

Prescribed Fire Impact Forecasting System

A prescribed fire (PF) impact forecasting system has been developed to facilitate the dynamic management of air quality by modulating PF activity. Approximate location and size of fires are predicted based on the weather forecast and historic PF patterns. While burn permit data are used in Georgia, satellite-derived (GBBEP) fire data are employed for other southeastern states.

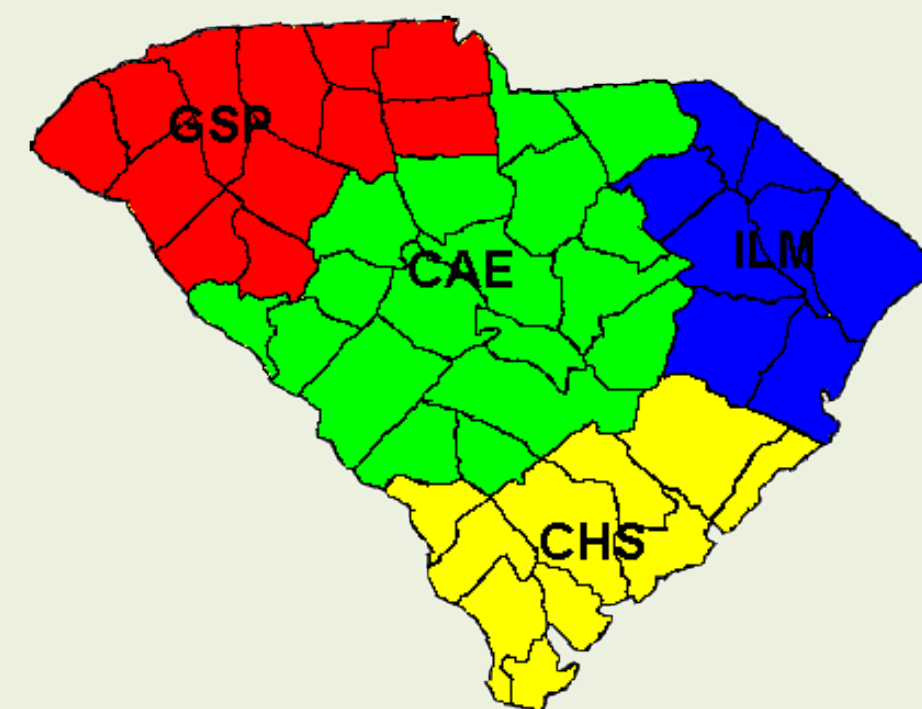
PF emissions are estimated using MODIS-enhanced FCCS fuel maps and emission factors specific to southeastern fuels. These emissions are input into CMAQ-DDM air quality model and simulations are performed to forecast the impacts of PF on trace gas and particulate matter concentrations.

Burn Day and Burn Size Determination

WRF-simulated meteorology and national fire weather forecasts are used as predictors. A classification and regression tree (CART) model is used for Georgia while the following criteria are employed in other states.

Burn Day Criteria:

