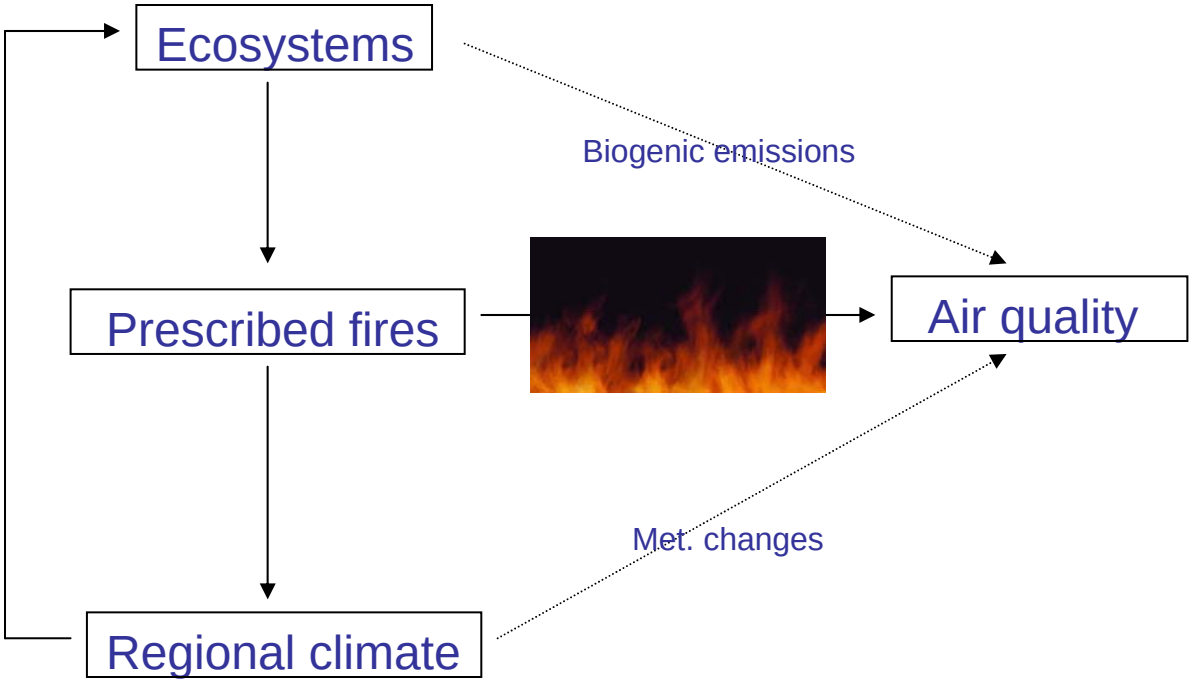
Interactions of ecosystems, fires, air quality and climate change in the Southeast

Tao Zeng, Yasuko Yoshida, Yuhang Wang (EAS, GIT)
Di Tian, Ted Russell (CEE, GIT)
Chi Zhang, Hanqin Tian (Auburn U.)
Yongqiang Liu (Forest Service)



Objectives

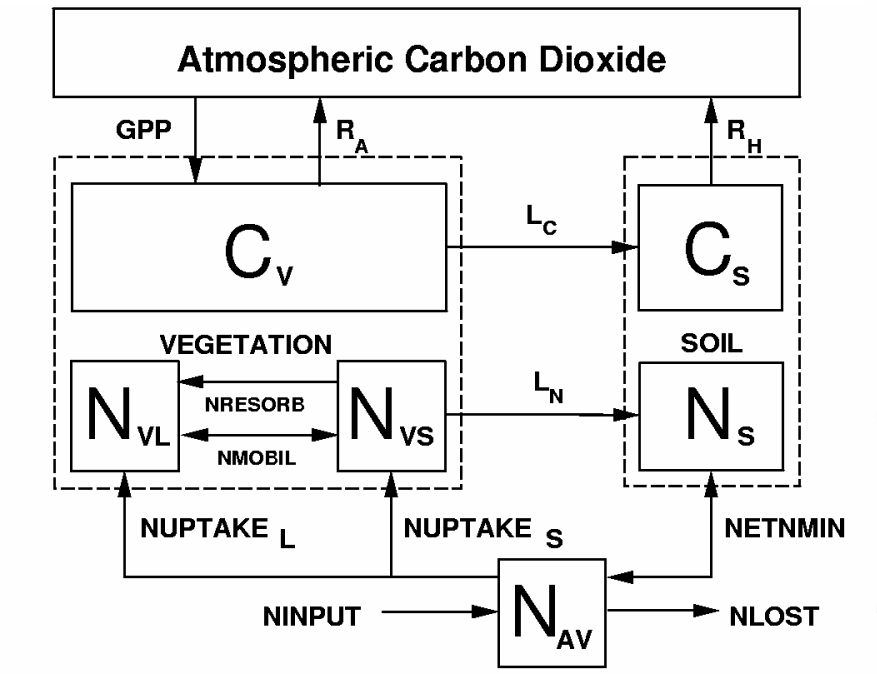
(1) Integrate process-based ecosystem, fire emissions, air quality, and regional climate models to systematically understand the complex interactions of these components in the Southeast in a climate change setting.

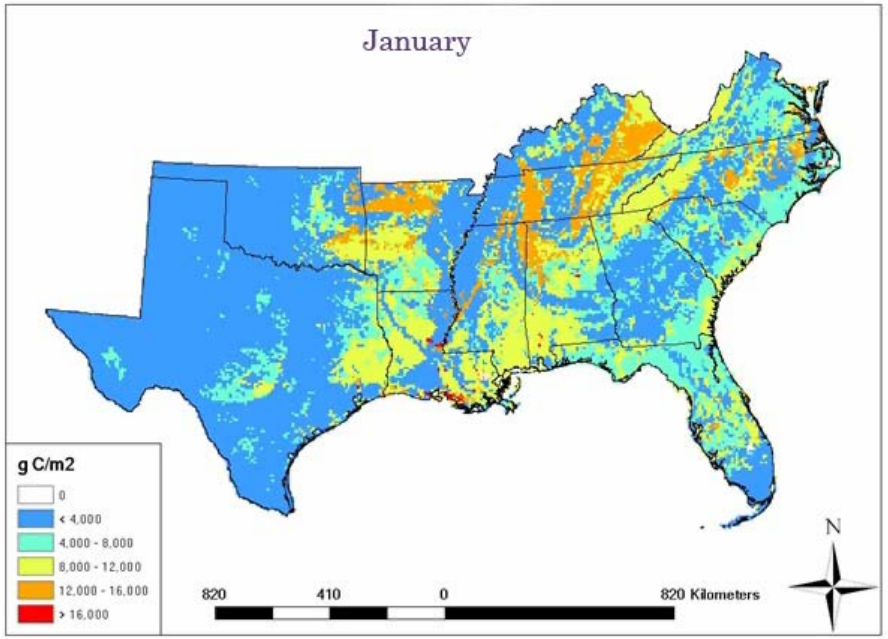
(2) Evaluate the integrated modeling system with ground and satellite observations for the present and understand better the effects of fire emissions on air quality in the Southeast.

