**Assimilation, Surface Flux Estimation, and Error Analysis of Atmospheric CO2 Observations from Space Using a Comprehensive Modeling System**

NASA

2009-2012

We propose to analyze GOSAT/Tanso data using a combination of existing models of CO2 exchanges due to hourly photosynthesis and respiration (Baker et al, 2008), daily air-sea gas exchange (Doney et al, 2009), biomass burning (GFED, Randerson et al, 2007), Fossil Fuel Emissions (Gurney et al, 2009), and atmospheric transport (PCTM, Kawa et al, 2004). This comprehensive system allows direct comparison to the observed record of both in-situ and remotely sensed atmospheric CO2 at hourly timescales. We have previously demonstrated that a lower-resolution version of the system has good skill at replicating diurnal, synoptic, and seasonal variations over vegetated land surfaces (Parazoo et al, 2008). The analysis system will be operated on a 0.5° x 0.67° grid (∆x ~ 50 km), providing global mesoscale coverage. The system is driven by meteorological output from the NASA Goddard EOS Data Assimilation System, version 5. Surface weather from the system drives calculations of terrestrial ecosystem metabolism (radiation, precipitation, humidity, temperature) and air-sea gas exchange (wind), with other input data coming from satellite data products (e.g., fPAR and LAI from MODIS, and ocean color from SeaWiFS and MODIS).

The result will be estimates of time-varying surface sources and sinks of CO2 that are optimized with respect to in-situ flask and continuous CO2 observations, TCCON data, GOSAT/Tanso retrievals, MODIS data, emissions inventories, and mechanistic models. We will use the modeling and analysis system (1) as a “smart interpolator” of non-satellite CO2 observations that can be used to estimate systematic errors in GOSAT retrievals; (2) to map and interpret sources and sinks; (3) to quantify the effect of systematic errors in spectroscopic retrievals on source/sink estaimates; and (4) to establish detection criteria for fossil fuel emissions.

Full Proposal

Final Report

Publications

Students