Title: Inverse modeling of NOx emissions over Texas using OMI NO2 data

Problem to be solved: Sophisticated techniques have been introduced in recent years for the application of satellite data to the inverse modeling of emissions. However, these techniques are rarely applied in regulatory photochemical modeling at the state or regional level. Regulatory emissions inventories often lack lightning and aircraft emissions and underestimate soil NOx emissions. This can lead to spatial discrepancies between observed and modeled NO2, especially over rural regions.

Project description: We will build upon our recently submitted paper that demonstrated an application of Discrete Kalman Filter inverse modeling with OMI NO2 data to scale emissions of NOx in Texas. Whereas the previous application relied upon the vertical profile and air mass factors from the OMI Standard Product, we are working with Lok Lamsal to adjust those profiles based on the CAMx regional photochemical modeling. We are also working with source-specific emission data provided by TCEQ so that emissions can be scaled on a sector basis rather than solely based on region. In separate but related work, we are continuing to test an initial implementation of a new soil NOx scheme into the CMAQ photochemical model and quantify its impacts in a multi-month simulation. It is hoped that related Tiger Team work will enable us to expand this implementation to include dynamic year-specific fertilizer data and other features and to test its results relative to OMI NO2 data. This will be valuable to future inverse modeling efforts by providing better characterization of emissions in rural regions. As data become available from the NASA DISCOVER-AQ Houston 2013 field campaign, we will prepare to conduct photochemical modeling of those episodes.

Deliverables:
- Publication describing the approach of adjusting the OMI NO2 data based on vertical profiles in the regional photochemical model, and presenting results of the inverse modeling.
- An initial implementation of the soil NOx scheme will be shared with CMAQ developers.

Expected AQ management outcomes:
- Better understanding of the strengths and limitations of using OMI-based inverse modeling of NO2 to adjust emissions inventories used in regulatory attainment modeling.