6.3 ***BLUESKY-RAINS*** – A WEB-BASED INFORMATION SYSTEM TO HELP MANAGE PRESCRIBED AGRICULTURAL AND FORESTRY BURNING

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1. INTRODUCTION

Air quality impacts from prescribed agricultural and forestry burning, wildfires, and other sources of burning are suspected of posing a threat to human and environmental health. Our understanding of the magnitude of the problem and potential remedies is limited by the incomplete information available on source characteristics and emission levels, pollutant dispersion, population exposure levels to key pollutants, and the resulting human health impacts. Although some burning sources fall under the purview of compulsory or voluntary smoke and other management programs in certain political jurisdictions, air quality impacts respect no political boundaries. While some management programs have a presence on the Internet, the spatial extent, content, and functionality of their websites are limited. This situation impedes operational and strategic decision-making and the ability of affected communities to develop a coherent perspective on the impacts they have experienced, are experiencing, and will experience.

To assist the USDA Forest Service (USFS) and EPA Region 10 in addressing this issue, Pacific Northwest National Laboratory (PNNL) is designing and implementing the ***BlueSky-RAINS*** information system (Figure 1).

Figure 1. The ***BlueSky-RAINS*** Homepage

2. SYSTEM FEATURES

Major products of ***BlueSky-RAINS*** are:

- Graphical and tabular information on the source characteristics and emissions for prescribed burns
- Graphical displays of forecasts of meteorological data. The data are from the University of Washington's nightly mesoscale (MM5) model run.
- Graphical displays of trajectory plots for smoke plumes from prescribed burns and other non-burn locations. Also, displays of backward trajectory plots for air parcels passing over selected receptor locations.
- Links to regional National Weather Service forecast offices and other websites that provide information related to agricultural and forestry burning.

The system provides information for burns conducted yesterday and scheduled to be conducted today and tomorrow. Information is provided on active burns, forecast meteorological conditions, and trajectories every three hours (beginning at 1:00 AM PST) on each study day. Temporal, spatial, and thematic navigational tools are available to move around the system.

Source characteristics and emissions data for prescribed burns are obtained by ***BlueSky-RAINS*** from the USFS. The USFS acquires this data using its FASTRACS burn system and other sources of information. Burn data includes the date, start time, duration, location, and type of burn. Emissions data are provided for particulate matter (PM), PM_{10}, $PM_{2.5}$, carbon dioxide, carbon monoxide, methane, and total non-methane hydrocarbons.

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Graphical displays of forecasts of meteorological data are generated from data files from the University of Washington's nightly MM5 v3.4 model run[1]. Automated processes copy the data files to the ***BlueSky-RAINS*** server and process these data for display and modeling applications. The MM5 data files cover the period from model initialization out to 60 hours into the future. The MM5 data used by ***BlueSky-RAINS*** has a 12-km grid resolution and covers the states of Washington, Oregon, Idaho, and western Montana. Northern portions of California, Nevada, and Utah as well as the southern portion of British Columbia are also included in the modeling domain. Vertically, MM5 offers data at 38 pressure levels. The parameters that are available for graphical display in ***BlueSky-RAINS*** are winds at the surface, winds at 40-m above ground level, winds at 200-m above ground level, relative humidity, mixed layer height, and ventilation index. Figure 2 presents a sample display of MM5 data.

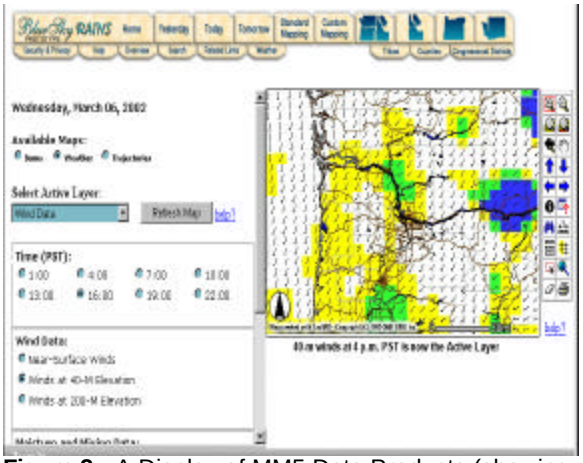

Figure 2. A Display of MM5 Data Products (showing forecasts of 40-m winds and ventilation index).

Graphical displays of trajectory plots for smoke plumes and backward plots of the trajectories of air parcels passing over key receptor locations are obtained using NOAA Air Resource Laboratory's HYSPLIT model[2]. The HYSPLIT model has been configured to use MM5 input data (system processors reformat MM5 data into a HYSPLIT-compatible format). Forward trajectories can extend out beyond 48 hours into the future. Forward trajectories are computed for releases from prescribed burn sites (as shown in Figure 3) and from ~110 default burn locations that are situated across the study domain. Backward trajectories are computed from a similar number of receptor locations.

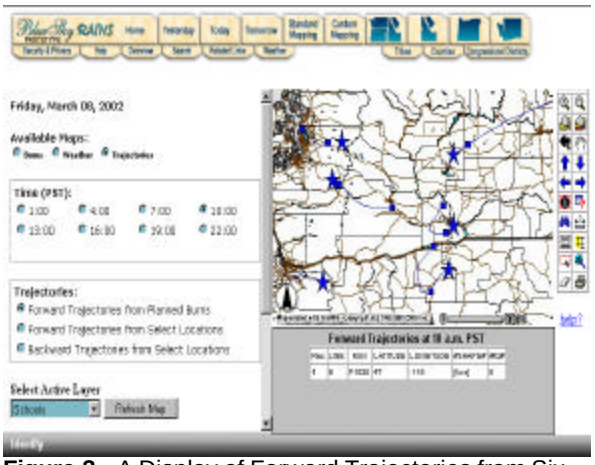

Figure 3. A Display of Forward Trajectories from Six Burn Sites (indicated by the blue stars)

Detailed "help" functionality is provided in the system to assist the user in using the website and interpreting its products. The help feature includes a glossary of terms, a site search engine, and descriptions of the key display products.

BlueSky-RAINS employs custom mapping capabilities using ArcIMS graphical software[3]. This system allows users to overlay various geographic information system layers (e.g., county boundaries, major roadways, major waterways, schools) over data displays and to zoom in or out of display images to focus on areas of concern.

3. FUTURE DEVELOPMENT

Our development team will work with users of ***BlueSky-RAINS*** this burning season to implement immediate improvements in the website's functionality and to plan future upgrades. Among likely upgrades are speeding up the display of graphical products (a valuable feature for those users with "slow" communication lines) and providing more historical burn data (e.g., data from any prior day during the current burning season). Plans are in place to incorporate air quality modeling into the system before the beginning of the 2003 burning season. The CALMET/CALPUFF modeling system is the leading candidate for use in generating air quality estimates within ***BlueSky-RAINS***.

A long-range goal for ***BlueSky-RAINS*** is to provide users an interactive modeling capability so that they can estimate the potential air quality impacts from their own prescribed burns. This could further assist burn managers in optimizing the design and schedule of their burns to minimize air quality impacts to sensitive populations.

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[1] Information about the UW's MM5 modeling program is available at http://www.atmos.washington.edu/mm5rt/info.html

[2] Information about the HYSPLIT model is available at http://www.arl.noaa.gov/ss/models/hysplit.html

[3] Information on ArcIMS is available at http://www.esri.com/software/arcims/index.html