PACE MISSIONS APPLICATIONS- Air Quality

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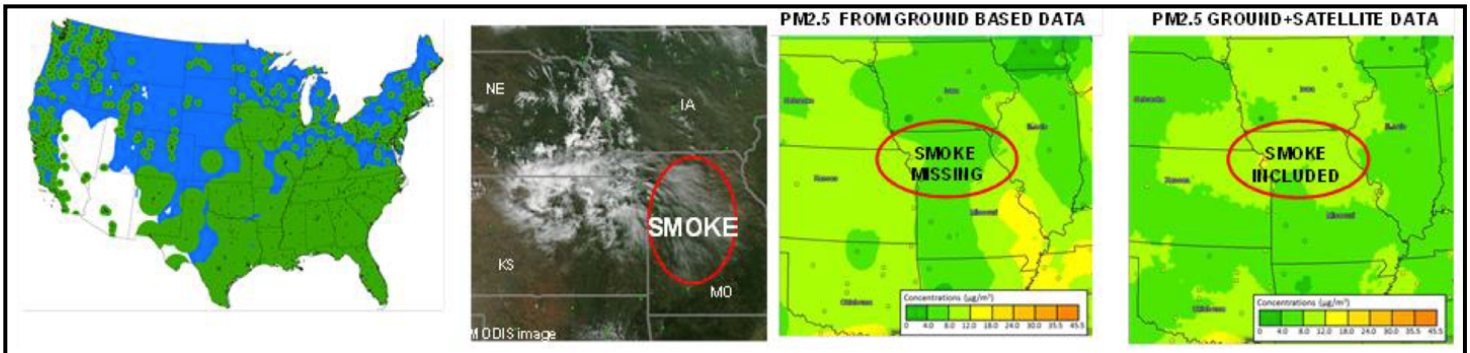

Figure 1. Ground monitors (denoted by small dots) for measuring the concentration of particulate material (PM). Without satellite data, the area of coverage would be limited only to areas shaded green. The MODIS satellite data is used to fill most of the gaps (but not all). The next columns show MODIS images of a typical area quality situations resulting from fires, the nominal solution (PM2.5 for 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 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 in 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 indications of this poorer air quality (Images courtesy of the AirNow Group).

Application Question/Issue

How do we monitor air quality in regions where there are no ground measurements of particulate matter concentration (PM)? PM is an indication of the extent of air pollution and can be predicted from satellite measurements of the aerosol optical depth (AOD). Figure 1 shows how satellite data can be used to monitor air quality in remote locations.

Who Cares and Why?

In regions without ground measurements of PM, the Environmental Protection Agency (EPA) and the public has no indication of the extent of air pollution. Without proper air quality advisories, public health can be put at serious risk. Satellite measurements of AOD can be used to estimate PM, which can then inform public air quality advisories. The EPA produces a daily air quality index (AQI) which relies on both ozone and particulate matter concentrations. Recent surveys show that 75-80% of the public are aware of the AQI and over 50% report taking action based on the index.

Needed Measurements

The accuracy of the daily AQI depends on the spatial resolution, latency, and accuracy of the satellite AOD measurements and on the validity of the relationship between column AOD and surface PM. To meet the needs of the community, the predicted surface PM must have uncertainties comparable to the EPA's AirNow predictions: an AOD within ±0.05. Satellite measurements of AOD must also be produced at high spatial resolutions with short data latency.

The NASA Response

PACE's two multi-angle polarimeters SPEXone and HARP-2 will enable AOD estimates at an accuracy of ±0.05, with a horizontal resolution of approximately 2.5 km and 3km at nadir, respectively. PACE's two polarimeters will compliment and significantly reduce reliance on ground-based measurements resulting in enhanced accuracy of the predicted PM. PACE's Ocean Color Instrument (OCI) may also be able to provide useful estimates of AOD in tandem with additional capabilities such as ground-based lidars, dropsondes, or models of trajectories and chemical transport. This is because PACE will measure whole column AOD and the air quality concern is only the layer closest to the surface. PACE's polarimeters and OCI will be able to provide a direct societal benefit via their AOD estimation capabilities.

Comments? Thoughts?

For additional information about PACE mission applications or this particular application, please contact PACE Applications Team at:
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