



APPLIED SCIENCE PROGRAM

Gulf of Mexico Initiative

**NNH08ZDA001N-GULF Research
Opportunities in Space and Earth
Science (ROSES-2008) Earth
Science for Decision Making—
Gulf of Mexico Region**



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Coastal Fire Assessment in the Northern Gulf of Mexico

Project Duration: Two Years

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Co Pi's: **Valentine G. Anantharaj** (*Geosystems Research Institute, GRI*)

Jinmu Choi (*Geosciences Department, MSU*)

Georgy Mostovoy (*Geosystems Research Institute, GRI*)

Collaborator: **William Jolly** (*Fire Sciences Lab, US Forest Service*)



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OBJECTIVES

- (a) verify the effectiveness of our **fire potential algorithms, optimized with NASA data** and model results, to meet the operational requirements; (b) **quantify the potential improvements** in the performance of our fire potential model for Gulf Coastal environments; (c) **characterize the risks and uncertainties** in the products; (d) **transition** our research for **operational implementation** at the USFS Fire Sciences Laboratory; and (e) **document the potential improvements** in the decision making process resulting in socio-economic benefits.



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PRIMARY NASA FOCUS

- The proposal has a primary focus on the ***Disaster Management applications area*** toward preparing for and responding to wild fire risks.



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NASA ASSETS

- NASA data, models and research results are fundamental in our proposed approach for improving the wildfire risk assessment in the eastern United States. We plan to (a) incorporate routine high-resolution, multi-temporal observations from the **MODIS** sensors on-board NASA's Terra and Aqua platforms to derive better estimates of the *fuel content of vegetation*; (b) *use the award-winning **NASA Land Information System (LIS)** to provide **improved land surface cumulative moisture budgets***; (c) *evaluate potential **improvements to soil moisture simulations in LIS** by assimilating observations/products from the Advanced Microwave Spaceborne Radiometer – **EOS (AMSR-E)***; and (d) *develop and verify seasonal fire risk assessment products. Our algorithms and methodologies will also be able to readily **take advantage of future observations** from the **NPP** (for example **VIIRS**), Soil Moisture Active Passive (**SMAP**), **GOES-R**, and Global precipitation Measurement (**GPM**) missions.*



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Decision-making Activity

Wildland Fire Assessment System (WFAS)

Science and Technology Baseline

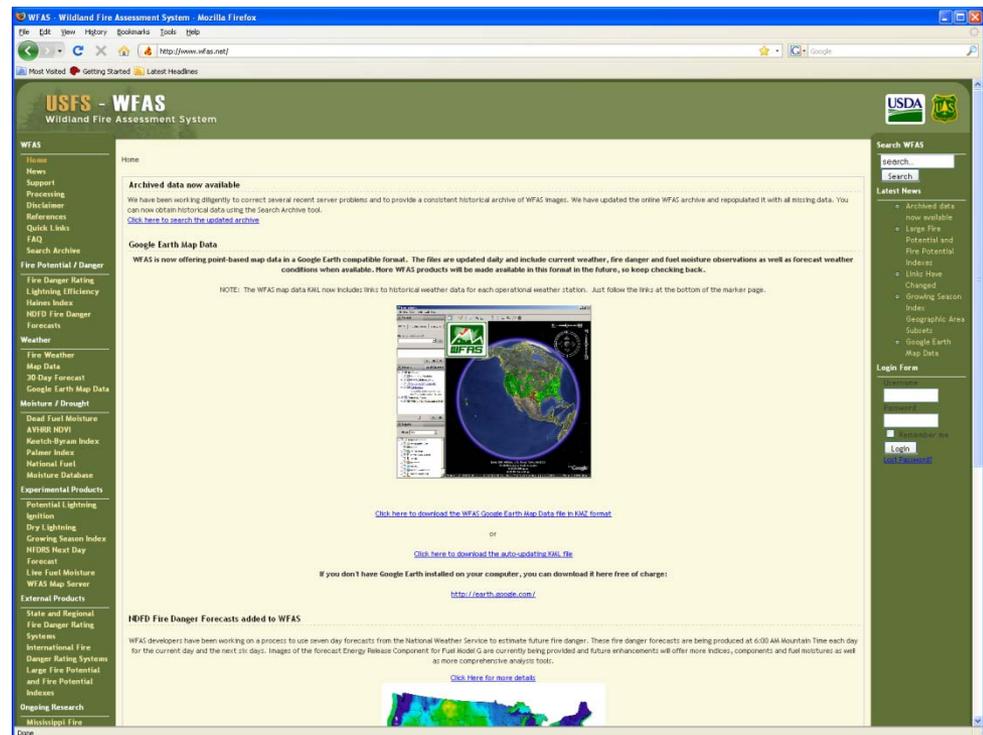
WFAS combines surface weather observations, surface weather forecasts and satellite-derived vegetation metrics into a single, user-friendly format that is useful in fire management applications

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3 Major Components of the Wildland Fire Assessment System (WFAS)

- Fire Potential and Danger
- Weather
- Moisture and Drought



WFAS - Wildland Fire Assessment System - Mozilla Firefox

USFS - WFAS
Wildland Fire Assessment System

USDA US

WFAS

Home

Archived data now available

We have been working diligently to correct several recent server problems and to provide a consistent historical archive of WFAS images. We have updated the online WFAS archive and repopulated it with all missing data. You can now obtain historical data using the Search Archive tool.
[Click here to search the updated archive](#)

Google Earth Map Data

WFAS is now offering point-based map data in a Google Earth compatible format. The files are updated daily and include current weather, fire danger and fuel moisture observations as well as forecast weather conditions when available. More WFAS products will be made available in this format in the future, so keep checking back.