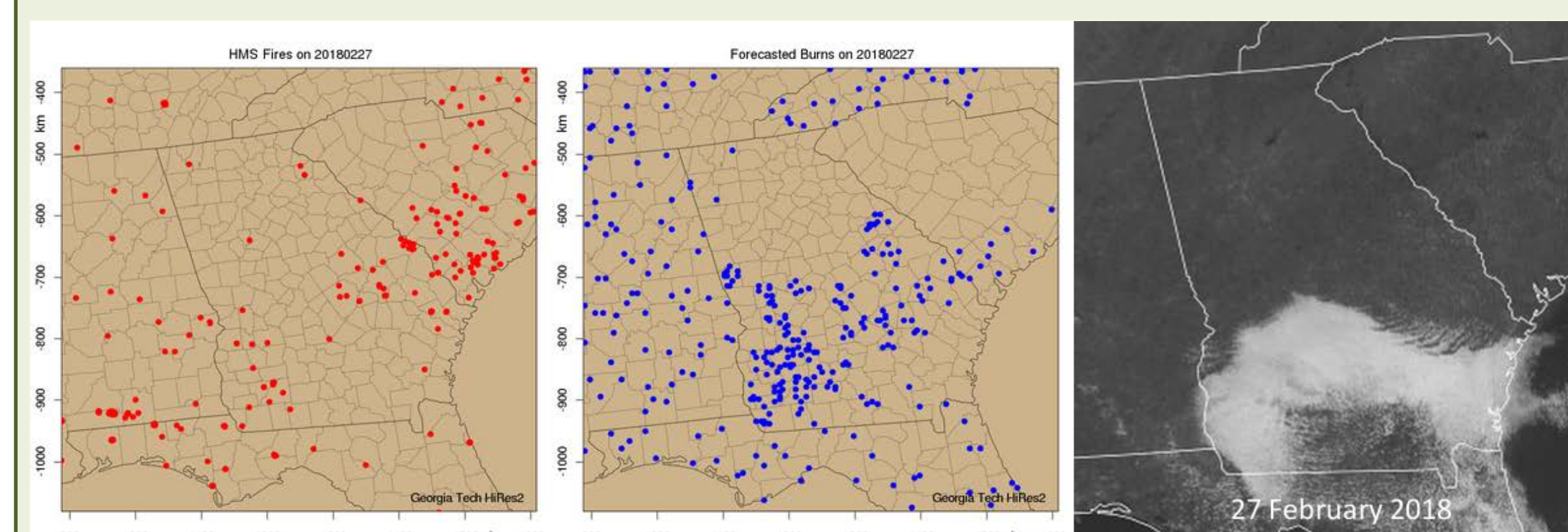
- 1) PBL height: 500–2000 m
 - 2) Transport wind speed: 4–9 m/s
 - 3) Surface wind speed: 3.5–6 m/s
 - 4) Relative humidity > 30%
 - 5) Temperature < 303 K
 - 6) 24-hr accumulated rain < 0.6 cm.
- *Criteria 1–5 applied at 13:00 EST



South Carolina Weather Zones

Burn Sizes and Number of Burns:

- 1) Significant Burn Size: Corresponds to 67th percentile of state total burned area (smaller fires are ignored).
- 2) Typical Burn Size: For each month, monthly average burn size for significant burns.
- 3) For each forecast burn day, the number of burns is = Total Burned Area / # Burn Days / Typical Burn Size rounded to the nearest integer.

