

Tactical Fire Remote Sensing Advisory Committee Meeting
Boise, Idaho, 5 November 2013

Enhancing Wildland Fire Decision Support and Warning Systems



Presenter: S. V. Nghiem
Jet Propulsion Laboratory, California Institute of Technology

Project Team

Investigators/Partners

Principal Investigator: S. V. Nghiem, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California (Other JPL personnel: G. Neumann, J. Kwan, S. Chan)

Co-Principal Investigator: M. Kafatos, Schmid College of Science and Technology, Chapman University, Orange, California (Other Chapman personnel: B. Myoung, N. Hatzopoulos, S. H. Kim, X. Liu, S. Calderon, D. Stack, L. Rodriguez, H. El-Askary, A. Schilbach)

Co-Investigators/Partners:

National Weather Service, Los Angeles/Oxnard, California: M. Jackson, D. Gomberg, J. Dumas, J. Layber, and E. Boldt

US Forest Service, Pacific Southwest Research Station (Emeritus); also Chapman: F. Fujioka
Atmospheric, Meteorological, and Environmental Tech., ATMET LLC, Boulder, CO: C. Tremback

Collaborators

Los Angeles County Fire Dept.: Fire Chief F. Vidales, J. Lopez, T. Hanna, D. Smith, J. Wilson

Orange County Fire Authority: Fire Captain G. Hosburg, G. Ewan, K. Boman

Ventura County Fire Department: Fire Chief C. Cook, Fire Captain B. Ripley

Jet Propulsion Laboratory Fire Department: Fire Chief J. Twyman

USFS Predictive Service, South Ops GACC: Program Manager T. Rolinski

USFS Pacific Southwest Research Station (aka USFS Forest Fire Laboratory)

USFS Angeles National Forest Headquarters (Angeles Training and Conference Center)

U.S. National Ice Center (Navy, NOAA, U.S. Coast Guard): Chief Scientist P. Clement-Colón

NASA Goddard Space Flight Center: Associate Chief and Senior Scientist D. K. Hall

Outreach and Press Release

Jet Propulsion Laboratory News Room, A. Buis; **Chapman Public Relations,** S. Ledbetter

Focus

Rather than post-fire assessments, the focus will be primarily on the pre-fire fire phase, which is the most important for fire agencies to make key decisions, leading to mandatory actions and measures that are crucial to saving lives and properties with appropriate situation preparedness before wildfires actually occur.

This is a Phase-1 project to demonstrate the feasibility. If successful, Phase-2 work will be extensive to achieve operational capability.

Objective

The objective of this project is to investigate the feasibility of satellite remote-sensing measurements and derived products for enhancing wildfire operational systems such as the National Fire Danger Rating System (NFDRS), the Wildland Fire Decision Support System (WFDSS) and wildfire system for Fire Weather Watches (FWW) and Red Flag Warning (RFW), with a multi-institutional and multi-agency interdisciplinary team.

Approach

- Use NASA and international satellite remote sensing data, including moisture and vegetation observations, to obtain direct and derivative products that are specifically tailored to the needs and requirements for operational wildfire applications.
- Assess weather and fire modeling capabilities, including the Regional Atmospheric Modeling System (RAMS) and the Fire Area Simulator (FARSITE) using remote sensing/ancillary data.
- Demonstrate how the above can help enhance fire danger rating, fire weather watch, and red flag warning.
- Work closely and interactively among investigators and fire agencies.