NOTE: The WFAS map data KML now includes links to historical weather data for each operational weather station. Just follow the links at the bottom of the marker page.

[Click here to download the WFAS Google Earth Map Data file in KMZ format](#)

or

[Click here to download the auto-updating KML file](#)

If you don't have Google Earth installed on your computer, you can download it here free of charge:
<http://www.google.com/>

NEDS Fire Danger Forecasts added to WFAS

WFAS developers have been working on a process to use seven day forecasts from the National Weather Service to estimate future fire danger. These fire danger forecasts are being produced at 6:00 AM Mountain Time each day for the current day and the next six days. Images of the forecast Energy Release Component for Fuel Model G are currently being provided and future enhancements will offer more indices, components and fuel moistures as well as more comprehensive analysis tools.
[Click Here for more details](#)

Search WFAS

search

Search

Latest News

- Archived data now available
- Large Fire Potential and Fire Potential Indexes
- Little Snow Changed
- Growing Season Index
- Geographic Area Subsets
- Google Earth Map Data

Login Form

Username

Password

Login

Web Developer

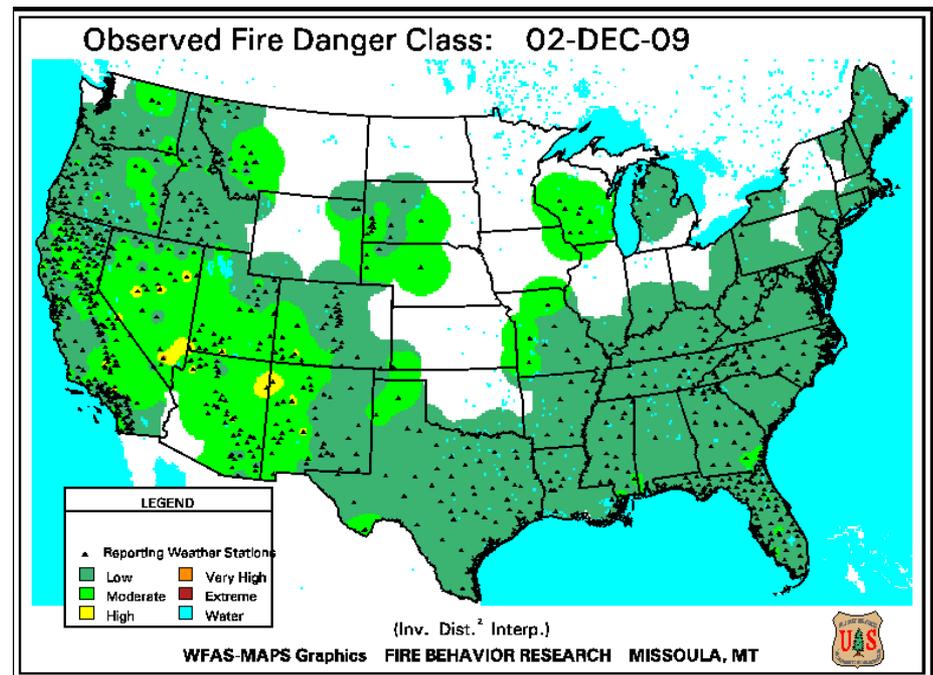
Mississippi Fire Done

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Benchmark - NFDRS

- A Fire Danger Rating level takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture ([Deeming and others 1977](#), [Bradshaw and others 1984](#)).
- The new Fire Potential Model will be considered an improvement if a higher percentage of fires occur in the highest fire danger classes as compared to the baseline fire danger assessments from NFDRS.

