Wildfire Inputs to Regional Air Quality Remote Spatial-Temporal Measures for Improved Inventory Assessments [07-2-1-60]

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Introduction:

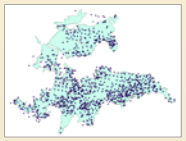
Providing accurate information on regional smoke concentrations is essential to burn permitting and air shed management. Calculating the quantity and spread of these emissions is further highlighted by the 2006 revisions to the National Ambient Air Quality Standards (NAQQS) that lowered the 24-hour PM2.5 standard from 65 μg m^{-3} to 35 μg m^{-3}. This change combined with the Healthy Forest Initiative and fuel management targets require land managers to reduce fuels on a scale never before achieved. The BlueSky system was developed by the U.S. Forest Service to estimate wildfire emissions for dispersion modeling purposes. Recently, this system has been upgraded with a module called SMARTFIRE to incorporate both ground-based fire reports and MODIS (Moderate Resolution Imaging Spectroradiometer) satellite data. This combination potentially results in an improved estimate of the fire location and size as a basis for estimating emissions within a new BLUESKY framework.

MODIS sensor data, collected onboard two satellites, provide data that can be used to estimate FRP (Fire Radiative Power) which past studies have developed empirical relationships with smoke production (Ichoku and Kaufman, *IEEE Geosci. Remote*, 43,11, 2636-2649, 2005). In this project, MODIS FRP data are used with these relationships to provide an independent evaluation of current wildfire emission estimates and to assess the feasibility of the FRP approach for providing emissions for regional air quality modeling. This study estimated smoke emissions for selected fires in Regions 1 and 6 and compared both the BLUESKY/SMARTFIRE pathway. and the MODIS FRP emissions.

Methods and Results:

For each of our selected fires (10 total, 4 reported here), all MODIS active fire points within a 1-km buffer of each fire perimeter where selected. The FRP points within each daily progression perimeter (derived from Landsat/NIFC records) was then integrated over the area burned per day and that value used in the MODIS smoke empirical relationships. As multiple MODIS pixels are present within a daily fire perimeter, the total FRP per day was calculated as:

$$FRP = \frac{\sum FRP}{\sum \text{pixel area}} \times \text{New Burn Area}$$



The area under this curve is called the Fire Radiative Energy (FRE). This is the value that is used to estimate PM 2.5 emissions. A conversion factor between FRE and PM 2.5 has been found for several different fuel types (Freeborn et al 2008, JGR: doi:10.1029/2007JD008679). The conversion factor for the Pacific Northwest are ~0.018 to 0.066 kg/MJ; for this project, we take 0.04 kg/MJ as an average. Simply multiplying the FRE each day by this factor will produce daily PM 2.5 emissions in kg/day. Independently, our SMARTFIRE collaborators calculated emissions for the same fires and our team compared the results.

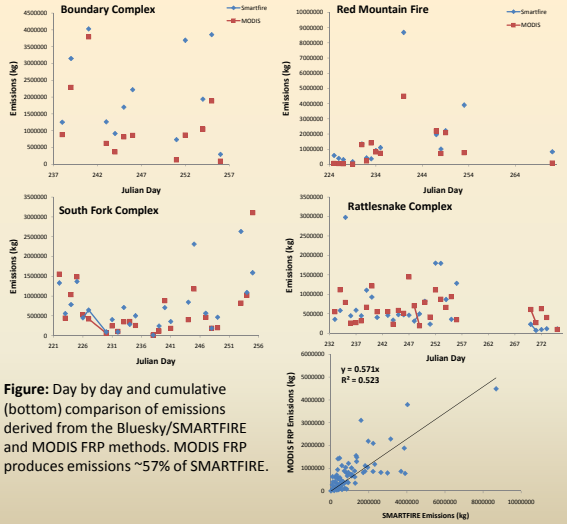
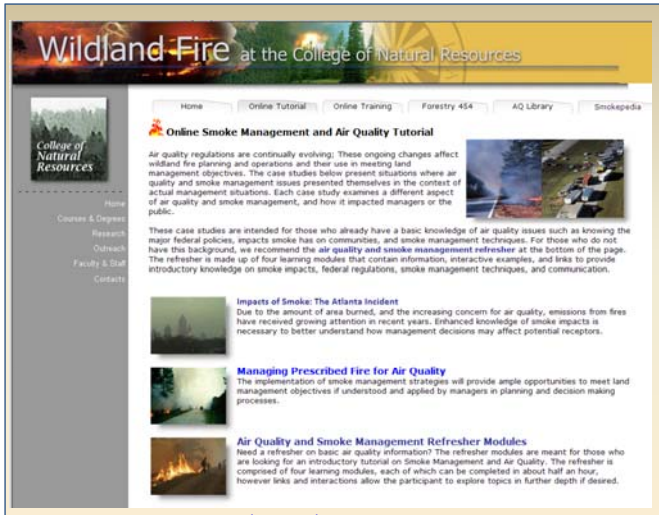


Figure: Day by day and cumulative (bottom) comparison of emissions derived from the Bluesky/SMARTFIRE and MODIS FRP methods. MODIS FRP produces emissions ~57% of SMARTFIRE.



Website: www.cnr.uidaho.edu/wildfire/fact.htm

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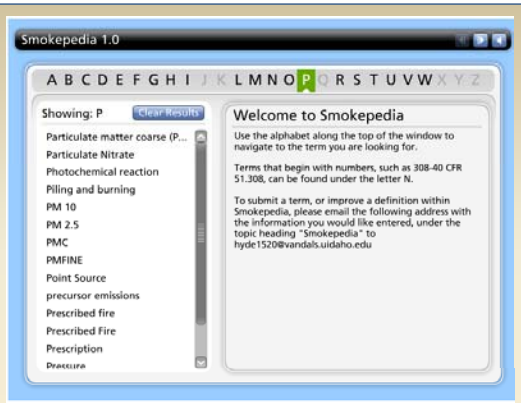
Furthering Air Quality and Smoke Management Trainings

Alongside the National Wildfire Coordinating Group's (NWCG) Smoke Committee (SmoC) we have developed a range of educational materials to help further the knowledge of air quality and smoke management:

- Online tutorials are designed for members of the fire community who are seeking an overview of air quality impacts and their affect on wildland fire management.
- Smokepedia is an online interactive glossary of smoke management terms
- AQ Library contains links to several air quality guides and web sites
- Online training directed at agency fire personnel responsible for coordinating and collaborating with air quality regulatory agencies at the state level.

The online training is a two month program during which participants will view presentations from smoke management and air quality experts from multiple agencies, as well as interact with each other in an online environment. The training is composed of both a series of online presentations and online discussions with other participants. The presentations are from smoke management and air quality experts from multiple agencies who spoke at two ***Effective Communication for Smoke Management in a Changing Air Quality Environment*** Workshops that we organized in 2008 and 2009 . Presentations include basics on air quality regulations and impacts, multiple perspectives on smoke and air quality, negotiating and networking, and smoke management plans and approaches. The goal of this training is to give fire staff a better understanding of how wildland fire smoke fits into the evolving air quality regulatory environment, and how to collaborate at the state and local level to address regulations and implementation in their region.



What Are We Doing Now?

Assessment of NWCG Courses and Positions for Smoke and Air Quality Content, Training Requirements and Material Delivery

Alongside the NWCG Smoke Committee (SmoC) we are currently reviewing air quality and smoke requirements in wildfire and Rx fire positions. We are also reviewing all NWCG courses where smoke and air quality are included. The goal is to identify gaps in what different positions are supposed to know about smoke and air quality and whether they are getting the correct trainings.