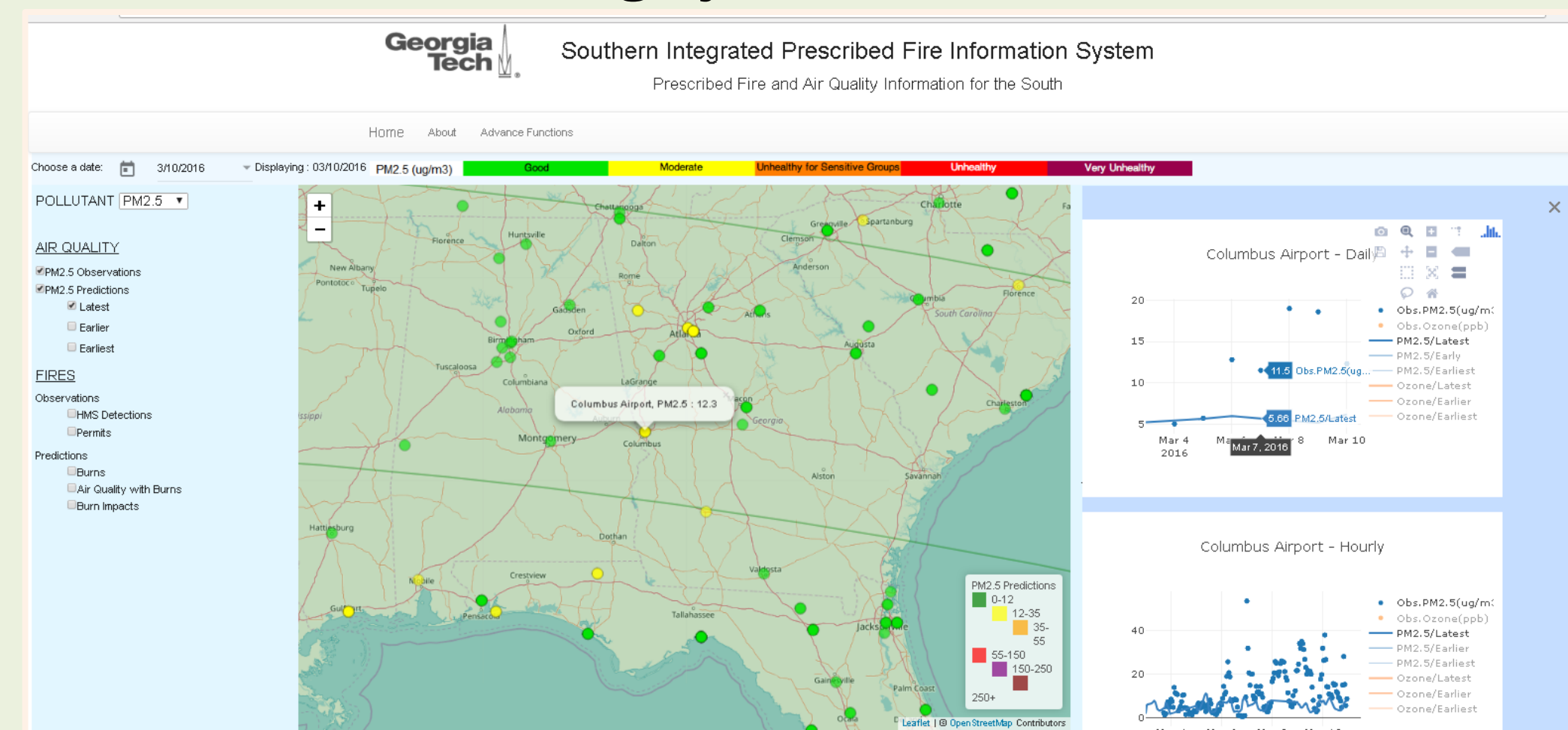


Comparison of PF Forecast to HMS Fire Detections

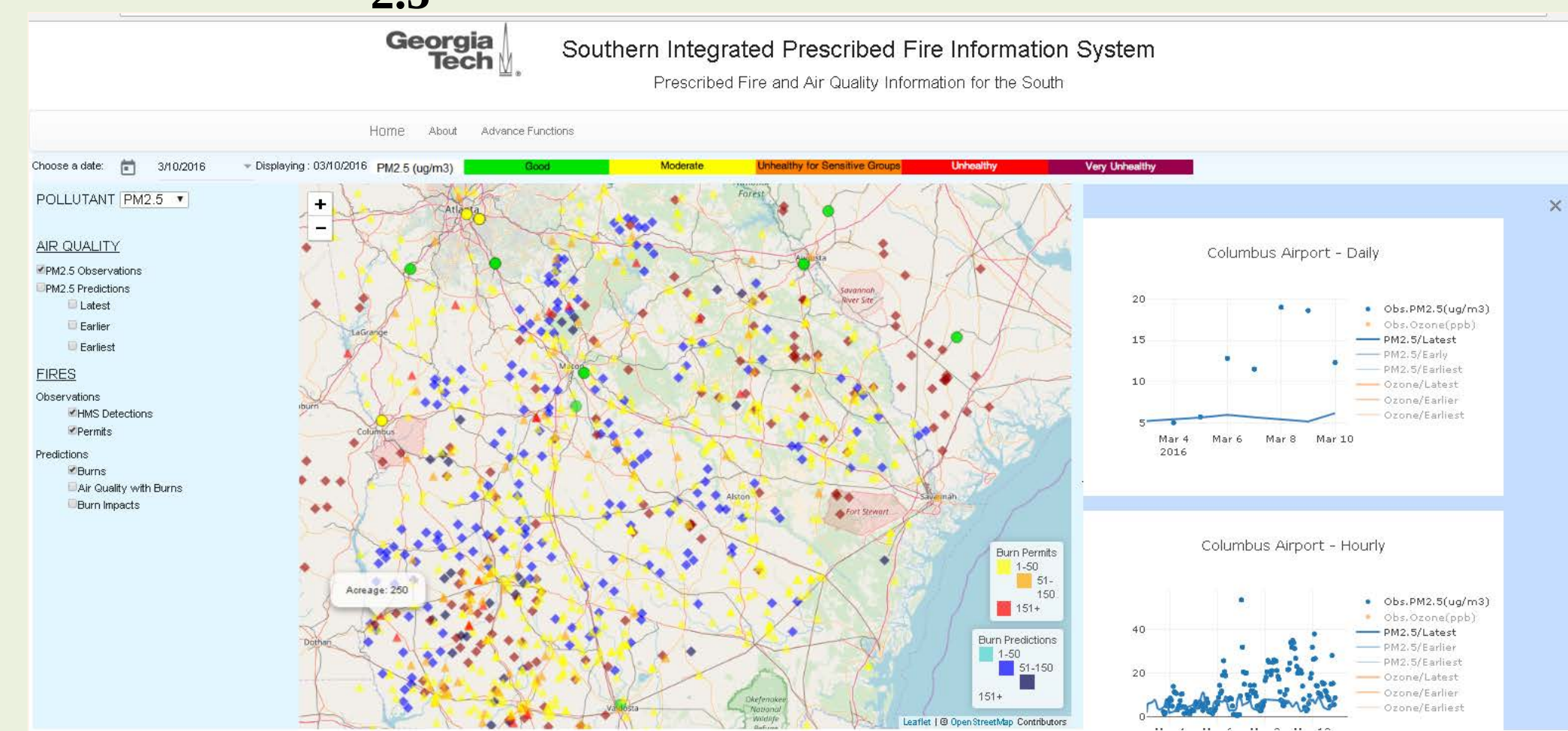
SIPFIS Website

<https://sipc.ce.gatech.edu/SIPFIS/map/>

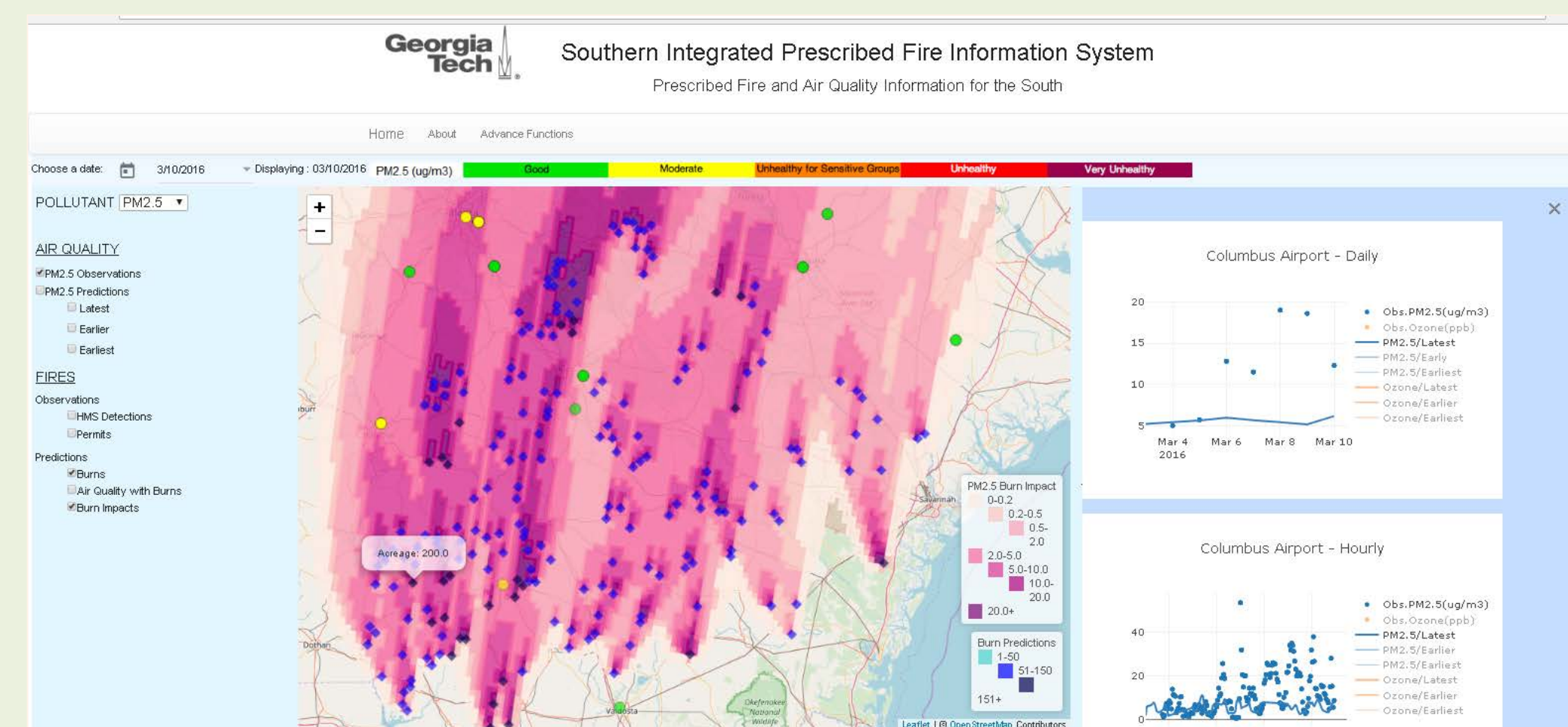