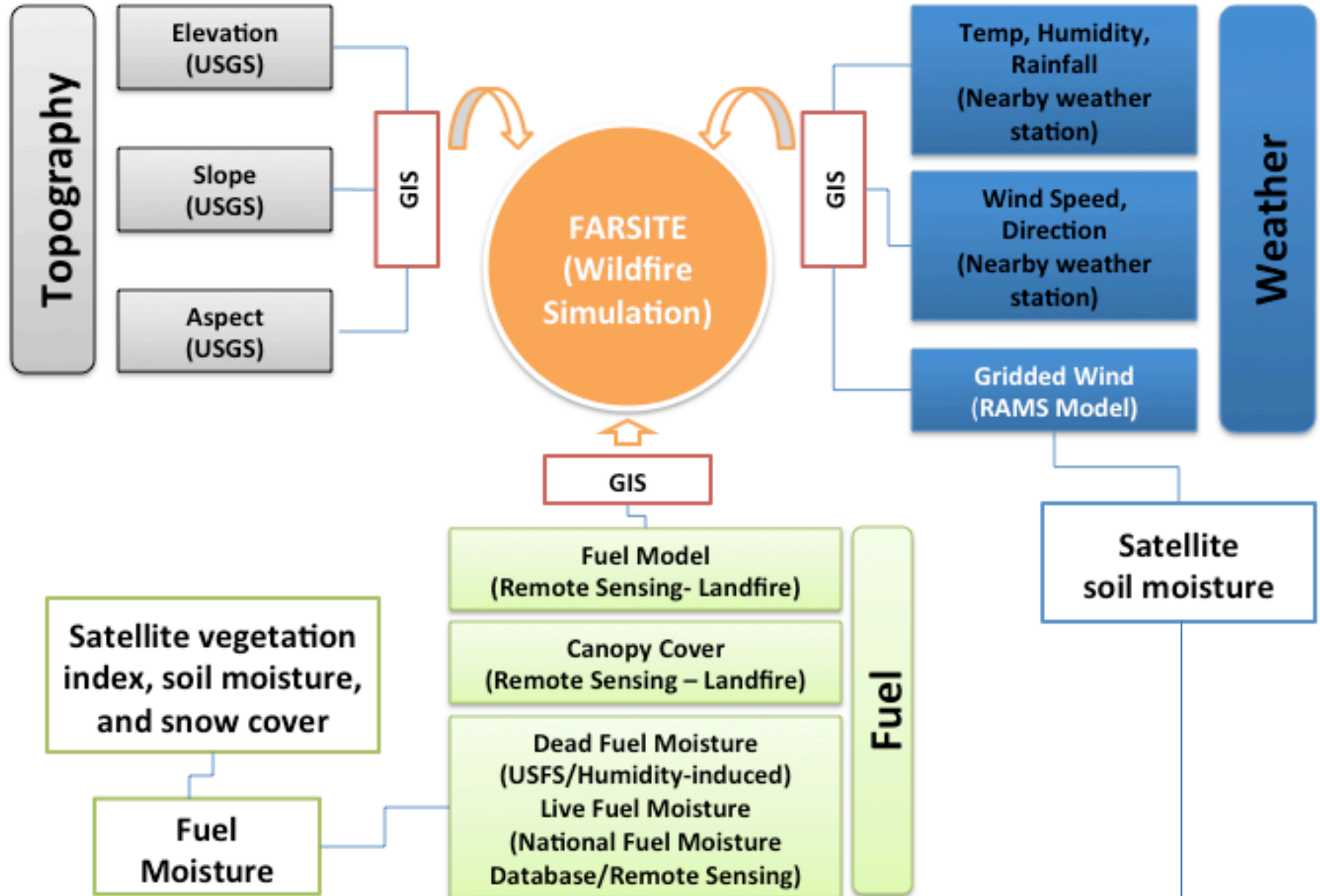
Remote Sensing

- Multispectral sensors: NASA Moderate Resolution Imaging Spectroradiometer (MODIS) and Visible Infrared Imager Radiometer Suite (VIIRS).
- Passive microwave sensors: Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) and AMSR-2.
- Active microwave sensors: NASA QuikSCAT/SeaWinds scatterometer (QSCAT) and Indian Space Agency Oceansat-2 scatterometer (OSCAT).
- Combined active and passive sensors: NASA Soil Moisture Active and Passive (SMAP) mission, planned for launch in 2014.

Earth Satellite Missions



Modeling



Interactions



- Promote close interactions between researchers and practitioners (fire agencies) like this meeting.
- Exchanging and sharing research information and practice information: How products can be best derived to meet the needs of practitioners.
- Visiting and learning capabilities among research and operational institutions. Many meetings.
- Field observations: e.g., Live fuel moisture sampling in Black Star Canyon hosted by OCFA.
- Outreach: NASA/JPL/Chapman press release.