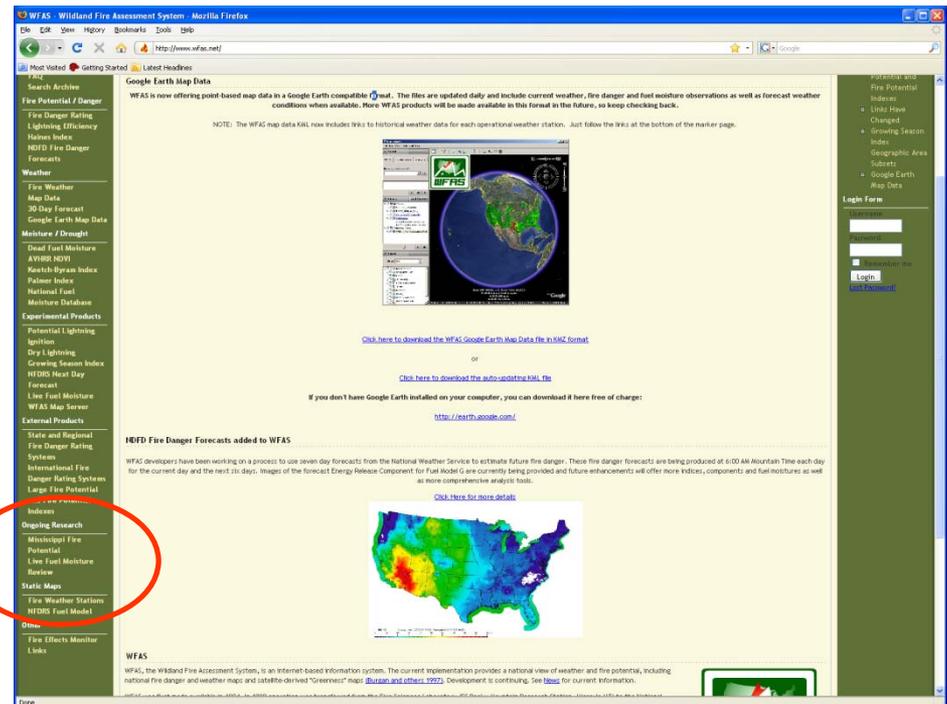


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Current WFAS Support for Fire Modeling in Mississippi and the Eastern U.S.

Systems
International Fire
Danger Rating Systems
Large Fire Potential
and Fire Potential
Indexes
Ongoing Research
Mississippi Fire
Potential
Live Fuel Moisture
Review
Static Maps
Fire Weather Stations
NFDRS Fuel Model



WFAS - Wildland Fire Assessment System - Mozilla Firefox

http://www.wfas.net/

Most Noted: Getting Started Latest Headlines

Fire Potential / Danger

- Fire Danger Rating
- Lightning Efficiency Index
- Palmer Index
- NFDRS Fire Danger Forecasts

Weather

- Fire Weather
- Map Data
- 30 Day Forecast
- Google Earth Map Data

Moisture / Drought

- Dead Fuel Moisture (NFDRS FMI)
- Keetch-Byram Index
- Palmer Index
- National Fuel Moisture Database

Experimental Products

- Potential Lightning Ignition
- Day Lightning
- Growing Season Index
- NFDRS Next Day Forecast
- Live Fuel Moisture
- WFAS Map Server

External Products

- State and Regional Fire Danger Rating Systems
- International Fire Danger Rating System
- Large Fire Potential

Ongoing Research

- Mississippi Fire Potential
- Live Fuel Moisture Review

Static Maps

- Fire Weather Stations
- NFDRS Fuel Model

Other

- Fire Effects Monitor
- Links

Google Earth Map Data

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[Click Here for more details](#)

WFAS

WFAS, the Wildland Fire Assessment System, is an Internet-based information system. The current implementation provides a national view of weather and fire potential, including national fire danger and weather maps and satellite-derived "Greenness" maps (Burton and others, 1997). Development is continuing. See [News](#) for current information.

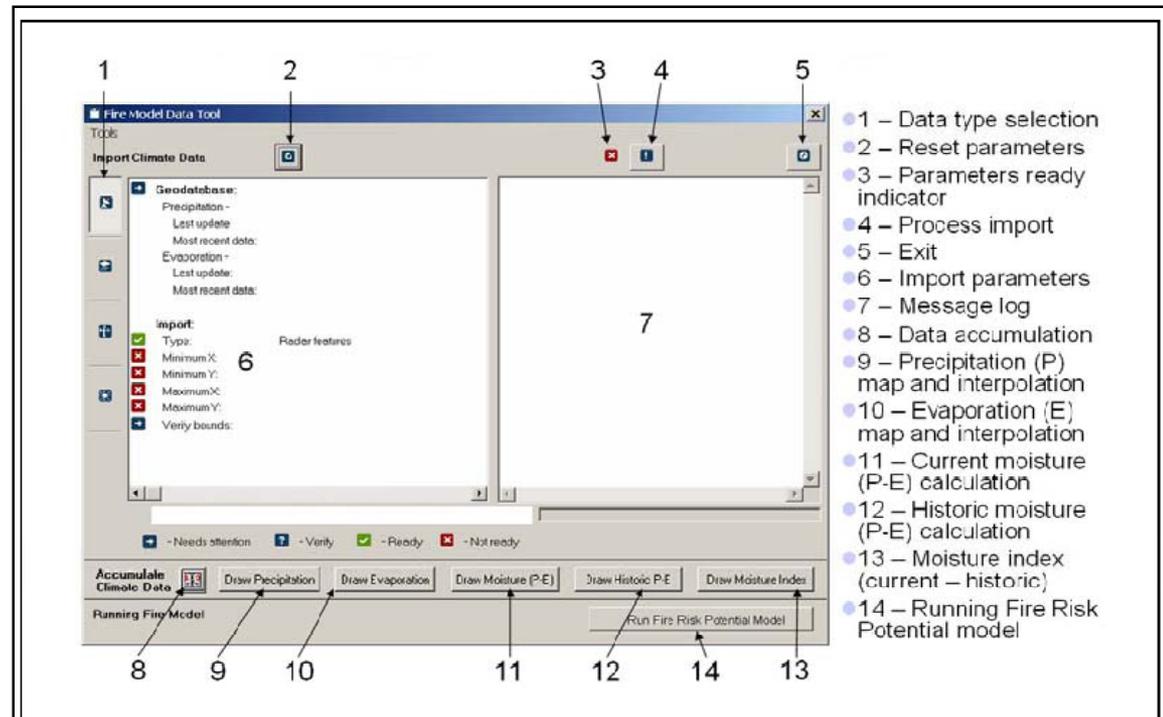
Date

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Current Fire Risk Modeling Tool