Southern Integrated Prescribed Fire Information System (SIPFIS) merges prescribed fire and air quality data into a common analysis framework. One of its objectives is to create a unified prescribed fire database for the southern U.S. providing multi-year data for fire occurrence and characteristics. Currently, this objective is fulfilled by combining data from prescribed burn permits and open burn authorizations issued by state agencies with satellite detections of fires in the region. The information available through SIPFIS includes air quality observations from routine monitoring networks as well as air quality, burn activity and burn impact predictions from Georgia Tech's HiRes-2 forecasting system.



PM_{2.5} Observations and Predictions



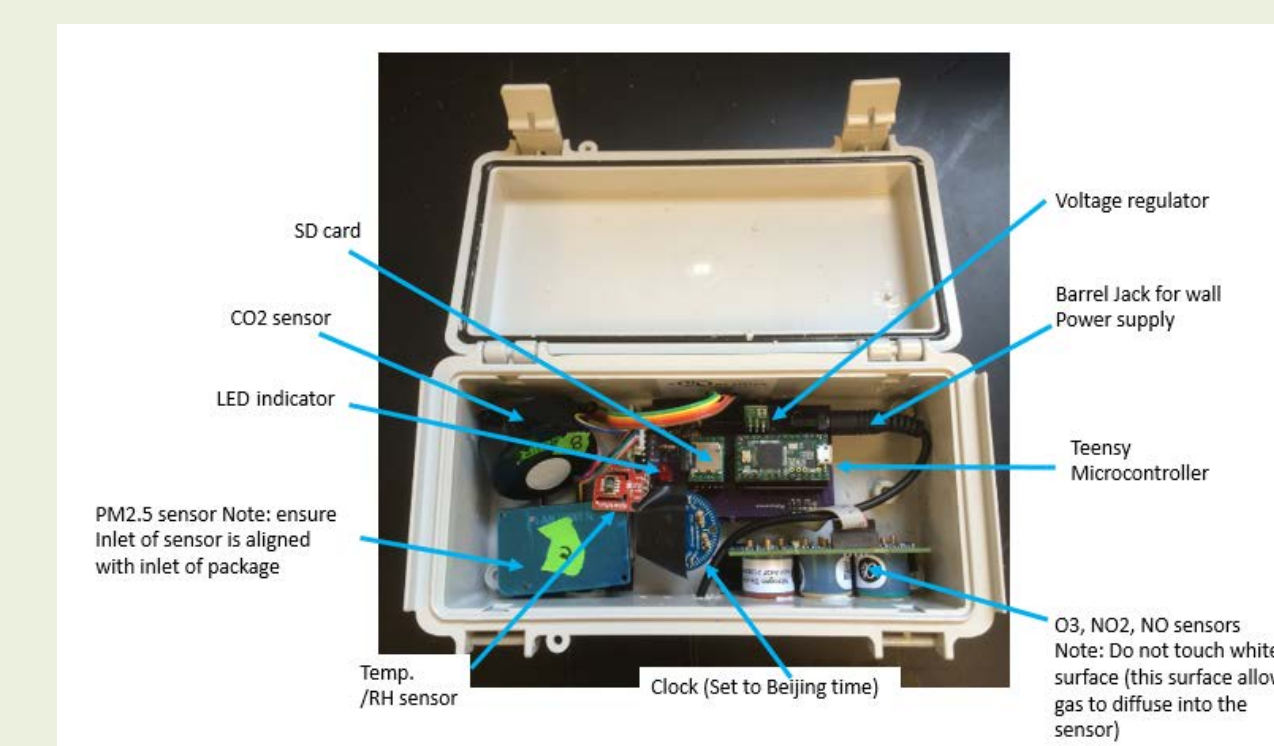
Permitted, Satellite-detected (HMS) and Forecast Fires