(3) Propagate and calculate the sensitivities of the modeling system to major inputs, and to use those sensitivities to quantify uncertainties in the system results.

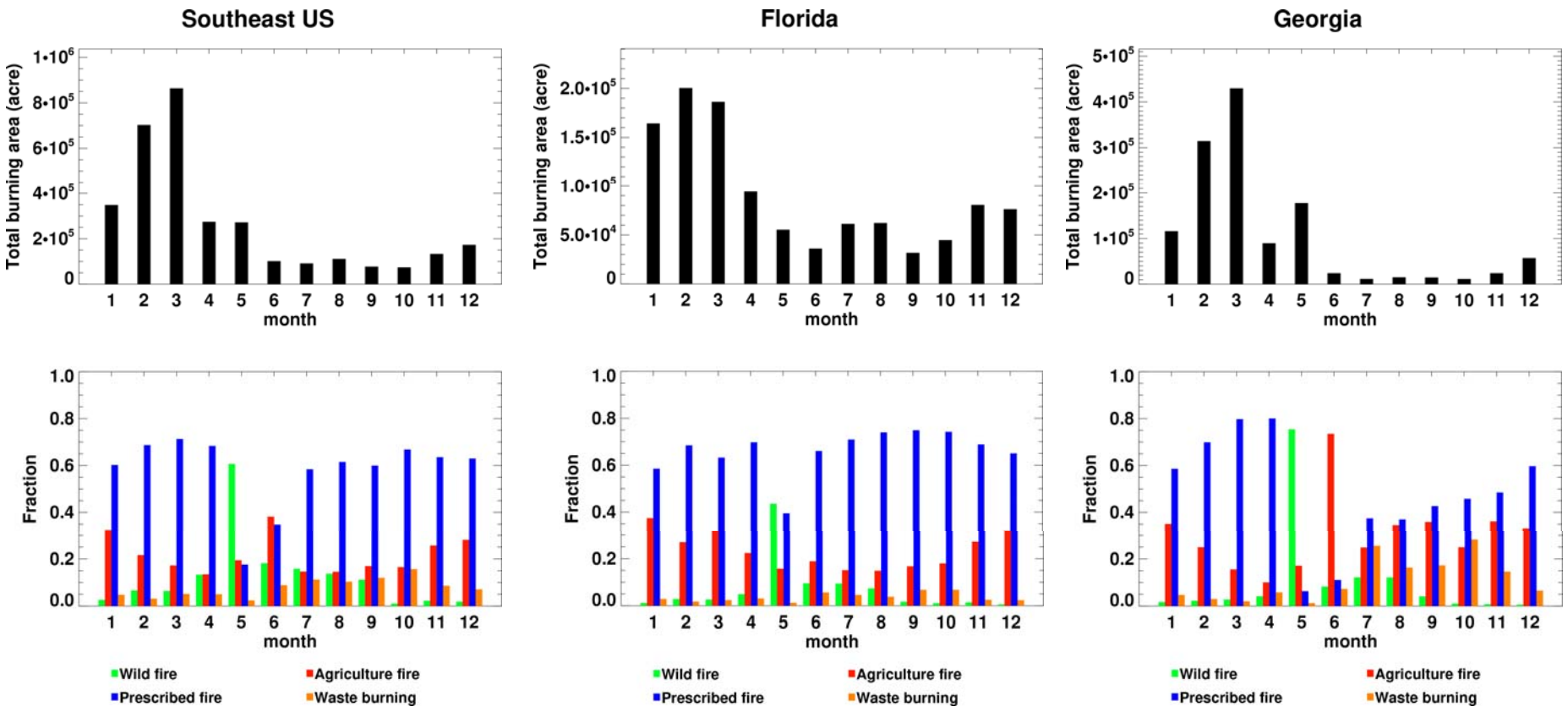
(4) Assess the impact of regional climate and land use changes and fire management on ecosystems and fire emissions and the consequent effects on air quality in the Southeast. Further, assess the impact of changing aerosol concentrations as a result of fire emissions and other sources on regional climate.

Dynamic Land Ecosystem Model



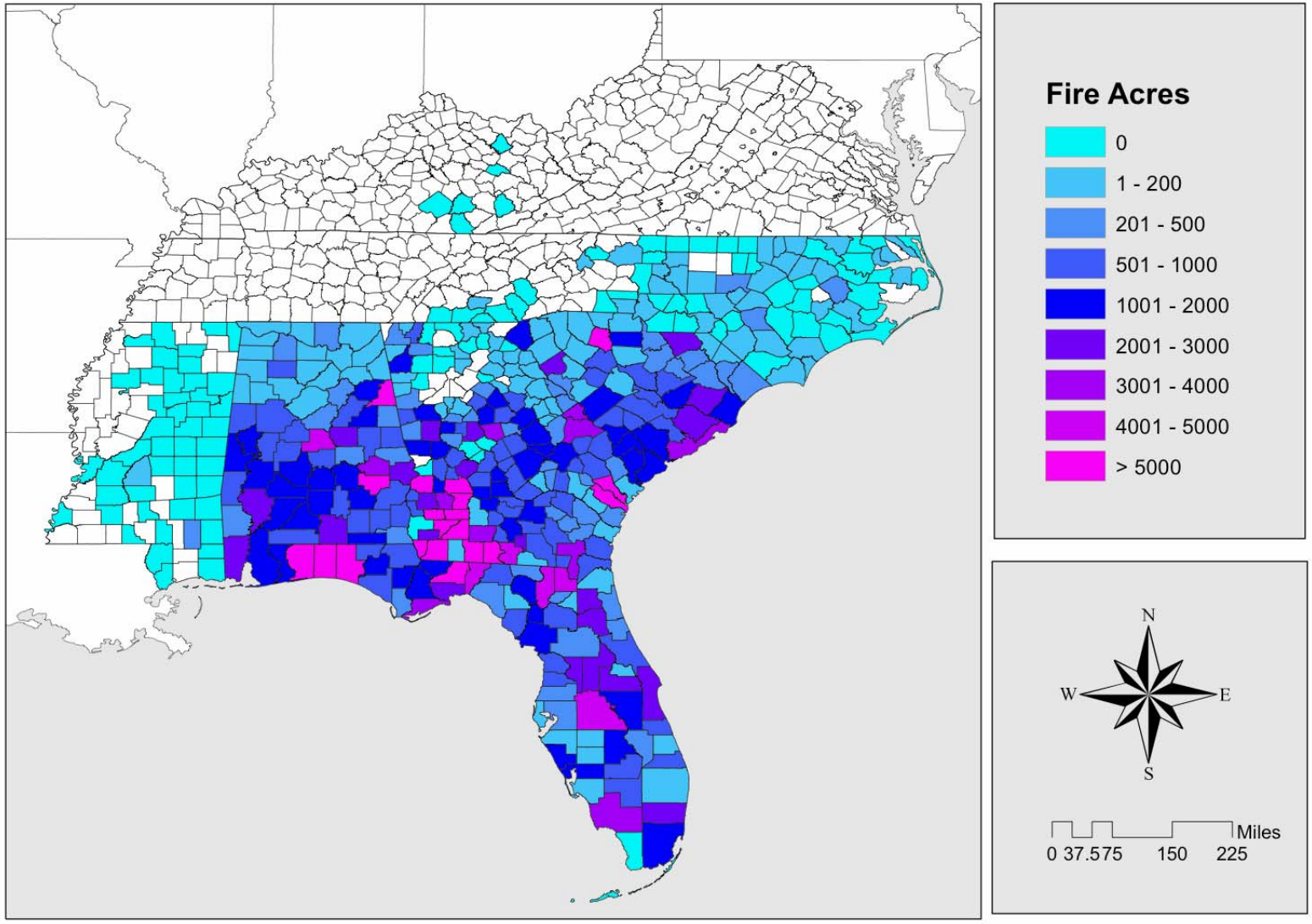


Fire emission over SE US



Visibility Improvement - State and Tribal Association of the Southeast (VISTAS)
William R. Barnard, MACTEC Engineering and Consulting, Inc.