- Currently:
 - VB Front End
 - Access Database
- In Development
 - SQL Server
 - WebApp





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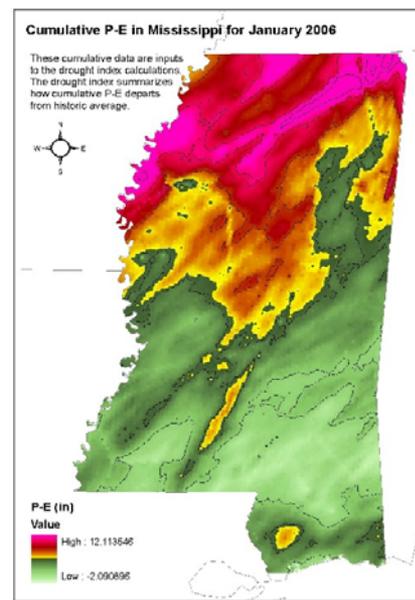
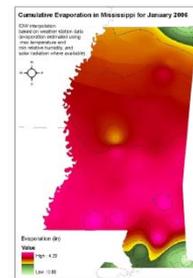
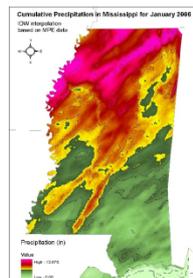
Mississippi and Eastern Fire Potential Modeling (EFPM) Efforts

USFS - WFAS
Wildland Fire Assessment System

Mississippi Fire Potential

More Information:
[Click here for model flowchart.](#)
[Click here for more information on this work.](#)
[Click here for some example products.](#)

Powered by [The Missoula Fire Sciences Lab](#) and [SEM](#)



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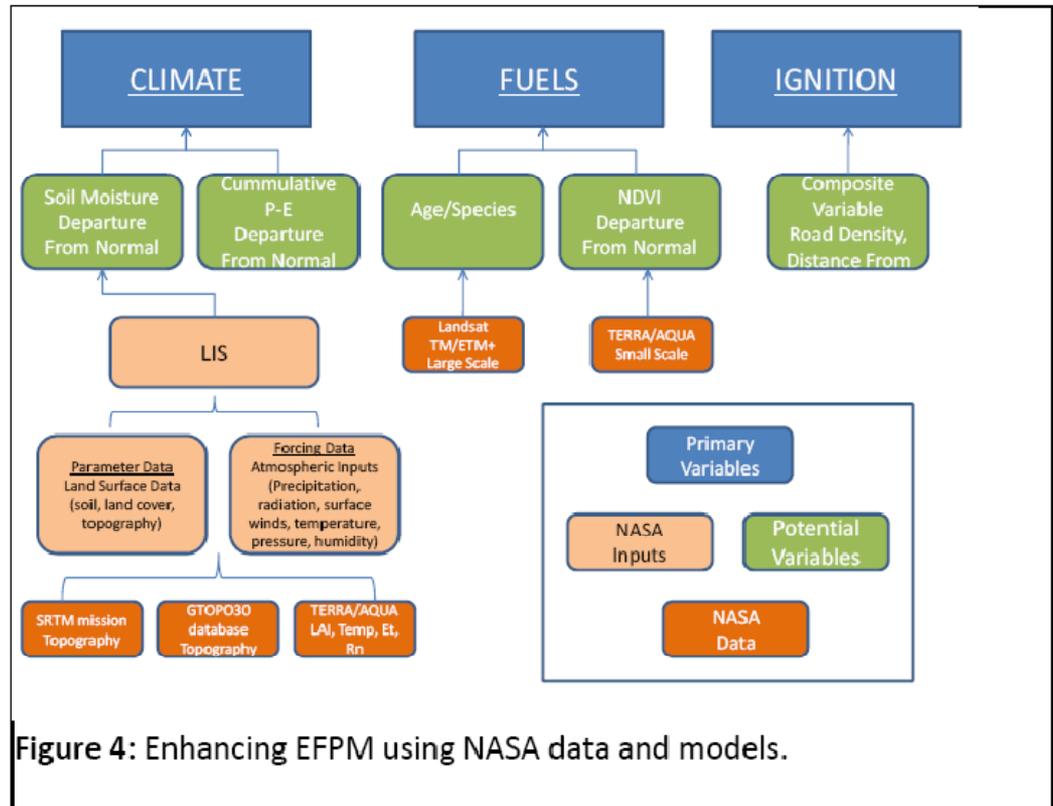
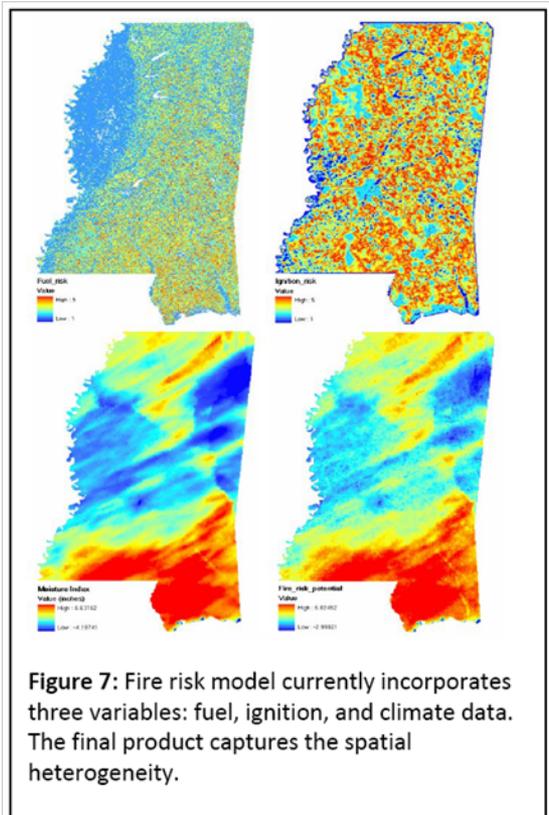
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Powered by [The Missoula Fire Sciences Lab](#) and [SEM](#)

