The CANSAC/BLUESKY Connection

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Program for Climate, Ecosystem and Fire Applications

Reno, NV

California and Nevada Smoke and Air Committee

Products | Overview | Projects | Committee | COFF | Updates | Links

CANSAC provides experimental forecast products of fire weather, smoke dispersion/transport, fire danger and fire behavior.

The California and Nevada Smoke and Air Committee (CANSAC) membership includes:

[USDA Forest Service Region 5]

[Bureau of Land Management California State Office]

[Bureau of Land Management Nevada State Office]

[U.S. Fish and Wildlife Service Pacific Region]

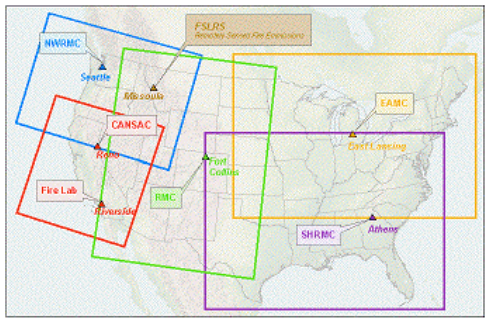
[National Park Service]

[USDA Forest Service Pacific Southwest Research Station]

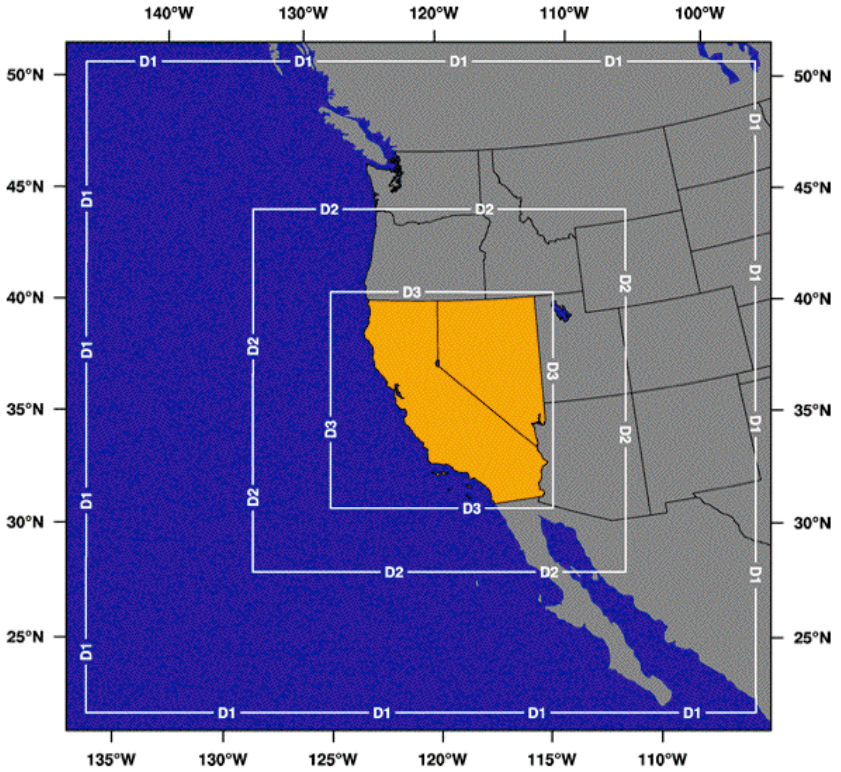
[California Department of Forestry and Fire Protection]

[California Air Resources Board]

[San Joaquin Valley Air Pollution Control District]



[Fire Consortia for Advanced Modeling of Meteorology and Smoke (FCAMMS)]



The three CANSAC model domains.