Progress

| Technical | | | Budget/Cost | | | Schedule | | | Performance | | | Overall | |
|-----------|--------|--|-------------|--------|--|----------|--------|--|-------------|--------|--|---------|--------|
| Prev | This | | Prev | This | | Prev | This | | Prev | This | | Prev | This |
| Review | Review | | Review | Review | | Review | Review | | Review | Review | | Review | Review |
| N/A | G | | N/A | G | | N/A | G | | N/A | G | | N/A | G |

Technical:

- (1) Developed/implemented data processing systems to obtain soil moisture prototypes from QuikSCAT/Oceansat-2/AMSR-E, (2) system to obtain EVI prototype from MODIS, (3) proven satellite capability to replicate critical parameters for fire danger assessment, (4) performed RAM/FARSITE model simulations, (5) fire agencies/partners provided specifications/requirements for Phase-II products to enhance FWW, RFW, NFDRS, WFDSS systems, (6) stakeholders to use products from Phase 2.

Budget/Cost:

- All costs are within budget. Significant in-kind contributions from partners and collaborators.

Schedule:

- Project was a later start (1-1-13) than other A35 projects (~9-30-13); Requires “special case” eval. for Phase II continuation. An NCE was completed for the end date of 4/1/2014.
- Schedule and major milestones: recent ones met. Significant ones upcoming - final report to submit.

Performance:

- Current ARL: **2** (Starting ARL: **1**; Projected Ending (Goal) ARL: **3**). PI is “ARL-savvy”, and has modified ARL estimates. Tracking well to Goal ARL.

Partners/Users: Strong collaborations and participations from fire agencies/stakeholders.

Goal ARL 3 achieved, results shown in several presentations in this meeting

Publications

Journal papers:

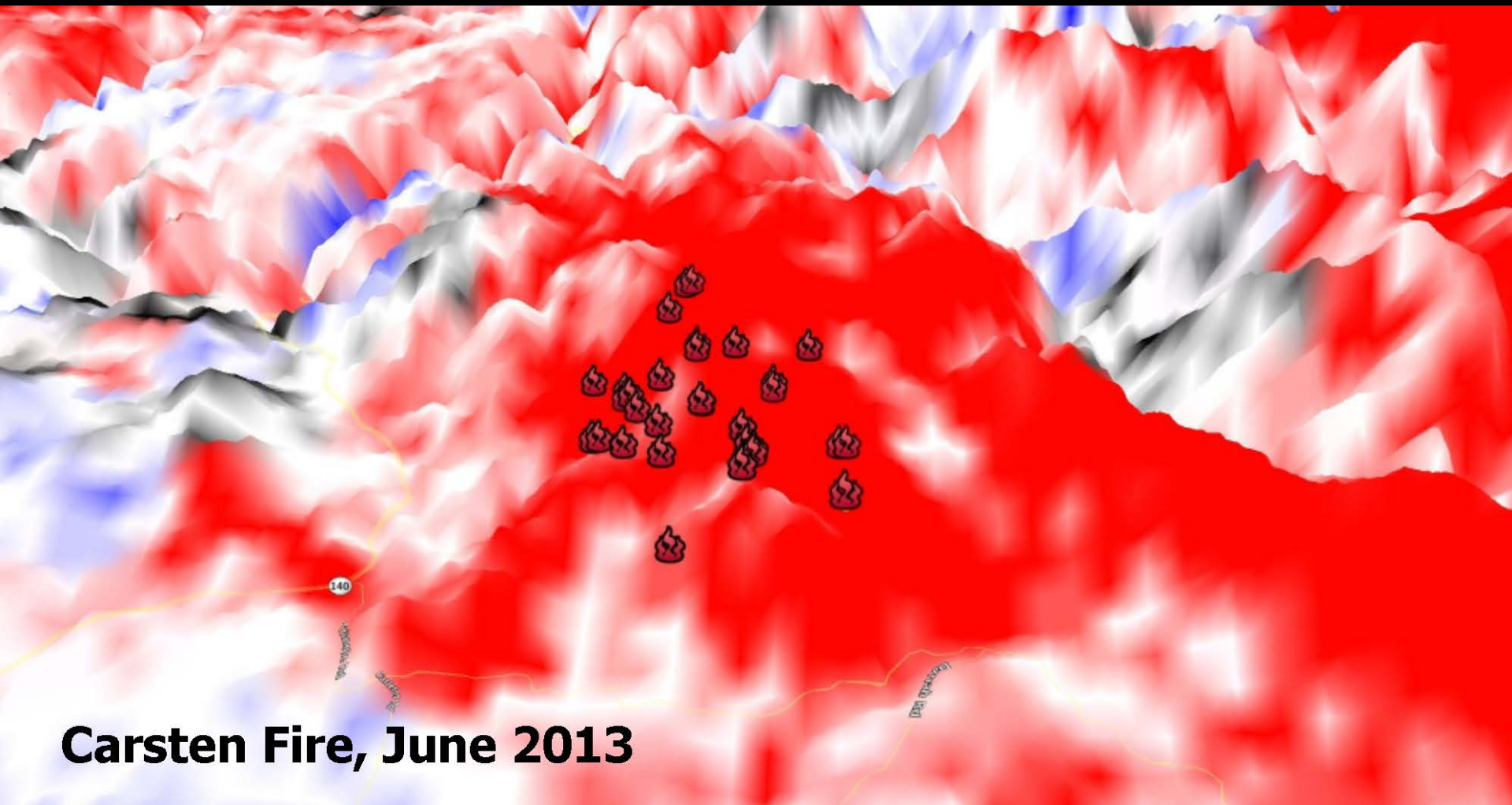
- Myoung et al., Possibilities and limitations in Estimating Live Fuel Moisture by Satellite EVI in Southern California, *paper in preparation*, to be submitted for peer-reviewed publication, 18 pp., 2013.
- Nghiem et al., Pattern and Frequency of Soil Moisture Variability over the Continental United States, including a section presenting results for the Tea, Sayre, and Freeway Fires in 2008, and the Jesusita Fire in 2009, *paper in preparation*, to be submitted for peer-reviewed publication, 54 pp., 2013.

