

Expansion of the ClearSky Smoke Forecast System for Management of Agricultural Biomass Burning in Washington

To improve Ecology's capability to make burn/no-burn decisions related to agricultural field burning and orchard tear-out pile burning, we propose to expand the ClearSky smoke forecast system to include all of Eastern Washington. The ClearSky system was developed with support of the Idaho DEQ and applied for the Fall 2002 burn season to aid smoke management for grass field burning in Northern Idaho. The system employs daily MM5 forecasts with 4-km horizontal grid spacing to drive the CALMET/CALPUFF modeling pair. The University of Washington (UW) currently operates MM5 twice daily to make weather forecasts for the Pacific Northwest. In ClearSky, the early morning MM5 forecast is used as input to CALMET, a diagnostic wind field model, and the results are used to drive the CALPUFF dispersion model. In the Idaho DEQ implementation of ClearSky, during the afternoon prior to a potential burn day, burn managers use a web-based form to choose potential fields to burn for the following day. Multiple burn scenarios—high acreage to low acreage—can be chosen for a given area. These burn scenarios are then automatically input into CALPUFF and the resulting smoke plume animations are available over the web by 0800 the next morning. The modeling domain for ClearSky is based upon a relatively large gridded 4-km domain, shown in Figure 1, however the CALPUFF dispersion results for the Idaho burn areas are shown in smaller, locally focused windows (see the box in Figure 1).

The Washington Department of Ecology has developed a web-based field burn database used as part of the daily burn decision process. In the expansion of ClearSky to include Washington, work will be required to exploit the Department of Ecology field-burning database to drive the ClearSky mechanism for generating burn scenarios for each region of interest in Eastern Washington. New windows for CALPUFF output on the web will be designed in consultation with Ecology, to balance the competing needs of scope and specificity. Web-application screens for burn scenario construction will be easy to use if they support selection from relatively small sets of spatially clustered fields, whereas animations of CALPUFF results may best be viewed in windows showing larger geographical areas. Further work is also needed to take advantage of data in the burn database related to field conditions and the estimation of PM_{2.5} emissions and plume rise.

Work Plan

Our approach to applying the ClearSky system to Washington will be to enhance existing functionality while adding pathways that offer Washington-specific application windows. These enhancements will take advantage of the detailed Ecology burn database to specify field locations and field conditions. A unique pathway will be developed to treat orchard tear-out pile burns. Treatment of orchard burns will be addressed after the expansion has been completed for field burning in Eastern Washington. The design of the expanded ClearSky system will still provide for ways to submit burn scenarios for each designated area of interest within Washington as well as within Idaho. Thus we will need to complete several specific tasks:

- 1) Design and implement methods for using the Ecology web-accessed burning database to support specification of burn scenarios for each burn day within Washington.

- 2) Revise the current default emission and plume rise parameters used in CALPUFF to take advantage of additional information on field type and field conditions contained in the Ecology database. This revision will also take advantage of current analyses comparing ClearSky predictions with observed PM_{2.5} data from the 2002 fall burn season in Idaho.
- 3) Identify appropriate administrative geographic areas of interest in consultation with Ecology to guide development of web products for burn-scenario generation and viewing of animated model output.
- 4) Incorporate real-time acquisition of Washington PM monitoring data and show PM_{2.5} monitoring data and ClearSky predictions as time series for each monitoring site on the day after each forecast. This automated evaluation process already exists as part of the original AIRPACT forecast system for Puget Sound.
- 5) Work with Ecology staff to implement the system and to evaluate the system once it is operational.
- 6) Provide daily maintenance as needed to assure reliable forecast operations throughout the spring and fall burn seasons.

The expanded ClearSky system will be operated on a daily basis during the 2003 spring and fall burn seasons. We expect that the system can be operational, at least in a test phase, in time for the spring burn season. The results from daily runs will be archived; available PM monitoring data will be compiled. The model results and observations will provide a basis for a thorough analysis of model performance following each burn season. This analysis will be initiated during the spring and continue beyond the burn season.

Project Schedule

The initial expansion and testing of ClearSky for Washington applications is proposed as a six-month study beginning January 1, 2003. The modeling system will be developed during January and February with the objective of a March 1 implementation date. The forecast system will be operated continuously during the spring and fall burn seasons. A final report will be prepared at the conclusion of the project.

MM5-CALMET Elevations

for ClearSky
4-km Cell Spacing

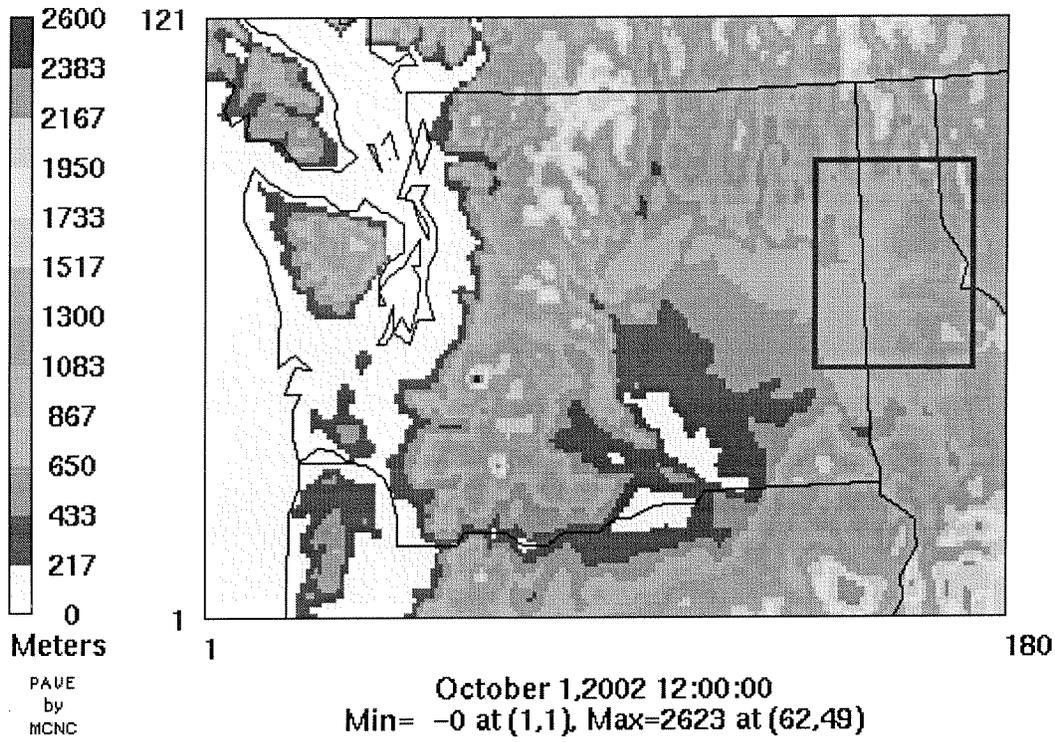


Figure 1. Terrain elevation in the Pacific Northwest domain for automated MM5/CALMET/CALPUFF forecast operations.