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ECOSYSTEM CLIMATE FIRE APPLICATIONS

Partners

- USDA Forest Service Region 5
- California Air Resources Board
- USDA Forest Service Pacific Southwest Research Station
- U.S. Fish and Wildlife Service Pacific Region
- National Park Service
- Bureau of Land Management California State Office
- Bureau of Land Management Nevada State Office
- California Department of Forestry and Fire Protection
- San Joaquin Valley Air Pollution Control District
- Los Angeles County Fire Department

CANSAC Structure

- Board of Directors
  - 9 members
- Operational and Applications Group
  - 7 members
- Technical Advisory Group
  - 5 members

CANSAC as a Science – Decision-Maker Partnership

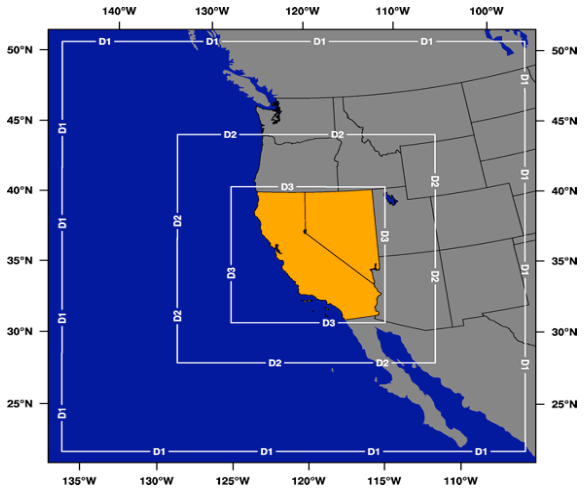
- Partnership structure
- Organizational design
- Availability of resources
- CANSAC management
- Leadership
- Progress

CEFA-CANSAC Personnel

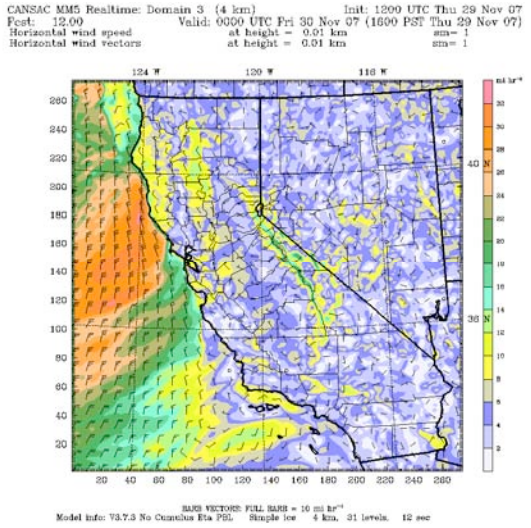
- Domagoj Podnar - Systems administration/Operations and Development Manager
- Hauss Reinbold - Web and graphics
- Tesfamichael Ghidey - Ph.D. student
- Crystal Kolden - Outreach

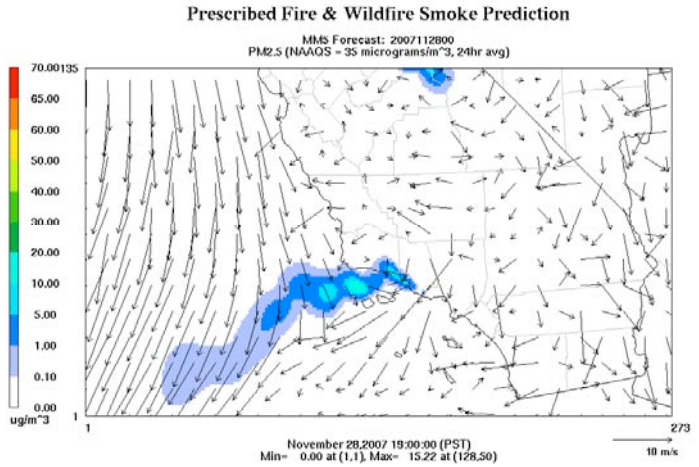
MM5 Configuration

- Coarsest domain 36 km, nested domain 12 km, and innermost (Nevada/California) domain 4 km horizontal grid spacing and 32 sigma (vertical) levels.
- Initialized at 00Z and 12Z
- Forecast length: 72 hr for domains 1 and 2, and 60 hr for domain 3



Sample products






sgi
sgi altix 3000
sgi

BLUESKY BACKGROUND

- BlueSky is a real-time smoke forecasting system that is used to predict surface smoke concentrations (PM2.5) from prescribed fire, agricultural burns, and wildfires.
- The BlueSky smoke forecasting system was developed by the USDA Forest Service in cooperation with the US EPA and funded by the National Fire Plan.
- It is currently being implemented and evaluated across the nation by the members of FCAMMS.

