Integration of satellite imagery and emissions data into ClearSky for enhanced modeling of agricultural burning and decision-maker support.

REU Mentors: Joe Vaughan and Brian Lamb

Project Description:

There are several sources for satellite data that potentially have relevance to agricultural burning and applicability to the ClearSky system (described below). In addition, there are relevant burning data available in the WRAP (Western Regional Air Partnership) Fire Emissions Tracking System (FETS).

This project will review the sources of satellite data and emissions data acquire and utilize selected imagery and/or data, hopefully involving at least one satellite product, for processing to enhance our treatment of agricultural burns in the ClearSky system.

The ClearSky system (Jain *et al.*, 2007) provides dispersion modeling support to regional air quality managers with decision-making responsibilities such as permitting or advising related to burning of crop residue on agricultural fields.

ClearSky:

- does model dispersion of smoke from scenarios describing field burning,
- does not treat forest prescribed burning or forest wildfires,
- may be expanded soon to treat orchard burning,
- could be adapted for application for rangeland wildfires,
- has no standard re-application for accomplished burns.

Some possible data/imagery sources:

Imagery from MODIS, GOES and other satellites has been used for mapping of satellite-detected fires in the NOAA Hazard Mapping System (http://www.firedetect.noaa.gov/viewer.htm).

Fire reports from a variety of agencies are archived in the WRAP (Western Regional Air Partnership) Fire Emissions Tracking System, where emissions estimates are also calculated (http://www.wrapfets.org/index.cfm).

Plume imagery is (potentially) captured over the region by the once daily over flights of the MISR (multi-angle imaging spectrometer) instrument on the Terra satellite (http://www-misr.jpl.nasa.gov/index.html).

Plume height and aerosol density data may also be available from the CALIPSO lidar instrument (http://www-calipso.larc.nasa.gov/).

The *objective* is improvement of the ClearSky system and associated information available to support decisions around agricultural burning in the Inland Northwest region of Washington and Idaho.

An Overview of the ClearSky System in Spring 2009:

Agricultural field burning is a common post-harvest activity, both in the farming of Kentucky Bluegrass for grass seed and in wheat farming. Consequently, many thousands of acres of agricultural fields are burned in northern Idaho and eastern Washington each year. Local burn managers, operating under various state and tribal jurisdictions, permit field burning when predicted meteorology suggests both safe burning and adequate dispersion of smoke. In spite of this precaution, smoke plumes sometimes affect population centers, constituting both a health hazard and a public nuisance. Networks of air-quality monitoring instruments for particulate matter (PM), operated by the various jurisdictions, capture data on such occurrences of smoky conditions. The ClearSky system provides air quality managers (those permitting or advising on field burning) with results of smoke dispersion model simulations. ClearSky simulates scenarios of field burning using user-defined scenario during overnight computer code runs, using current numerical weather forecasts, to provide daily plume dispersion simulations on burn days. In May 2009, a rapid-response gaming version of the ClearSky system is being developed for use later in 2009.

ClearSky is implemented in Perl and shell scripting, using numerous FORTRAN codes, including the CALPUFF puff plume dispersion modeling code (http://en.wikipedia.org/wiki/CALPUFF) and operating on large binary data files In a linux computing environment. Visualization for animation of simulation results is accomplished using PAVE (http://www.ie.unc.edu/cempd/EDSS/pave_doc) and posted to the web for user access.