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MFPM/EFPM Modifications

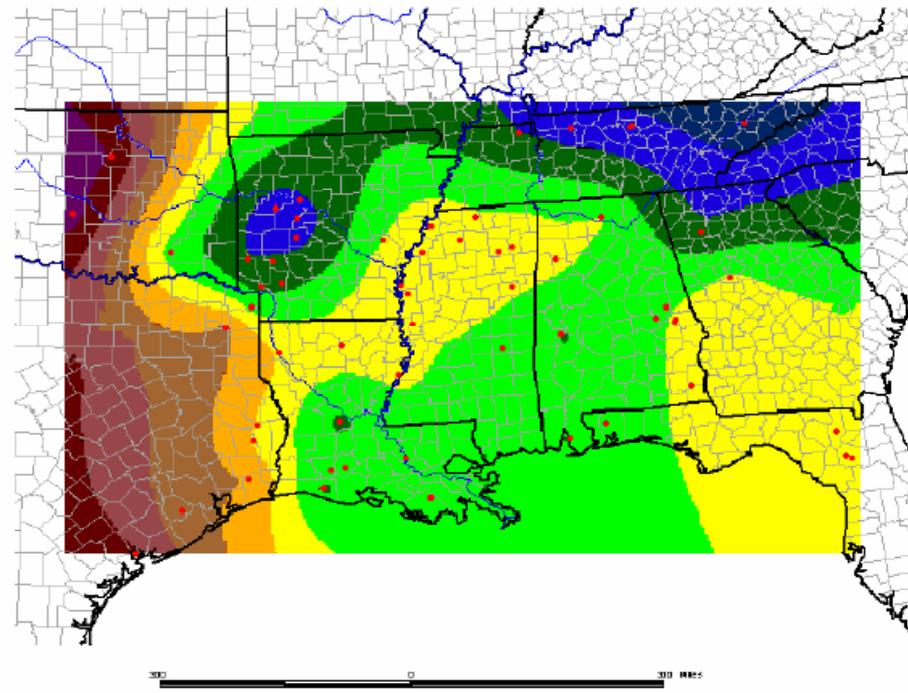




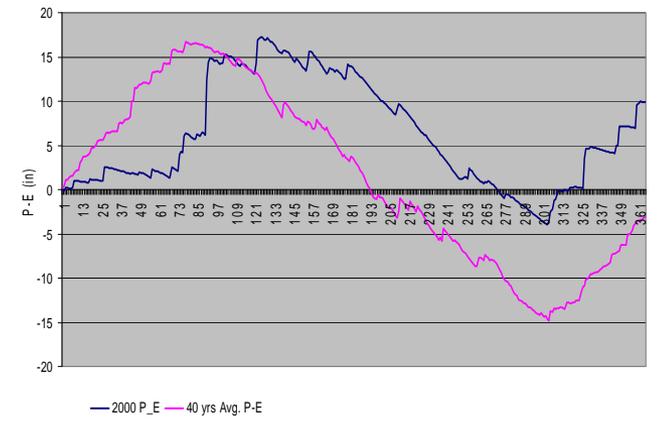
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EFPM - Expansion of the Mississippi Model



• Stations
Evaporation (in.)