BlueSky Modeling Framework

Fire Characteristics

Area burned

Fuel moisture

Fuel loadings

Fire location

Fire ignition time

Meteorology

CANSAC MM5 outputs

Winds/Temps/Moisture

12 and 4 km domains

72 and 60 hour (-12 hr spin up) forecast

Smoke Dispersion&Transport

CALPUFF/CALMET modeling system

PM2.5 concentrations

Emissions

EPM emissions model

Fuel consumption

Variable rate emissions

PM10, PM2.5,CO, CO2, CH4

Display

PAVE visualization package

NCL images (in progress)

Loops and hourly concentrations of PM2.5

BlueSky Framework

WEATHER FORECAST MODEL OUTPUT

MM5
WRF

MET INTERPRETER

CALMM5

FIRE INFORMATION REPORTING SYSTEMS

Wildfire ICS 209
FASTRACS
RAZU
Manual
Other

FUEL LOADING

FCCS
Hardy (West)
NFDRS

CONSUMPTION

CONSUME 1.02
CONSUME 3
BURNUP

EMISSIONS

EPM
FEPS
BURNUP
Idealized profile

HYSPLIT

TRAJECTORIES

DISPERSION

CALPUFF
HYSPLIT

SMOKE TRAJECTORY & CONCENTRATION PREDICTIONS

Framework is
- Modular
- Open-sourced
- Portable

AIRFIRE
ATMOSPHERE & FIRE INTERACTIONS RESEARCH & ENGINEERING

Fire Characteristics (I)

- Information to derive fire characteristics is obtained from the burn reporting systems. These can be multi-agency tracking systems such as FASTRACS in the Pacific Northwest, PFIRS in California, wildfire 209 reports (NIFC), and private manually entered burn information.
- When the fuel loadings are not provided, the BlueSky system has three default fuel loadings look-up tables to employ:
  - 1-km resolution fuel loadings mapping available for the western US (Hardy et al., 1998).
  - Fuel Characteristics Classification System (FCSS) at 1-km resolution (www.fs.fed.us/pnw/fera/fccs/index.html).
  - National Fire Danger Rating System (NFDRS) at 1-km resolution.

Emissions (I)

- Fuel consumption and emissions are calculated using the Emissions Production Model (EPM)/Consume v1.02
  - Consume is a fuel consumption model that computes the total amount of fuel consumed by a fire
  - EPM is a model that predicts the time rate of fuel consumption and emissions from wildland biomass burns. Hourly emission rates of PM10, PM2.5, PM, CO, CO2, CH4 and heat release are obtained from this system.

Meteorology

- Meteorology driving the BlueSky system is obtained from MM5 forecasts
- A preprocessor, CALMM5, is used to extract the meteorological fields used in CALMET
  - Horizontal and vertical winds, temps, pressure, humidity, and vapor, cloud, rain, snow, ice mixing ratios

Smoke Dispersion and Transport

- The BlueSky system incorporates the CALMET/CALPUFF system to predict smoke dispersion and transport
- CALPUFF is a multi-layer, multi-species non-steady state Lagrangian puff dispersion model which can simulate the time and space varying pollutant transport, transformation and removal
- CALMET is a diagnostic meteorological model that calculates the three dimensional winds and temperatures along with microphysical parameters such as surface characteristics, dispersion parameters, and mixing heights to be used by CALPUFF dispersion model

Burn Information

- The CANSAC BlueSky system is fed by the Wildfire 209 reports and the CANSAC web-based manual prescribed burn information system
- PFIRS will begin to feed data into the CANSAC system in spring 2008