Conference/workshop presentations:

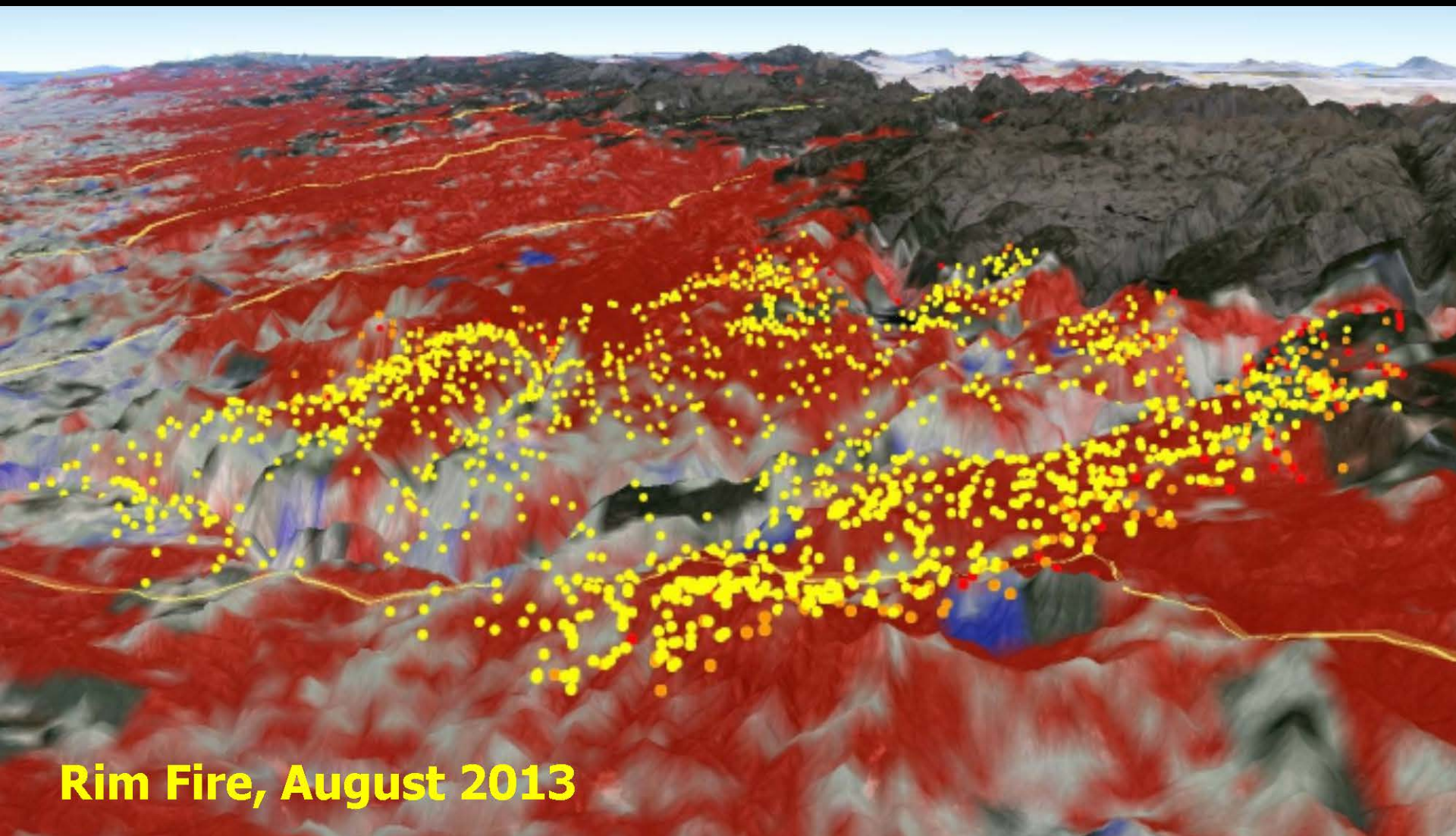
- Nghiem, S. V., and M. Kafatos, Satellite remote sensing and wildfires, invited presentation, *Measuring, Quantifying, and Reporting Drought Impacts*, sponsored by Western States Water Council and California Department of Water Resources in cooperation with the Western Governors' Association, San Diego, California, Aug. 2013.
- Nghiem, S. V., Feasibility of satellite measurements of soil moisture and vegetation for wildfire applications, invited presentation, *Fire Summit*, Diamond Bar, California, May 2013.
- Nghiem, S. V., Satellite remote sensing of soil moisture and urbanization for drought, flood, and wildfire applications in U.S. and across the world, invited presentation, *International Space Development Conference*, San Diego, California, May 2013.

