the AirNow Group).

Application Question/Issue

What is the air quality forecast of particulate matter concentration (PM, an indication of the extent of air pollution) predicted from *satellite* measurements of the aerosol optical depth (AOD) in regions where there are no *ground* measurements of PM? Figure 1 is an illustration of such an application.

Who Cares and Why?

In regions where there are no ground measurements of PM, the EPA and the public has no indication of the extent of air pollution, a situation that has deleterious public health implications. Satellite measurements of AOD can be used to estimate PM in such areas. The Environmental Protection Agency (EPA) produces a daily air quality index (AQI) which comprises both the ozone and particulate matter concentrations. The latest surveys show 75 -80% of the public is aware of AQI and 50% report taking action based on the AQI.

Needed Measurement(s)

The accuracy of the daily (and forecast) AQI depends on the spatial resolution, latency and accuracy of the satellite-observed AOD and the validity of the relationship between column AOD and surface PM. To meet the needs of the public, the satellite measurements of AOD must be produced at spatial resolutions of one km or less at a latency not exceeding 6 hours and at an accuracy of ±0.05 in the visible wavelengths. The predicted PM using the column AOD and auxiliary measurements must have uncertainties comparable to the EPA's AirNow predictions.

The NASA Response

Based on current estimates, the PACE mission will produce AOD at an accuracy of ± 0.05 at a horizontal resolution of approximately 1 km. The availability of a PACE Polarimeter will significantly reduce reliance on ground-based measurements and enhance accuracy of the predicted PM. In the absence of a Polarimeter, PACE's measurements of AOD from the Ocean Color Instrument (OCI) will require additional capabilities such as ground-based lidars, sondes or models of trajectories and chemical transport models are to identify elevated layers. This is because PACE will measure whole column AOD and the air quality concern is only the layer closest to the surface. It is expected that the latency of the broadcast PACE data will be at least as good as that of the Land Atmosphere Near Real-Time Capability for EOS (LANCE) for MODIS AOD data.

Comments? Thoughts? For additional information about PACE mission applications or this particular application, please contact Ali H. Omar at ali.h.omar@nasa.gov