Cummulative P-E in 2000 Versus 40-Year Average

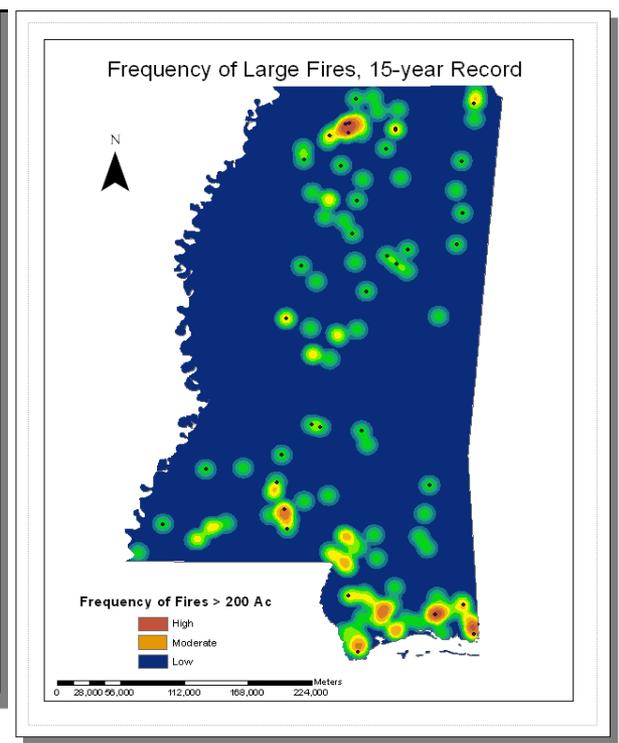
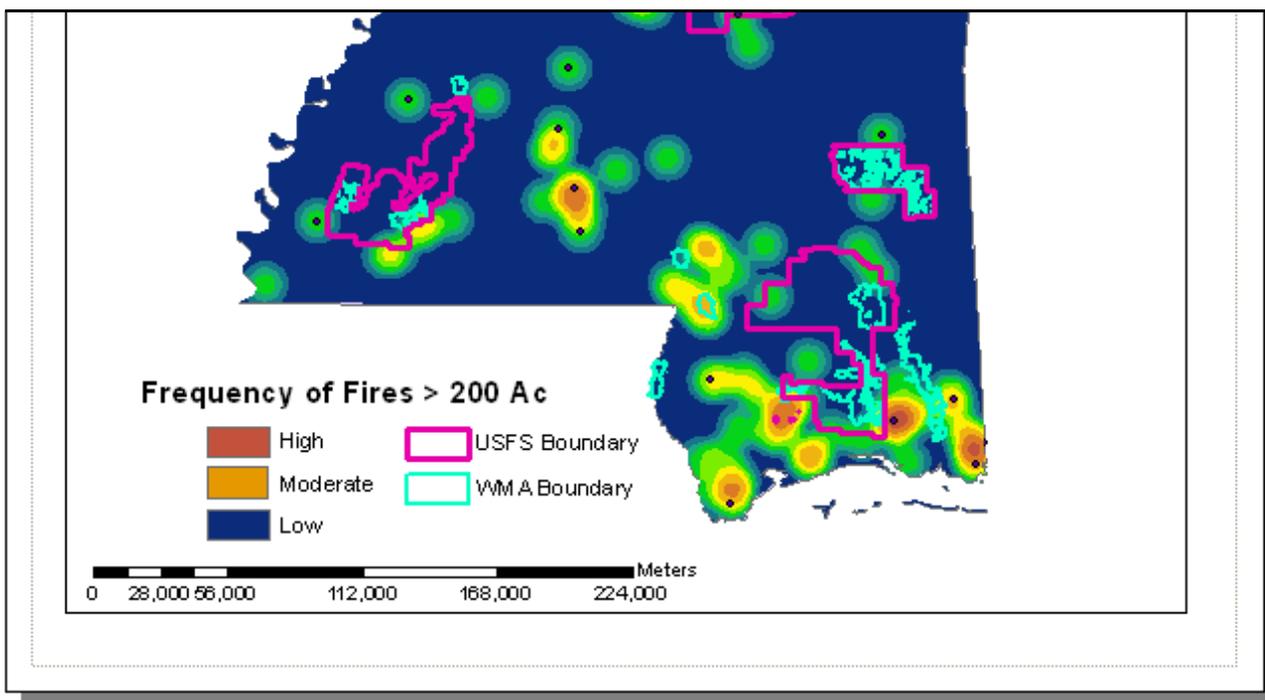
Figure 19: Regional Growing Season Evaporation



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Coastal Issues – Katrina Population Displacement



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Current WFAS (DSS) Deficiencies

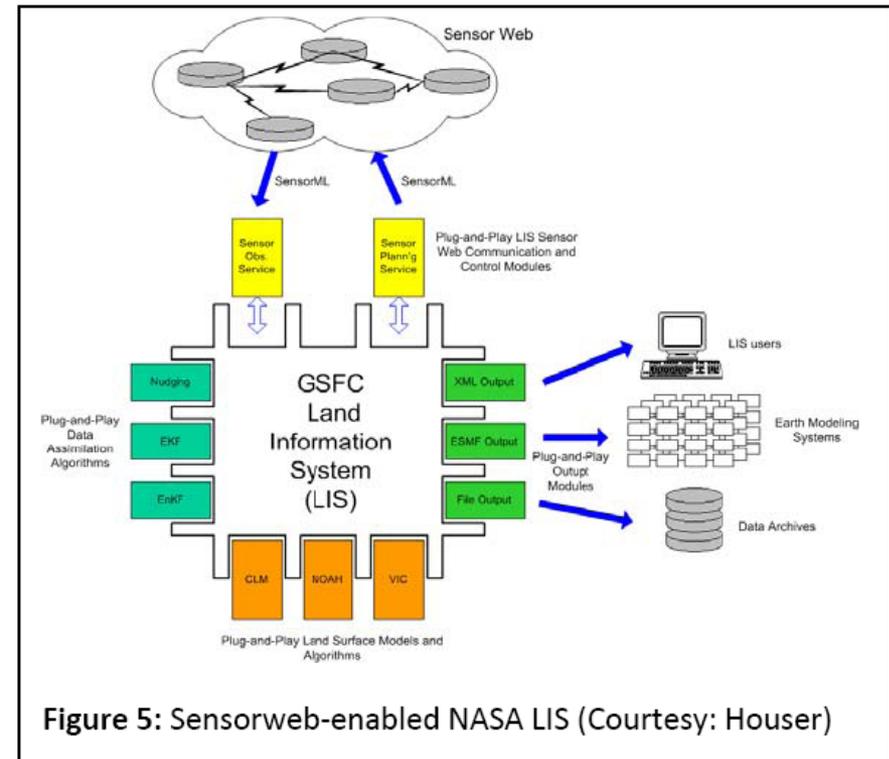
- Fire danger calculations are **not** performed on a **grid**, but are simply **interpolated from point-source fire danger determination...and,**
- Does not make full use of the finer spatial features that could be extracted from high-resolution remotely sensed observations as well as numerical models that provide gridded weather resources at finer spatial resolutions (1x1 km²).
- Spatial maps are created using inverse distance weighting resulting in the 'Bull's-Eye Effect'

