Improvement of forest fire smoke plume rise models using satellite data

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Background and objectives

Historically, fire smoke plume rise have been treated using Briggs plume rise equations, which were originally designed to be applied to bent-over-plumes originating from a discreet point, a smokestack. More detailed models developed specifically for forest fires account for factors important in forest fires, including particle entrainment, detrainment, and large eddies. However, these models require input parameters (e.g., number of fire cores) that make them currently impractical for use in operational smoke forecast systems that must cover large geographic areas.

A data set of plume rise data for the contiguous USA has been produced using the MISR Interactive Explorer (MINX) from NASA's MISR (Multi-angle Imaging SpectroRadiometer) instrument, aboard the TERRA satellite.

In this project, you will use data from NASA's MISR, which makes use of a nine-camera configuration to resolve the height of different geographic and atmospheric features, to improve the performance of plume rise models used in the BLUESKY modeling framework, which is used by regional air quality managers throughout the USA.

Tools used:

The student will be working in a Linux environment, using the IDL (Interactive Data Language) to compare data from the MINX dataset and results from the plume rise models used in BLUESKY . The IDL language is similar to MATLAB, but is much more powerful. While IDL can be an extremely powerful tool (and is commonly used in atmospheric science, particularly in the modeling community, as well as by researchers in other fields), the tasks in this project will allow you to become familiar and comfortable with adapting and writing relatively simple IDL codes. Tutorials at the beginning of the session will allow you to begin navigating the Linux environment.

Approach and specific tasks:

1) The student will compare plume heights from the MINX database to two different implementations of the BLUESKY framework. In particular, the student will test what geographic, meteorological, and fire factors most affect the accuracy of the plume rise models.
2) The student will work with the supervisor to make changes to plume-rise models based on the findings from (1).
3) The student will make a poster presenting their findings at the end of the program.