Prescribed Fire over Southeast United States in March 2002



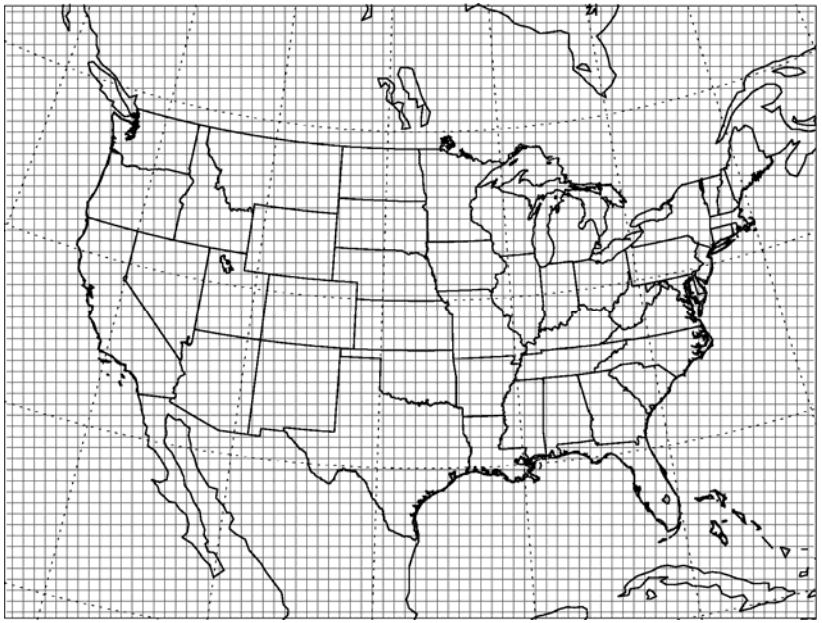
CMAQ simulations & evaluations

Simulation

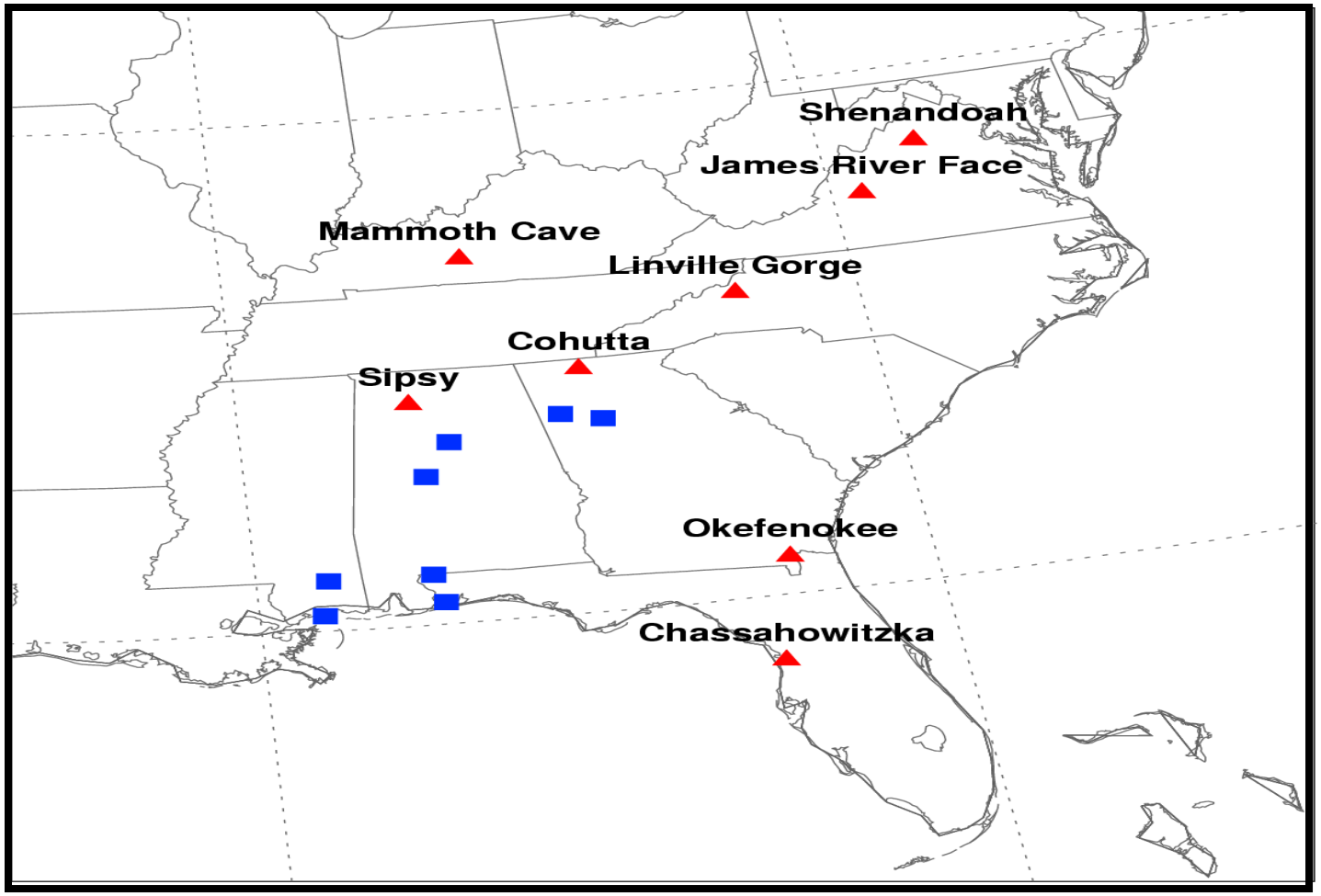
- March, 36x36 km^2
- VISTAS fire emissions

Evaluations

- Surface measurements of OC, EC, CO, and O_3
- Satellites: MODIS fire counts and MOPITT CO

