Rapid update of anthropogenic NOx emissions with fused satellite and ground observations: Initial application for NOAA ozone forecasting during the summer 2016

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Abstract:

Time lag inherent in emission inventory updates remains a major obstacle for accurately forecasting ozone and fine particulate matter ($PM_{2.5}$). In addition, emission projections sometimes fail to reflect rapid emission changes caused by unexpected socioeconomic events (e.g., economic recession). To reduce the uncertainty imposed by emission time lag, emission data assimilation capability is being developed and tested for rapid updates of NOx emissions using the NOAA National Air Quality Forecast Capability (NAQFC) test bed system. Since 2012, NOx emissions in NAQFC operations have been adjusted by using the Cross-State Air Pollution Rule (CSAPR) emission projection factors.

Comparisons of the NAQFC NO_x emission trends against Air Quality System (AQS) ground observations and the ozone monitoring instrument (OMI) remote sensing data showed that the CSAPR projection is consistent with the observed NO_x trend, but at a slower reduction rate (-3.6%/yr vs -5.0% from OMI and -5.3% from AQS), due in part to the unaccounted impact of the 2008 economic recession. A data fusion algorithm was designed to utilize temporal trends from both ground and satellite observations (OMI, GOME2, and potentially OMPS) to obtain "realistic" changes in NO_x emissions. Currently NAQFC is exploring several approaches, including state-level and grid-level adjustments, and will evaluate the effectiveness of these approaches by comparing O_3 forecasts against ground O_3 observations over time and space.