AQAST Investigator Project, 2012-2013

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Project duration: June 1, 2012 – May 31, 2013

Title: Derivation of point-source emission estimates from satellite retrievals

Problem to be solved: Is it possible to use satellite retrievals of NO2 and SO2 to estimate the emissions of NOx and SO2 from point sources with reasonable accuracy and, if so, under what conditions? Could the operation of large newly-built power plants be detected from the monthly variations of NO2 satellite retrievals?

Project description: Over the past year we have investigated the interannual variations of NO2 satellite retrievals over thermal power plants of China (for the period 2005–2007) and India (for the period 1996–2010) from the perspectives of both unit-based, power-plant emission inventories and chemical transport model simulations (with GEOS-Chem). Due to the dramatic increase of NOx emissions from thermal power plants, high growth rates of NO2 columns were observed from both multiple spaceborne instruments and the model simulations in China and India. Good agreement was found between satellite NO2 retrievals and NOx emissions (or modeled NO2 columns), especially over areas dominated by power-plant emissions. In the coming year, we will focus on previously identified areas that are dominated by power plants and study the relationships among NOx emissions, satellite NO2 columns, and/or modeled NO2 columns on a monthly basis. A monthly, unit-based emission inventory for the thermal power sector of India will be developed for the first time, and we will see whether satellite instruments have the capability to trace the operation of large power plants at high temporal resolution. We will also add to this regional coverage Southeast Asia, where we are tasked to identify major point-source regions under the NASA SEAC4RS campaign to be implemented in summer 2012. What is learned from SEAC4RS campaign measurements, modeling results, satellite retrievals, and emission estimates will be integrated with the China and India regions to give a comprehensive Asian perspective. Possible extensions to SO2 will also be investigated.

Deliverables:

- A journal article reporting the results of monthly comparison between NOx emissions and NO2 satellite retrievals over selected large power plants in India.
- An overview of two years of results for the Asian region with implications for the U.S.

Expected AQ management outcomes:

- The results will have benefits for AQ managers to cross-check power plant emissions (or operation) from spaceborne observations. If additional emission regulations were to be implemented in the future, AQ managers would also be able to monitor the actual operation of emission control devices. Both domestic and international EPA activities will benefit.