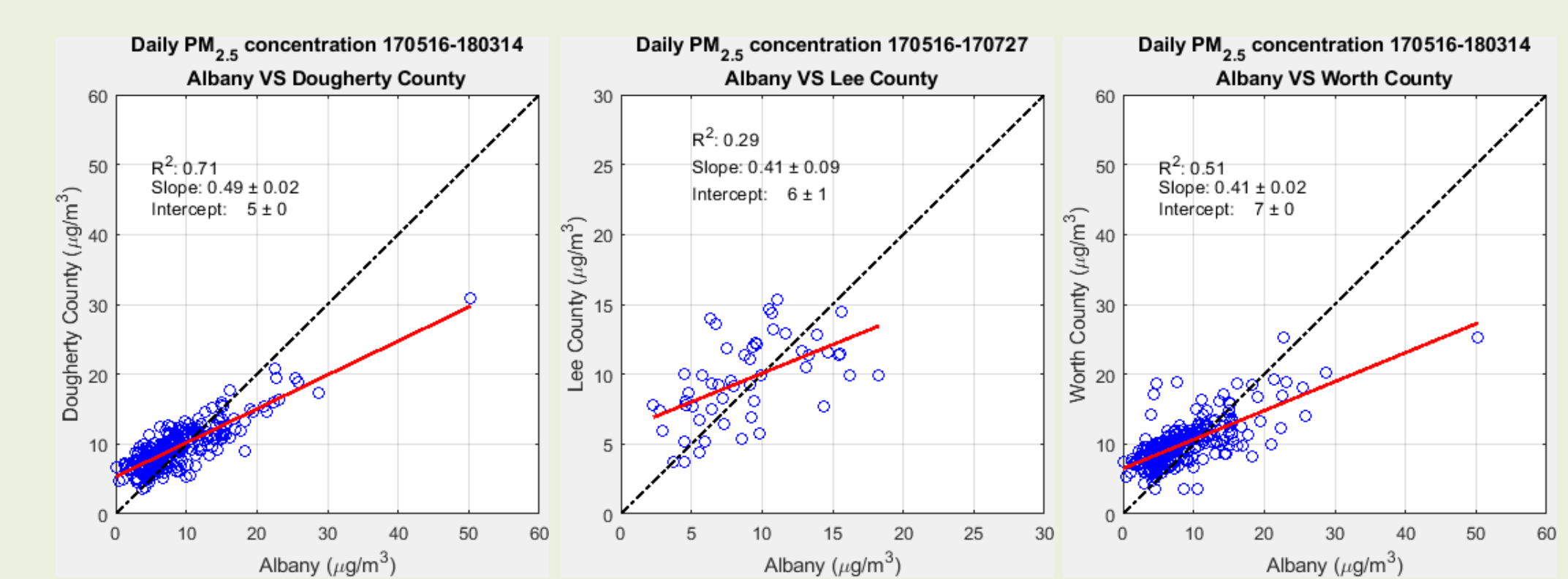
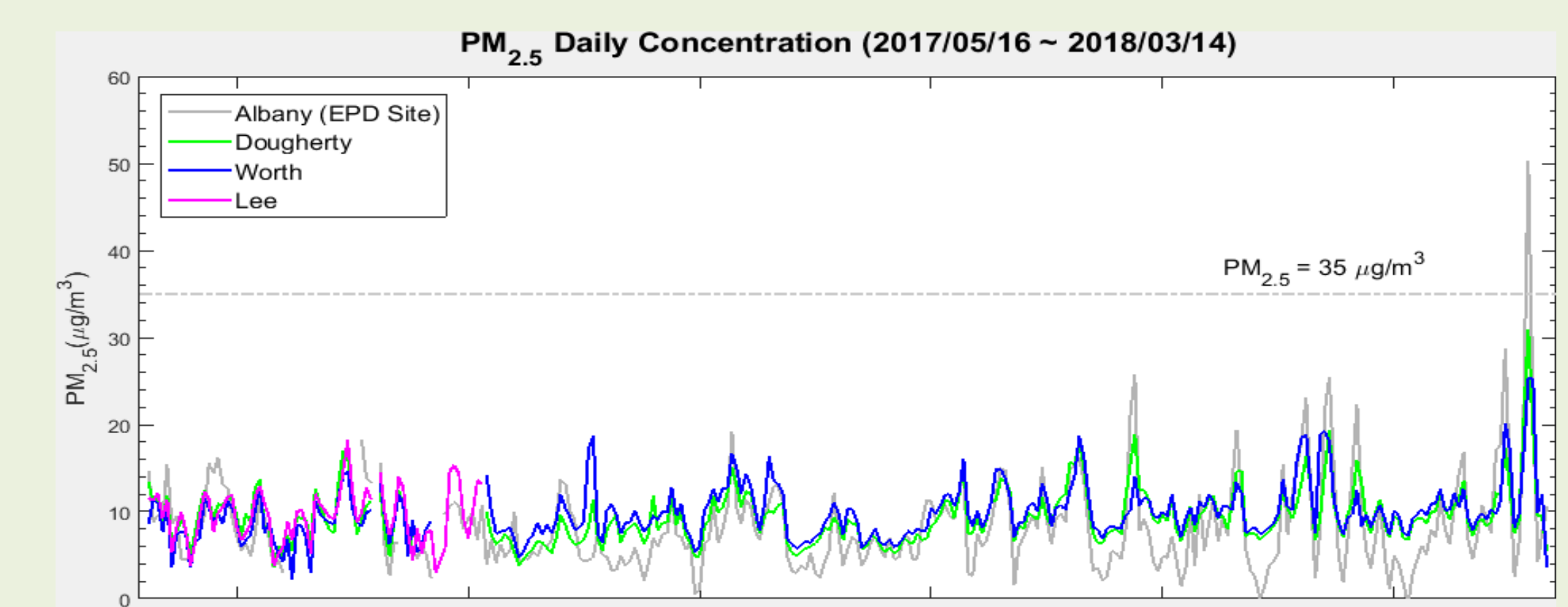
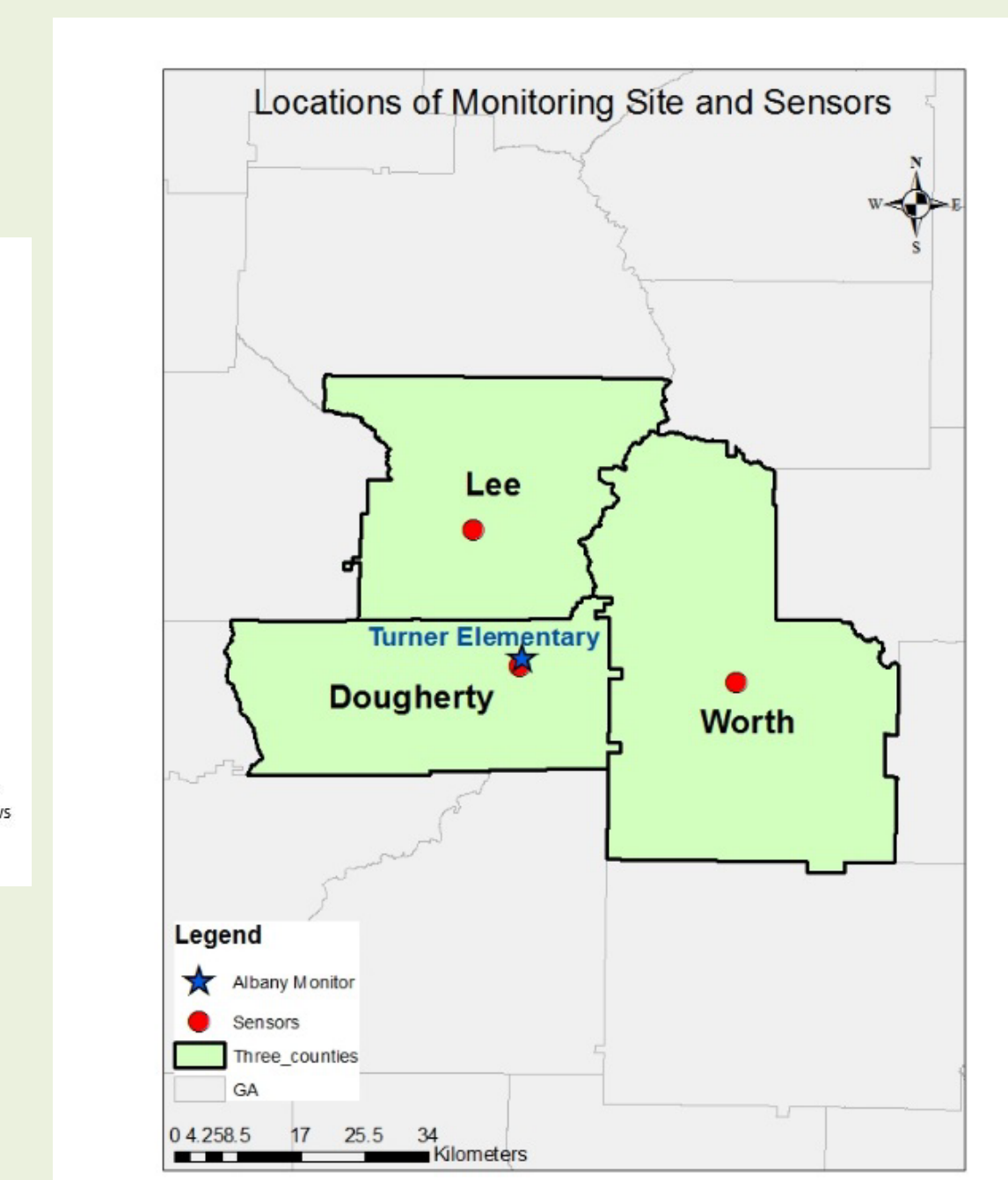
Forecast Prescribed Fires and their Impacts

Low-cost Sensors for Quantifying Prescribed Fire Impacts on Air Quality

Three low-cost sensor boxes containing gas and PM sensors (Plantower PMS 3003) were deployed at high schools in Southwest Georgia (Dougherty, Lee, and Worth Counties) to measure the local PM_{2.5} concentrations since July 2017 and a fourth sensor was placed near the state monitoring site for collocal measurements since March 2018. Turner Elementary site (ID 130950007) is a suburban location at Albany, Georgia where PM_{2.5} is measured with a beta attenuation monitor (BAM) as part of the Georgia Air Protection Branch Ambient Monitoring Program.



PM sensor: Plantower PMS 3003



Acknowledgement and Contact Information

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- ❖ For more information contact Talat Odman at 404-894-2783 or send e-mail to odman@gatech.edu.