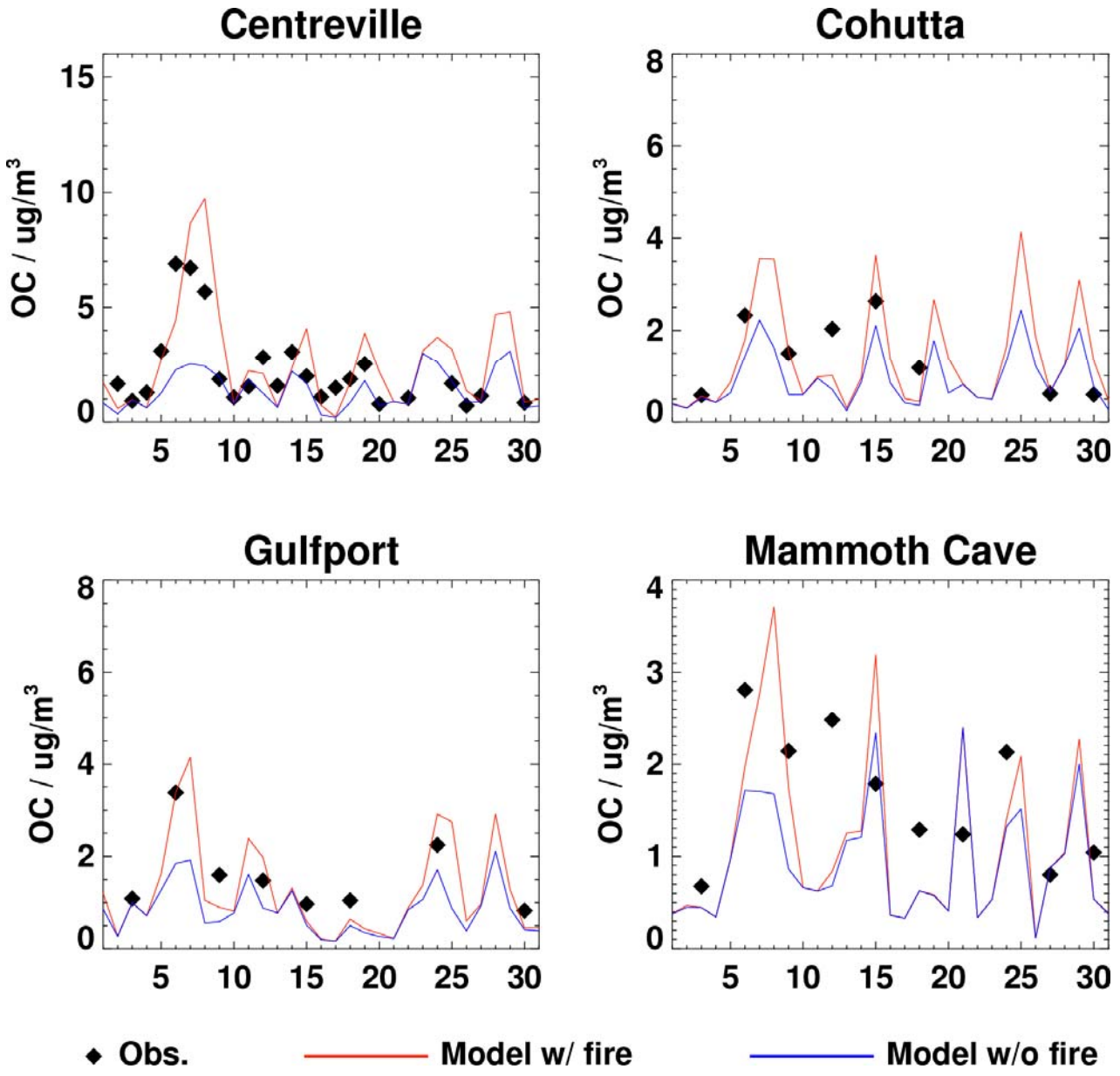


Surface observations

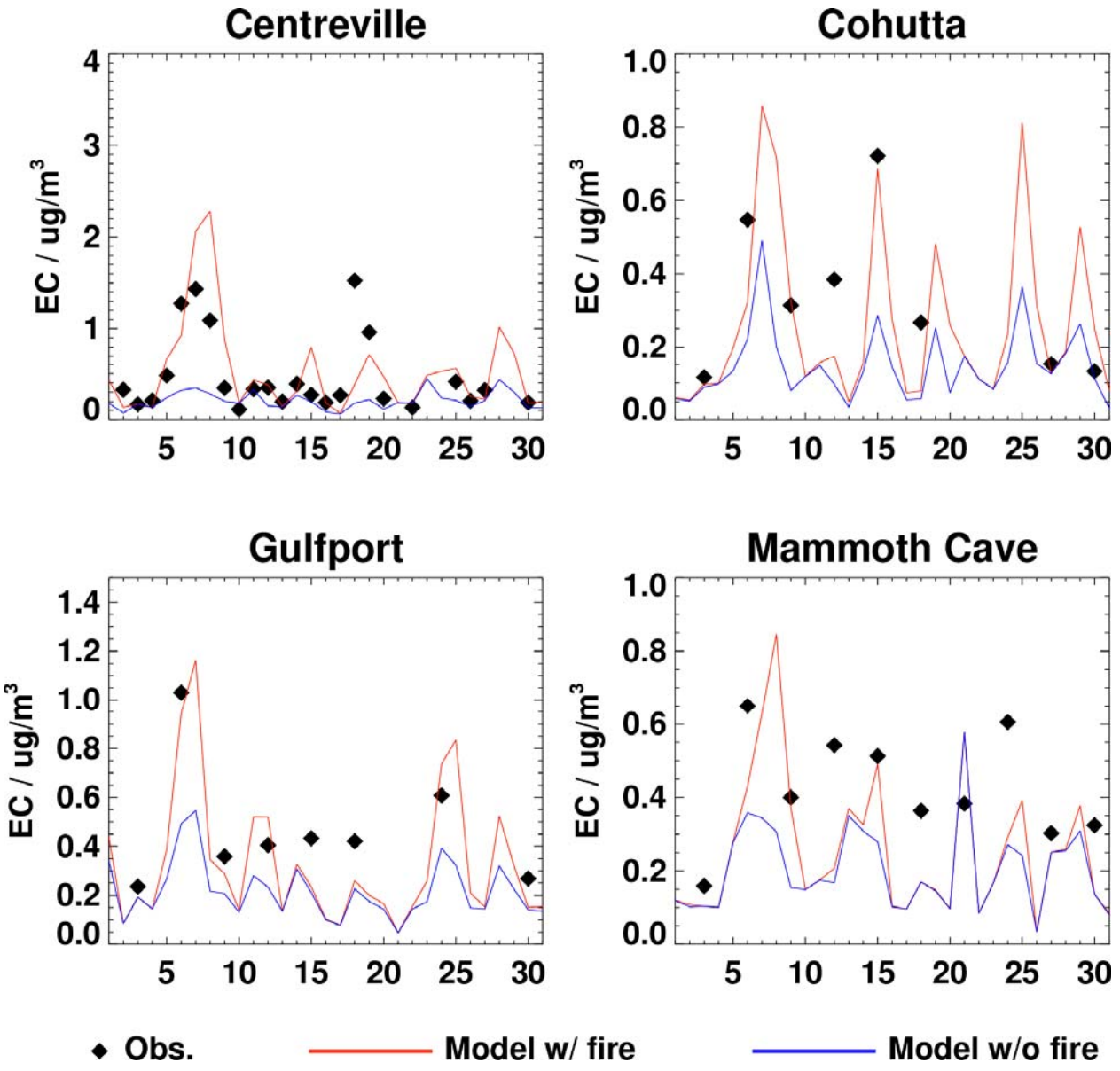


▲ IMPROVE Sites
■ SEARCH Sites

