SHRMC-4S AS A FIRE AND AIR QUALITY MANAGEMENT TOOL FOR PRESCRIBED BURNING

Yongqiang Liu, Scott L. Goodrick, and Gary Achtemeier
Center for Forest Disturbance Science, USDA Forest Service, Athens, GA

William A. Jackson
National Forests in North Carolina, USDA Forest Service, Asheville, NC

ABSTRACT

Prescribed burning is an important forest management technique. However, prescribed burning can cause degradation of air quality. One of the worst environmental consequences of prescribed burning occurs when smoke plumes unexpectedly invade urban areas. One such event occurred in Atlanta, Georgia, on 28 February 2007. Preventing such incidents is one of the goals for prescribed burn planning. This study describes applications of a research tool for helping fire and air quality managers achieve this goal. This tool, the U.S. Forest Service Southern High-Resolution Modeling Consortium Southern Smoke Simulation System (SHRMC-4S), is a modeling and prediction system for regional smoke particle transport, dispersion, and air quality effects. SHRMC-4S is composed of a fire emission model for hourly fire productions, SMOKE for initial and boundary chemical conditions, CMAQ for chemical modeling, and MM5 for meteorological conditions. A dynamical-stochastic plume model, Daysmoke, is coupled with SMOKE to obtain plume rise and initial plume vertical profiles. Simulation was conducted with SHRMC-4S for the 2007 Georgia burn case. The invasion of a smoke plume into Atlanta was simulated. Experiments with various burning scenarios were conducted, including varied ignition times, burning durations, and locations. The simulated plume transport and particulate matter concentration agree well with measurements. The experiment results would help managers better plan the prescribed burn to avoid invasion of plumes into the urban areas.

Keywords: fire management, plume invasion, prescribed burn, SHRMC-4S, simulation.

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A SMOKE PLUME PATTERN OF 2007 GEORGIA/FLORIDA WILDFIRES RELATED TO ATMOSPHERIC CYCLONIC CIRCULATION OVER ATLANTIC OCEAN

Yongqiang Liu, Scott L. Goodrick, and Gary Achtemeier
Center for Forest Disturbance Science, USDA Forest Service, Athens, GA

ABSTRACT

Severe wildfires broke out in spring of 2007 in southern Georgia and northern Florida around the Okefenokee National Wildlife Refuge. More than 600,000 acres (approximately 243,000 ha) were burned. For about 2 months these fires released a large amount of particles and gases. Under certain wind patterns, the smoke pollutants would be transported to the areas with dense population and cause tremendous air quality effects. This study investigates a special spatial pattern of smoke plume during a period when a cyclonic atmospheric circulation system prevailed over the Atlantic Ocean. Atmospheric conditions, smoke pollutant transport and dispersion, and initial vertical profiles of smoke plume were simulated with a mesoscale meteorological model (MM5), a regional air quality model (CMAQ), and a plume rise model (Daysmoke), respectively. The simulated smoke plume pattern is primarily controlled by atmospheric circulation. The smoke plume first travels down to the far south of Florida, then turns east to the Atlantic Ocean where it turns north and west. This brings a portion of the smoke pollutants back to the burning location. This pattern is confirmed by satellite measurements. The knowledge about this pattern is of potential significance for understanding smoke–atmosphere interactions, which is important to prediction of regional air quality effects and weather processes.

Keywords: air pollutant, atmospheric circulation, GA/FL wildfire, smoke plume.

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