Background Story

Years of scientists have been working for almost a decade with state, local, regional and federal air quality regulations and scientists on several projects that have been focused on introducing satellite data of biomass burning emissions within the United States National Emissions Inventory (NEI).

Initially, the NEI was based strictly on ground-based information that often used data aggregated from previous years reported at the county level, and completely ignored the spatial domain of all fires. This method resulted in gross underestimates; however it was an organized system and the users and organizations were largely comfortable. Although its limitations were recognized, improvements were viewed as too costly. One key task was to convince regulatory managers and users of the value of that could be added by infusing satellite data to enhance the NEI.

Certainly, there were individuals that understood the value of using satellite data, but they needed support to convince the establishment of the immediate, cost-effective value of merging publically available satellite data to the NEI. It was essential to present arguments, as well as requested verification and validation statistics provided in the format that most suited the objectives of application organizations.

This process incorporated knowledge of state-of-the-art satellite data, algorithms and science; a working knowledge of the users’ applications and requirements; interacting with individuals with a variety of skill levels, and goals; and perhaps most importantly, listening to the goals and responsibilities of the user community and fully communicating.

Improvements include:

- Enhancement in the accuracy and precision of the inventory.
- The ability to estimate emissions on an annual basis, as opposed to every 3 years.
- A substantial decrease in the amount of time required to generate the NEI.
- The ability to geographically represent data as they move through space and time.
- The inclusion features that had been previously missed in inventories.
- Fires that were previously reported at the county level can now be geographically located.

Implications:

- Improved science: States, regions and the EPA have an improved understanding of the scale and distribution of the combustion of biomass burning to the NEI.
- Improved accuracy: Saving an estimated $1,000,000 per year on focused inventories.
- Improved air quality modeling: More accurate air quality data results in more accurate air quality modeling.
- Improved federal and state air quality strategies: An enhanced NEI leads to improved strategies for attainment of the National Ambient Air Quality Standards (NAAQS).
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Potential Next Steps:

- Improve the mass quantities and transport of emissions using additional satellite data (i.e. injection height - CALIOP).
- Improve the tools state use to evaluate the impacts of biomass burning on monitoring data under the Exceptional Events Rule (EER). These exceptional events may include certain types of biomass burning (e.g., wildfires). Although remote sensing techniques can be used to quantify these events, an integrated framework for utilizing them is lacking. States also need to be able to model near-real time and/or ambient air quality concentrations and transport, as well as have the ability to link these estimates concentrations and emissions with available ground-based monitoring data across time and space.
- Leveraging to Carbon: There is a real opportunity to generate the best national biomass burning emissions dataset possible, one that could also be used for balancing the carbon budget and aspects of climate change.

The ultimate goal is to improve Air Quality, Visibility and Human Health.

Success

Today, the Environmental Protection Agency and several state and regional organizations are using satellite data to estimate biomass burning emissions at daily and annual scales for a number of critical environmental management and policy applications and to develop regional strategy for attainment of the National Ambient Air Quality Standards (NAAQS). We continue to work at the local, state and national level to improve the biomass burning pattern of our nation’s NEI at the core of the applications’ ‘largest cost-effective unknowns and uncertainties’ and for “best available science and data.”

Here, we present a diagram of the completed evolution of a successful project, which includes the basic science on which the development is built and the success of the use of satellite data within the applications and user communities.

This successful application of NASA satellite data was built on a firm scientific basis and patience, taking the time necessary to understand the customer’s process and demonstrating the enhancement gained with satellite data.