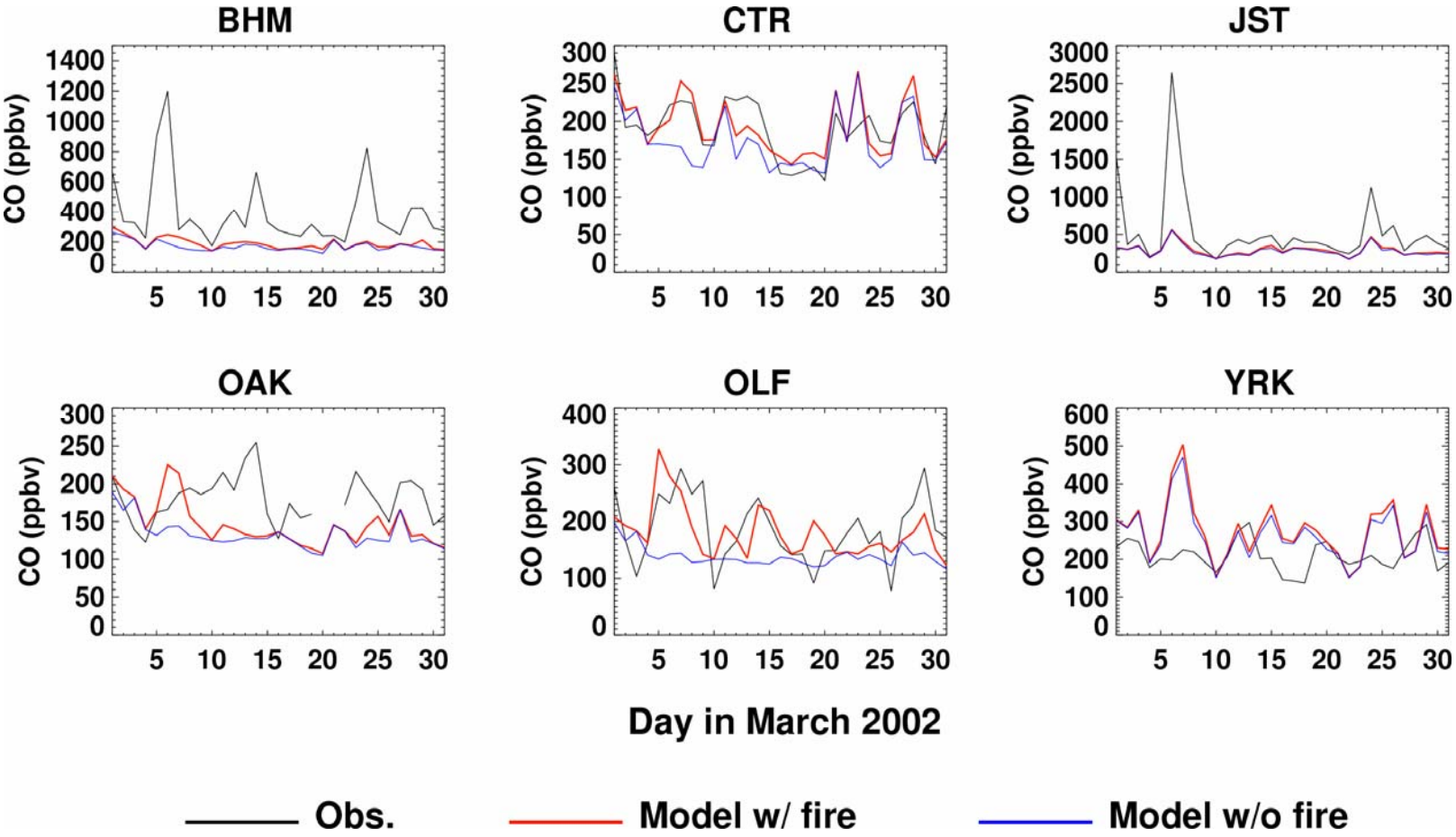
OC


Centreville
Cohutta
Gulfport
Mammoth Cave
OC / ug/m3
Obs.
Model w/ fire
Model w/o fire

