Developing a near real-time regional system for modeling air quality impacts of prescribed fire

16th Annual International Emissions Inventory Conference
Raleigh, North Carolina
Cast of characters

- US Forest Service
  - Scott Goodrick \textit{(emissions/visualization)}
  - Gary Achtemeier \textit{(plume modeling)}
  - Yongqiang Liu \textit{(CMAQ)}

- Florida Division of Forestry
  - Jim Brenner \textit{(fire activity data)}
Overview

- Background
- Florida Fire Management Information System (FMIS)
- Southern High Resolution Modeling Consortium (SHRMC)
- Southern Smoke Simulation System (4S)
- Future
Background

- 1998 Interim Air Quality Policy on Wildland and Prescribed Fire
- States urged to create a smoke management program
- Other issues such as regional haze have made smoke management plans even more important
Florida Fire Management Information System

- Integral component of Florida's SMP
- Manages almost all aspects of the Florida Division of Forestry's fire business
- Integrates GIS, Oracle database, numerical weather prediction (mm5) and a smoke screening system
Smoke Management

- Primary focus of smoke management directed toward public safety – smoke on the highway
FMIS Smoke Screening

- Prototype smoke screening tool used Vsmoke
- Eventually switched to a system combining HySplit trajectories with Vsmoke source strength model
- Focus on smoke concentrations (PM2.5) that would cause a visibility hazard
- Used for every prescribed fire authorized by the Florida Division of Forestry
Shift in Smoke Management Focus

- Air quality a growing concern as National Ambient Air Quality Standards (NAAQS) are tightened
- Allowable particulate matter emissions nearly cut in half
SHRMC

- One of 5 Fire Consortia for Advanced Modeling of Meteorology and Smoke (FCAMMS) funded by the National Fire Plan
- Focus on developing weather and smoke products to support fire operations
- Began producing operational products in 2002
Southern Smoke Simulation System

- Designed to assess prescribed fire impacts on air quality
- Conceptually similar to the BlueSky smoke modeling framework
- Use CMAQ to assess a wider range of air quality impacts than possible with BlueSky
Southern Smoke Simulation System

- Fire Data
- Emissions Calculation
- Weather Data (MM5)
- SMOKE
- CMAQ
- Visualization
Partnership

- Florida Division of Forestry has a need for air quality information
- SHRMC needs fire activity data
Fire Activity Data

- Location
- Date / Time
- Size
- Ignition Method
- Fuel Type / Load
- Fuel Moisture
Importance of Ignition Method

- Changes emission factors due to changes in combustion efficiency and variation in percent of fuel consumed during flaming or smoldering phase
- Impacts plume buoyancy and structure
Modeling Prescribed Fire Emissions

![Graph showing TSP concentration vs. downwind distance for backing and heading fires.](image_url)
Modeling Prescribed Fire Emissions

![Graph showing TSP concentration vs. downwind distance for different fire types.](image)

- **Back ing Fire**
- **Heading Fire-CL**
- **Heading Fire-NCL**
- **Total Head Fire**
Plume Modeling

Relative Emissions Production Model
CMAQ Forecasts

March 8, 2007 14:00:00
Min = 0.000 at (97, 25), Max = 51.144 at (71, 30)
CMAQ Forecasts

March 8, 2007 17:00:00
Min = 0.000 at (95,18), Max = 517.635 at (41,50)
CMAQ Forecasts

March 8, 2007 23:00:00
Min = 0.000 at (69,78), Max = 159.158 at (39,49)
Visualization
Future Plans

- Case Studies
- Implement system for Florida on daily basis
- Add other state's fire activity data (currently working with North Carolina)
Support for this project has been provided by

- National Fire Plan
- USDA Cooperative State Research, Education, and Extension Service (CSREES) Air Quality Program
- EPA

Burn information provided by Florida Division of Forestry