PRELIMINARY EVALUATION OF A MODELING SYSTEM FOR PREDICTING THE AIR QUALITY IMPACTS OF PRESCRIBED BURNS

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BACKGROUND

Prescribed burning (PB) is an effective and economical way of maintaining and improving the ecosystem, reducing wildfire risk, and improving training realism at DoD facilities. However, pollutants emitted from the fires may be transported long distances, mix with emissions from other sources, and contribute to air quality problems in downwind urban areas. Compliance with ambient air quality standards may require tougher restrictions on DoD’s air emissions in the future. Since the alternatives of PB are costly, it is important for DoD to be able to control the emissions from its PB operations and to minimize their air quality impacts.

OBJECTIVES

A modeling system is being developed to predict the impacts of prescribed burns on regional air quality. The objectives of this system are to better characterize the emissions from the fires, to accurately simulate the dispersion of the smoke plumes, and to increase the resolution of regional-scale models so that the impacts of PB emissions can be discerned from other pollution sources in the region.

APPROACH

The modeling system will be evaluated with field measurements and refined as necessary. There will be several cycles of evaluation including comparisons with new field measurements.

The initial modeling system consists of WRF/RFMMS for meteorology, CMAQ for chemistry and transport, and Daysmoke model for PB plume dynamics.

Field Measurements

In April 2008, a preliminary field study was conducted at Fort Benning to collect data for model evaluation. Ground-based mobile units tried to cover 60-degree arc zones 1-3 km, 3-5 km, and 5-7 km downwind from the burn plots. Each unit measured PM2.5 and CO in real time, spending at least 30 minutes before moving to the next location according to wind shifts, measurement levels and road availability. In addition, plume sighting and digital photogrammetry was conducted from fire towers to measure the plume height and direction and the number of updraft cores.

RESULTS

In April 2008, southeasterly winds carried the PB plume to Columbus, GA presenting an opportunity to compare model predictions with observations of PM2.5 and O3 at the metropolitan airport. The impact of the plume can be seen in observations with a PM2.5 peak of 22 µg/m3 at 18:00 and an O3 peak of 54 ppb at 17:00.

Lessons learned from the field study and this evaluation will help us design a more intensive field campaign for the 2009 burning season. There will be several cycles of data collection and model evaluation during this project and the models will be revised and refined as necessary. This evaluation sets the floor for future evaluations. Our indicator of success will be improved agreement of model predictions with observations and measurements. The resulting modeling system is expected to help DoD land managers minimize the regional air quality impacts of their PB operations.