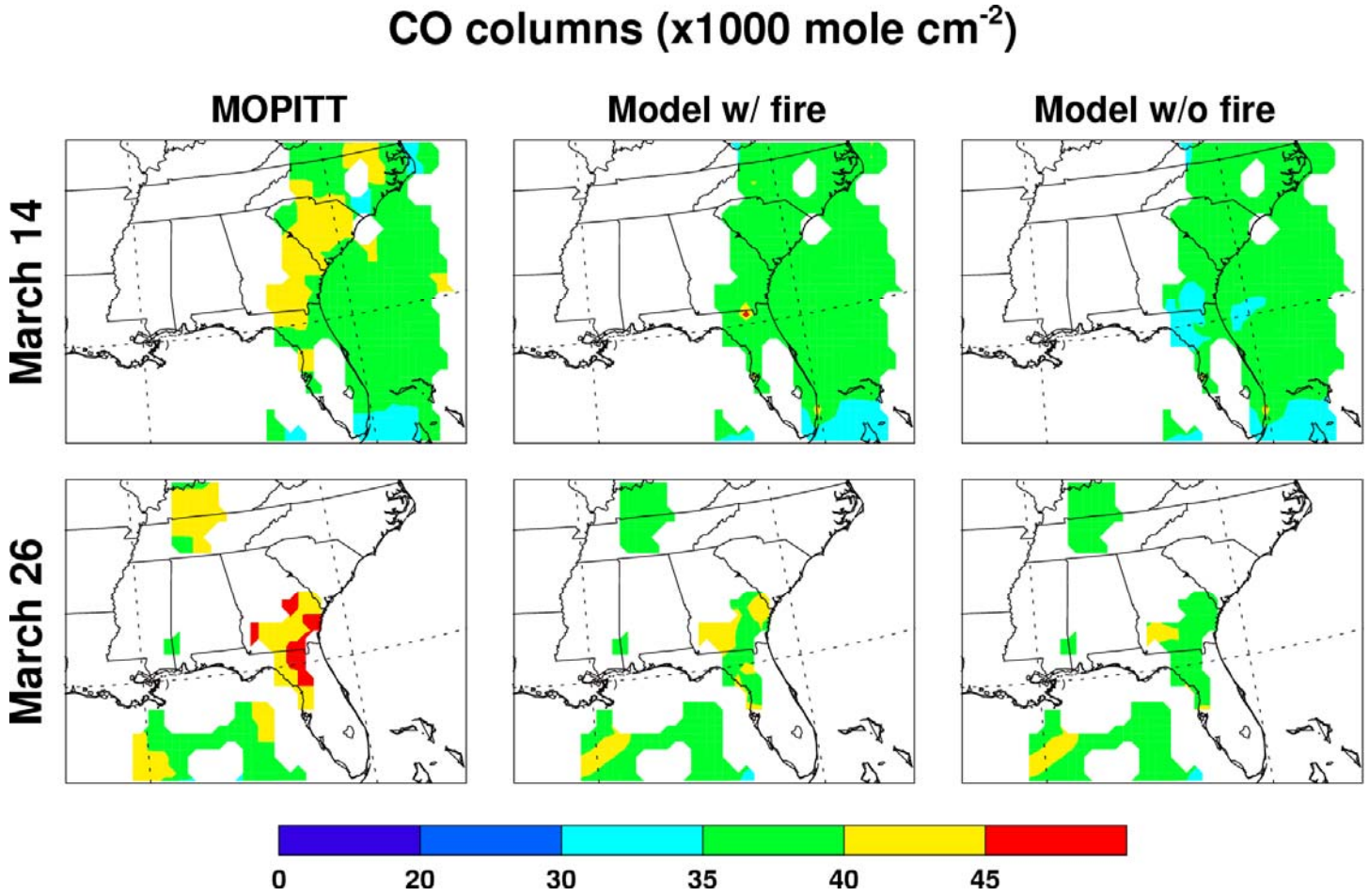
EC


Centreville
Cohutta
Gulfport
Mammoth Cave
EC / ug/m3
Obs.
Model w/ fire
Model w/o fire

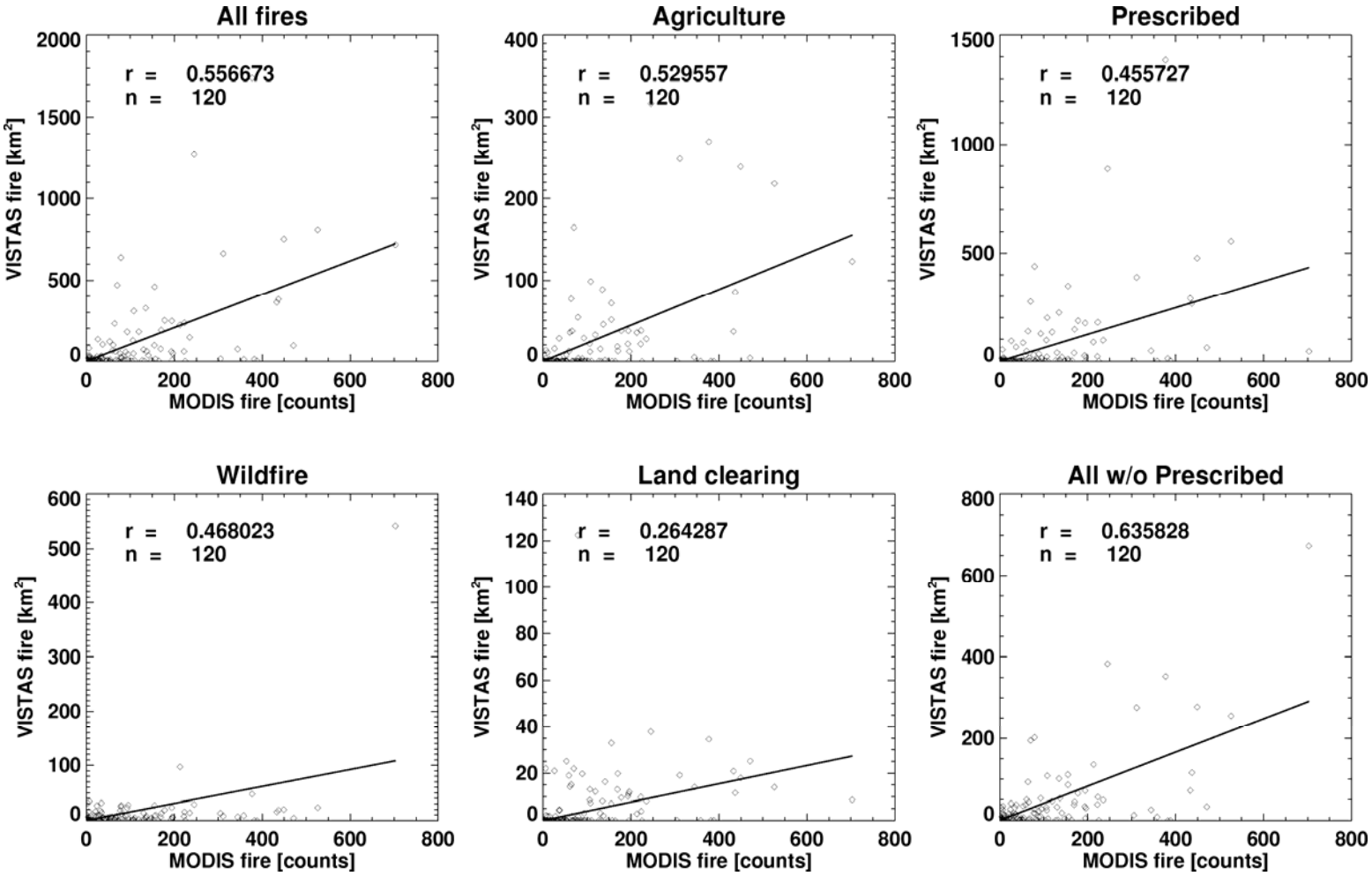
CO


BHM
CTR
JST
OAK
OLF
YRK
CO (ppbv)
Day in March 2002
Obs.
Model w/ fire
Model w/o fire