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Land Information System

- The **main objective** of this subtask is to **provide validated estimates of the soil moisture content and moisture budget components at regional and local scales**. The Noah (Ek et al., 2003) and Mosaic (Koster and Suarez 1992) land surface models (LSM) will be used to simulate soil moisture with $0.25^\circ \times 0.25^\circ$ grid resolution (baseline runs) over the SE states. Additional fine-scale simulations (at $0.01^\circ \times 0.01^\circ$ and $0.05^\circ \times 0.05^\circ$ resolutions) will be performed to evaluate the level of the soil moisture sub-grid scale variability within $0.25^\circ \times 0.25^\circ$ lat.-lon. grid cells.

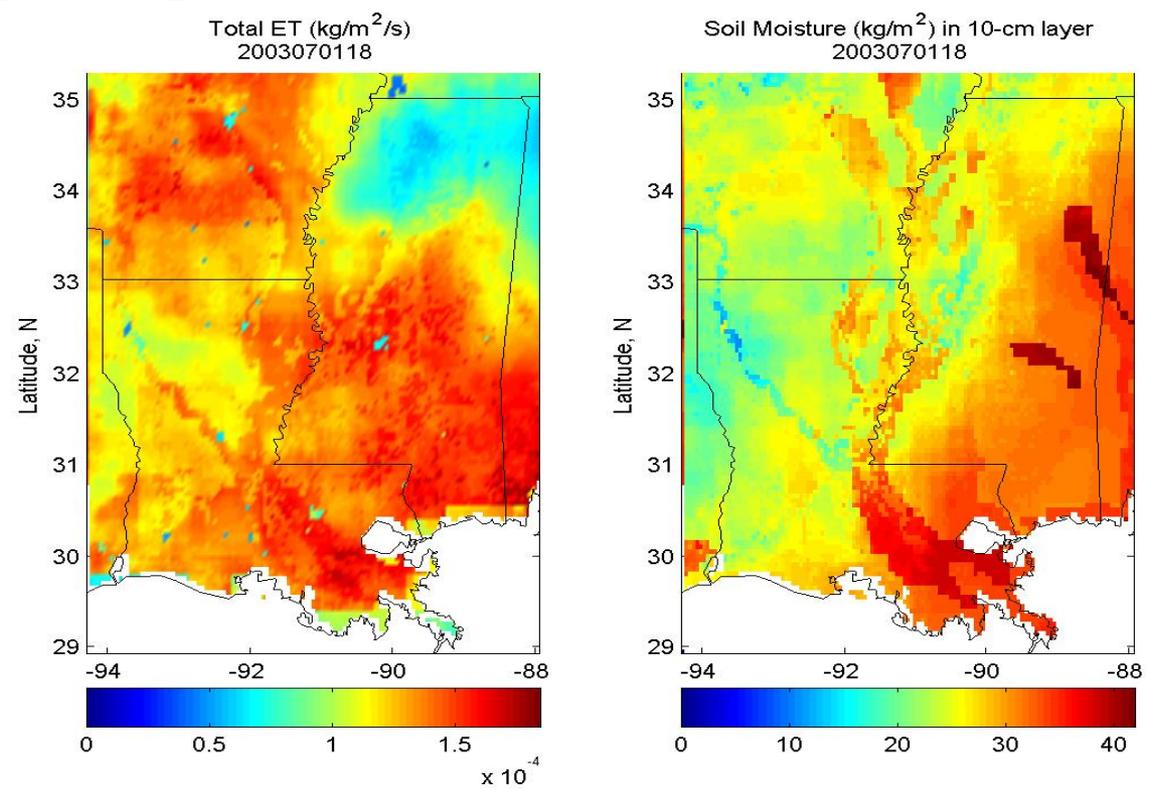




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Improved Moisture Budget

Evapotranspiration/Soil Moisture (ET – NOAH land model)