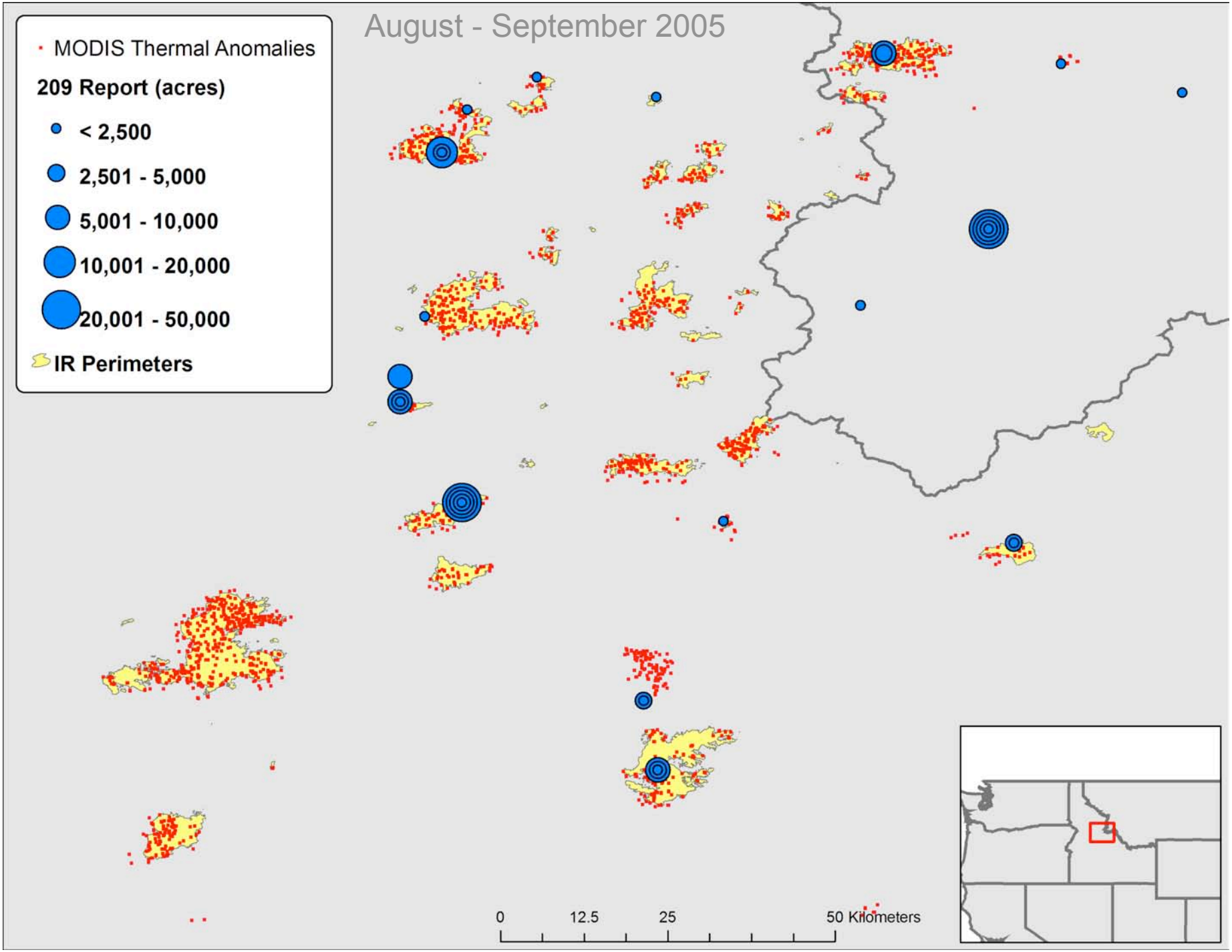
BlueSky Simulations

- The BlueSky simulations are performed daily using the MM5 output initialized at 0Z
- These simulations start at midnight
- Surface smoke (PM2.5) concentration predictions are obtained on the nested (12 km) and innermost (4 km) MM5 domains
- Forecast length – 72hr:
- Accomplished burns are reprocessed 4-6 days back in order to account for carryover smoke