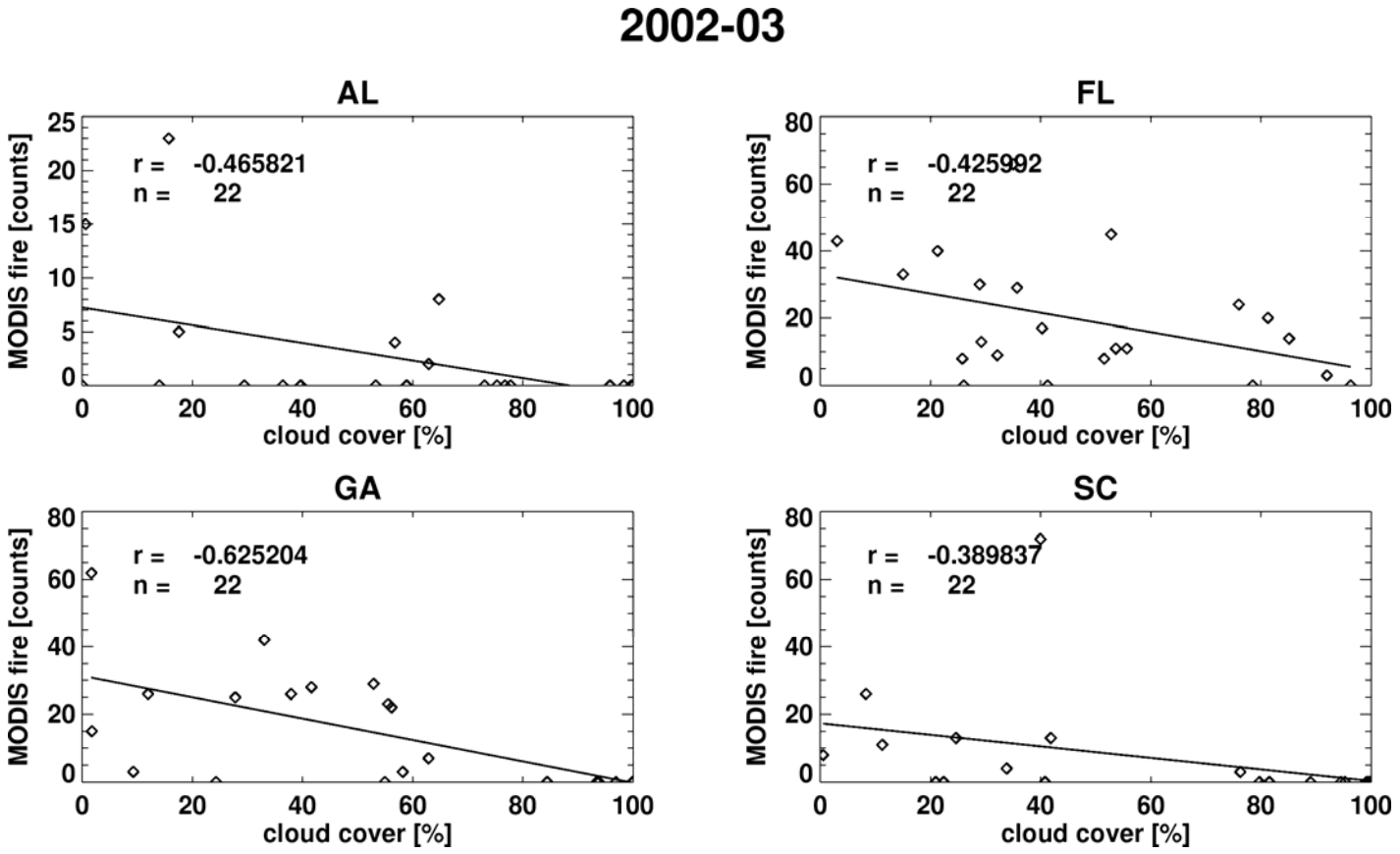
MOPITT and simulated CO columns



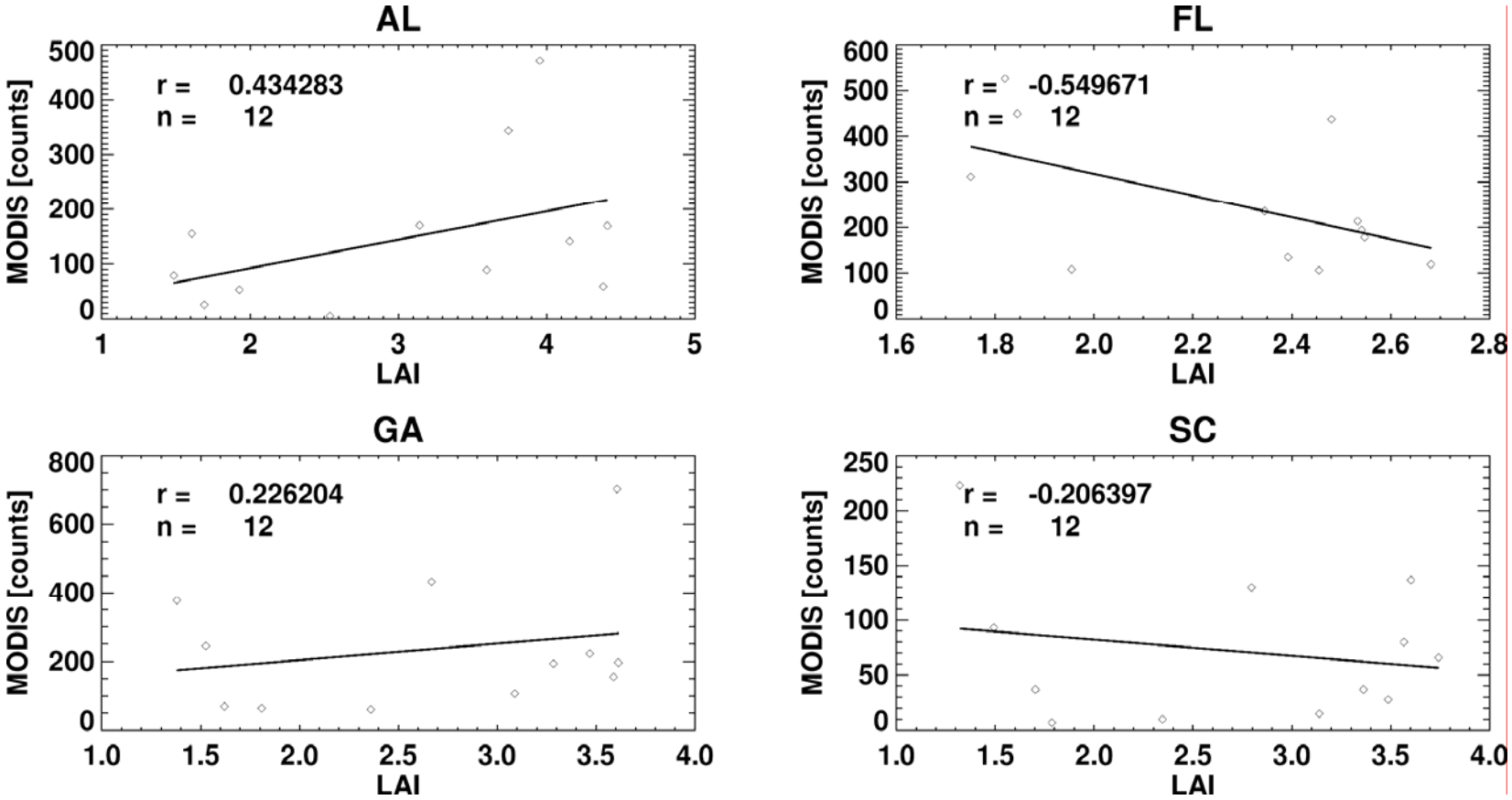
Correlation between MODIS fire count and VISTAS