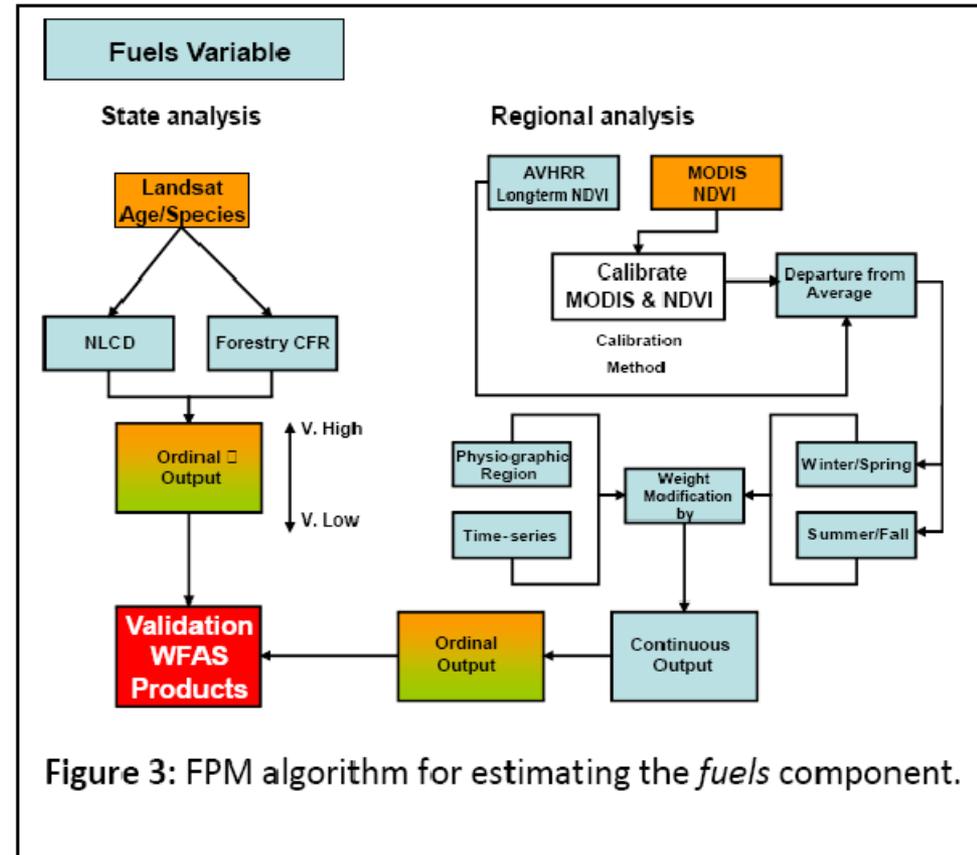


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New Vegetation (Fuels) Content

- MODIS NDVI
 - Calibrate to AVHRR Long-term NDVI
 - Calculate Departure from Average
 - Modify Weighting Coefficients via Time-series Results





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Data and Methods

The Eastern Fire Potential Model will employ a suite of NASA data in conjunction with the NASA Land Information System in order to assess and make predictions of wildfire risks in the eastern United States. We will incorporate NDVI and EVI products from the MODIS sensors on-board NASA's Terra and Aqua platforms to derive better estimates of the fuel content. The award-winning **NASA Land Information System (LIS)** will be used to simulate **improved land surface cumulative moisture budgets** at different spatial resolutions. We will also plan to assimilate observations from the Advances Microwave Spaceborne Radiometer – EOS (AMSR-E). The land surface models in LIS use forcing data from the National Land Data Assimilation System (N-LDAS) project, co-sponsored by NASA. Currently, **LIS uses vegetation fraction (VF), derived from historical AVHRR observations**, as parameter data. We will also **verify the effectiveness of VF derived from MODIS**. Besides, our algorithms and methodologies will also be able to readily take advantage of future observations from the NPP (for example VIIRS), Soil Moisture Active Passive (SMAP), GOES-R and Global precipitation Measurement (GPM) missions. The following table summarizes our plans for integrating NASA data, models and research results.

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Analysis of System Performance

- We will compare the daily/weekly predictions from the EFPM to those of the National Fire Danger Rating System (NFDRS) that is currently being used throughout the United States.
- The predictions from the new Fire Potential Model will be considered an improvement if a higher percentage of fires occur in the highest fire danger classes as compared to the baseline fire danger assessments from NFDRS.



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Analysis of System Performance

- We will perform **two independent parallel sets of verifications**: one by the research group at **Mississippi State University** and another by the **USFS Fire Sciences Laboratory (FSL)**.
- The MSU group will adopt some of the verification metrics for categorical forecasts used routinely by the numerical weather prediction community: measures of accuracy such as *proportion correct*, *probability of detection*, and *false alarm ratio* (Ebert et al. 2007; Wilks, 2007); and skill scores including *Heidke and Pierce Skill Scores* and *Gandin and Murphy Equitable Scores* (Livezey, 2003).



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Analysis of System Performance

- Emerging ***fuzzy verification techniques*** could offer more appropriate verification statistics by rewarding “closeness” and not penalizing near-misses (Ebert 2008).
- The USFS FSL will use spatial statistical method developed jointly between the **Missoula Fire Sciences Laboratory and the Mathematical Sciences Department of the University of Montana** to compare the effectiveness of the new southern fire potential model to the benchmark NFDRS model.



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Questions?