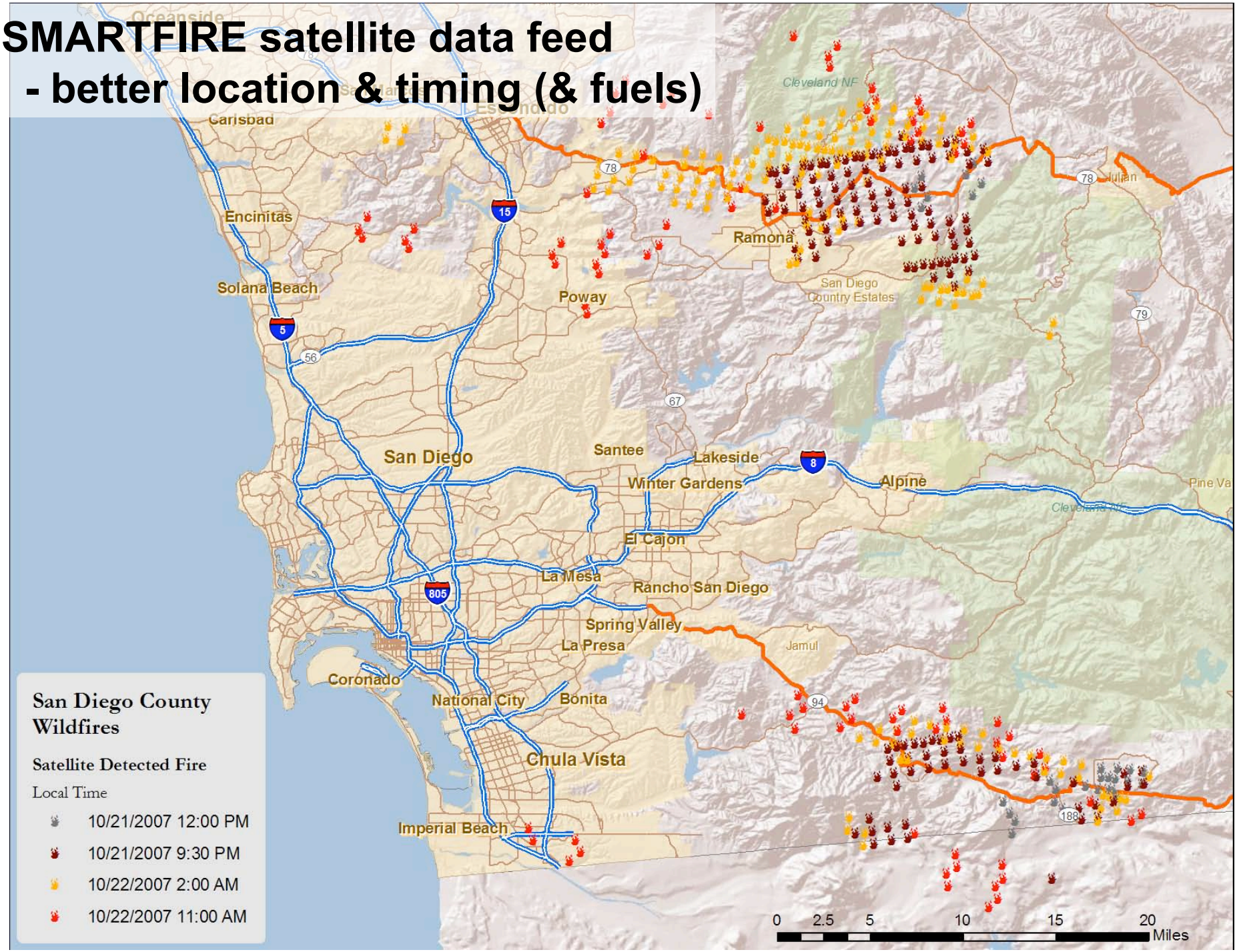
Plume Rise

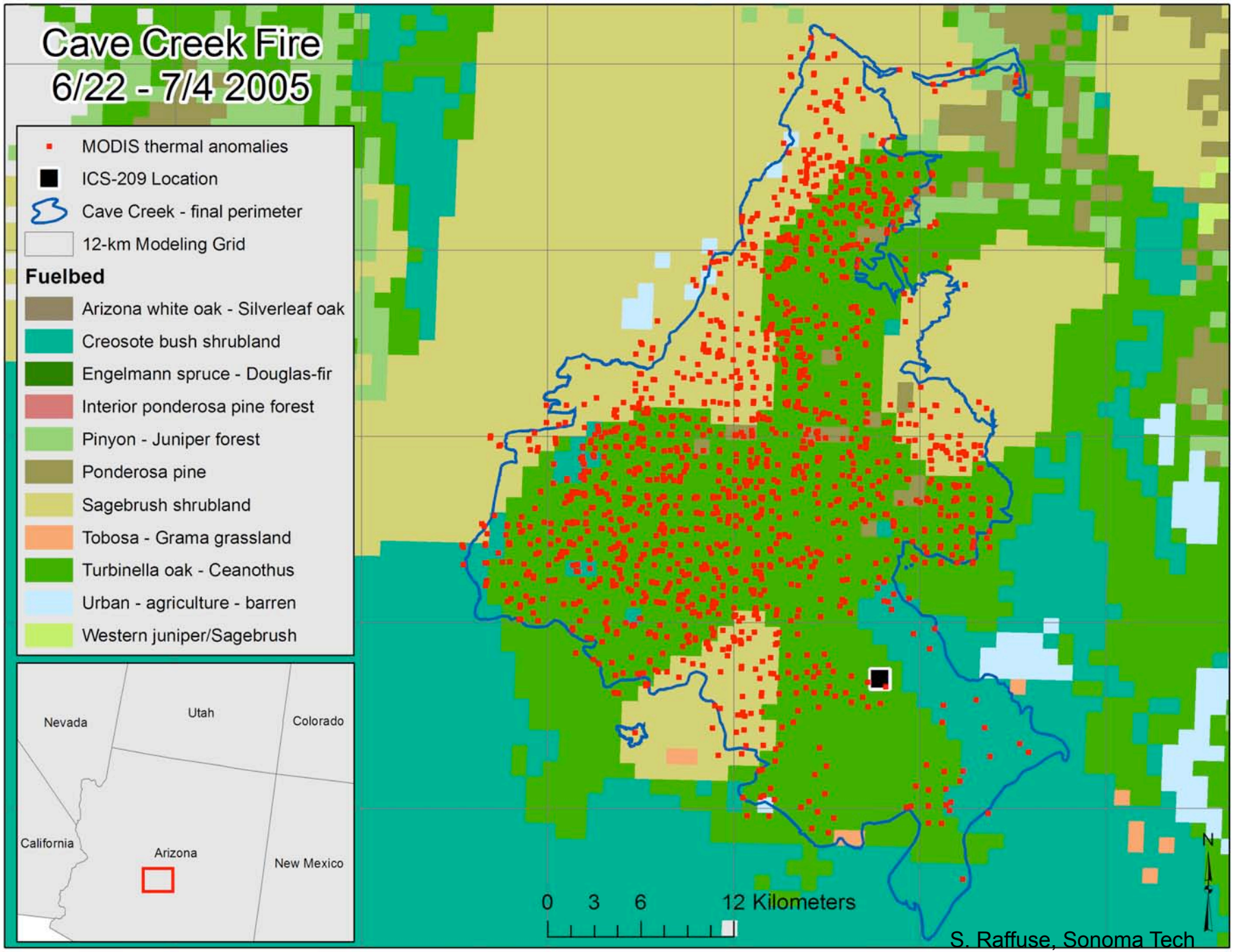
- Fires are currently modeled as single plumes, lofting smoke unrealistically high and lowering ground impacts

- In reality, fires are made of many burning areas lofting smoke to various heights


August - September 2005
MODIS Thermal Anomalies
209 Report (acres)
< 2,500
2,501 - 5,000
5,001 - 10,000
10,001 - 20,000
20,001 - 50,000
IR Perimeters
0
12.5
25
50 Kilometers

SMARTFIRE satellite data feed
- better location & timing (& fuels)




Cave Creek Fire
6/22 - 7/4 2005
MODIS thermal anomalies
ICS-209 Location
Cave Creek - final perimeter
12-km Modeling Grid
Fuelbed
Arizona white oak - Silverleaf oak
Creosote bush shrubland
Engelmann spruce - Douglas-fir
Interior ponderosa pine forest
Pinyon - Juniper forest
Ponderosa pine
Sagebrush shrubland
Tobosa - Grama grassland
Turbinella oak - Ceanothus
Urban - agriculture - barren
Western juniper/Sagebrush
Nevada
Utah
Colorado
California
Arizona
New Mexico
0 3 6 12 Kilometers
N
S. Raffuse, Sonoma Tech