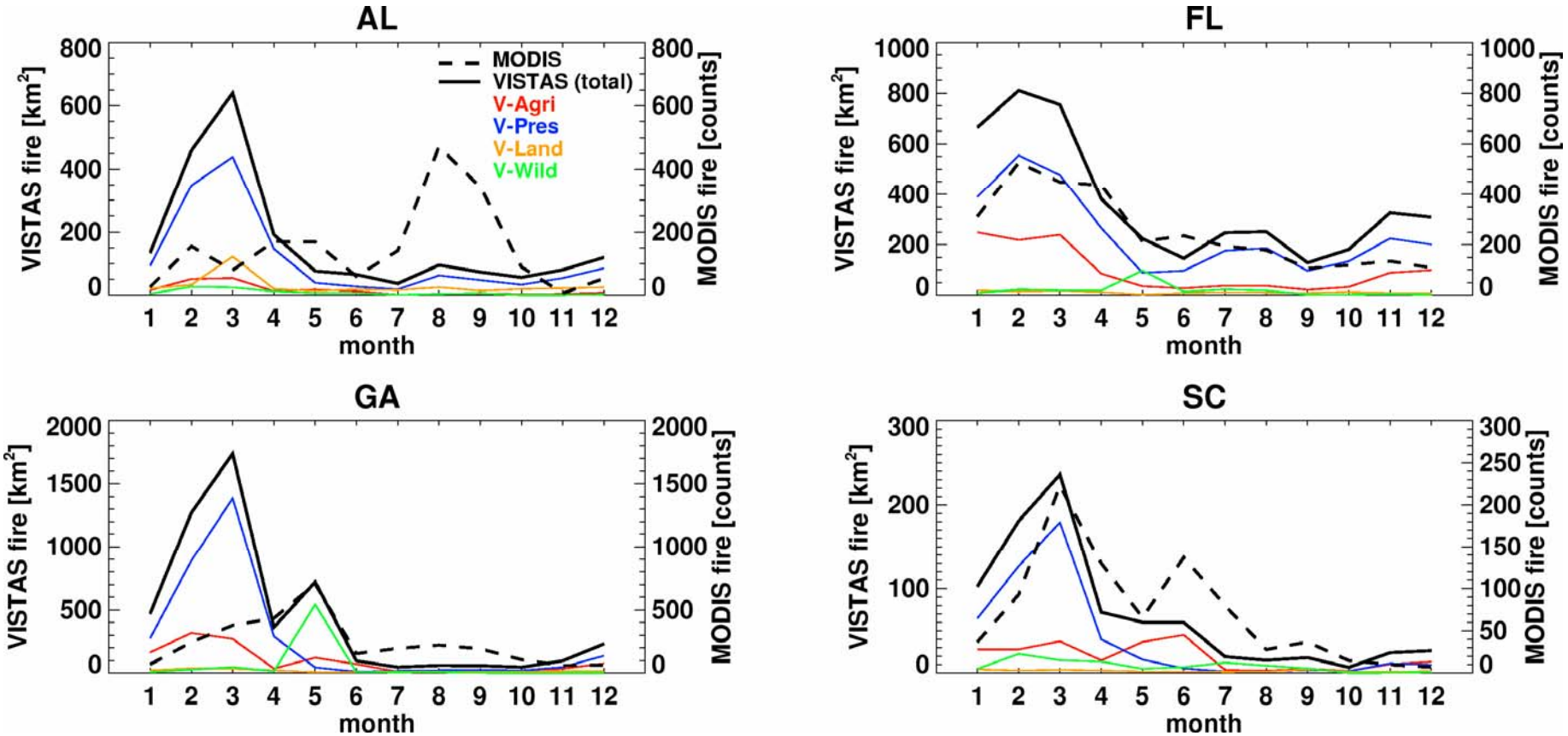
Correlation between MODIS fire count and cloud cover



Correlation between MODIS fire count and LAI

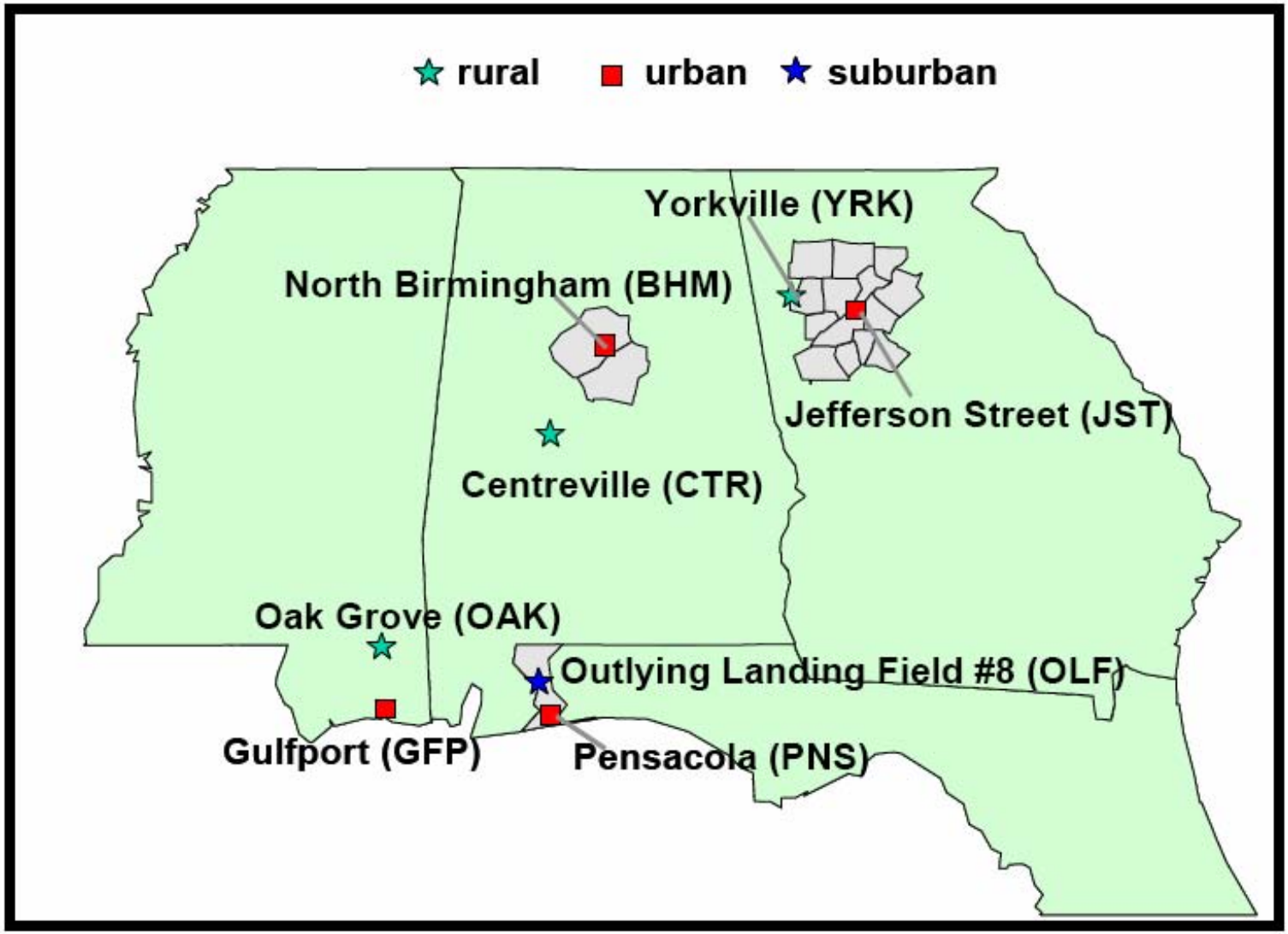


Seasonal variations of MODIS and VISTAS fire



Conclusions

- Inclusion of fire emissions improves model simulations.
- Large enhancements of OC and EC over the SE are attributed to fire emissions in March.
- Significant enhancements are also found for CO at surface sites. Very limited MOPITT CO measurements show larger fire enhancements than simulated in the model.
- MODIS fire counts in spring have a low bias. The summertime increases of MODIS fire counts are not supported by VISTAS inventory or surface PM2.5 measurements.


rural
urban
suburban
Yorkville (YRK)
North Birmingham (BHM)
Jefferson Street (JST)
Centreville (CTR)
Oak Grove (OAK)
Outlying Landing Field #8 (OLF)
Gulfport (GFP)
Pensacola (PNS)