News articles:

- Becerra, H., Satellite images show 'double jeopardy' wildfire danger, Los Angeles Times, <http://articles.latimes.com/2013/may/13/local/la-me-ln-satellites-shows-double-jeopardy-wildfire-danger-20130513>, May 2013.
- Brennan, P., Tracking wildfire Risk – from orbit, <http://www.ocregister.com/articles/fire-529368-wildfire-team.html>, *Orange County Register*, Oct. 2013.
- Buis, A., and S. Ledbetter, NASA/JPL/Chapman Press Release - Satellites See Double Jeopardy for SoCal Fire Season, <http://www.nasa.gov/topics/earth/features/earth20130513.html>. Extensive mass media coverage: NBC, ABC, CBS, Los Angeles Times, Orange County Register, Science Daily, Cal Fire News, etc., May 2013.
- CBS News video on CBS Evening News with Scott Pelley, Scientists developing weapons to fight fires before they start, <http://www.cbsnews.com/video/watch/?id=50150368n>, Jul. 2013.
- O'Connor, R., NASA: MODIS Satellites See Double Jeopardy for Southern California Fire Season, Cal Fires News, <http://calfire.blogspot.com/2013/05/nasa-modis-satellites-see-double.html>, May 2013.
- Platt, M., The Combustible Season, http://issuu.com/chapmanu/docs/cmmagz_f13/1, *Chapman Magazine*, Fall issue, pp. 17-18, Oct. 2013.
- Shuppe, J., California Wildfires – After Brutal Start, Wildfire Season Could Get Much Worse, NBC 4 News, Southern California, <http://www.nbclosangeles.com/news/local/California-Wildfires-Fire-Season-Destructive-211451011.html>, Jun. 2013.
- Tracy, B., Fighting wildfires with science, http://www.cbsnews.com/8301-18563_162-57592538/fighting-wildfires-with-science/, CBS News article, Jul. 2013.



Carsten Fire, June 2013



Rim Fire, August 2013



Baker Fire, October 2013