

Extreme Fire Weather and the Electric Power Grid

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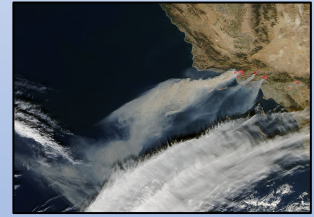


Acknowledgements: L. Carvalho, G-J. Duine, C. Thompson, D. Seto, K. Varga, K. Zigner, M. Coello, D. Roberts, A. Murray, R. Church, F. Fujioka, M. Moritz, A. Trugman, UC Lab Fees collaborators

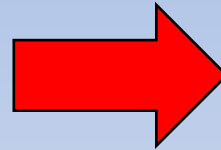
AGCI Navigating the Clean Energy Transition in a Changing Climate 14-15 Sep 2021



Extreme Fire Weather



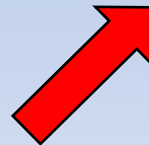
- High vegetation fuel-loads
- High Temperatures
- Low Humidity
- ★ High Winds



Explosive and fast spreading wildfires



Powerlines



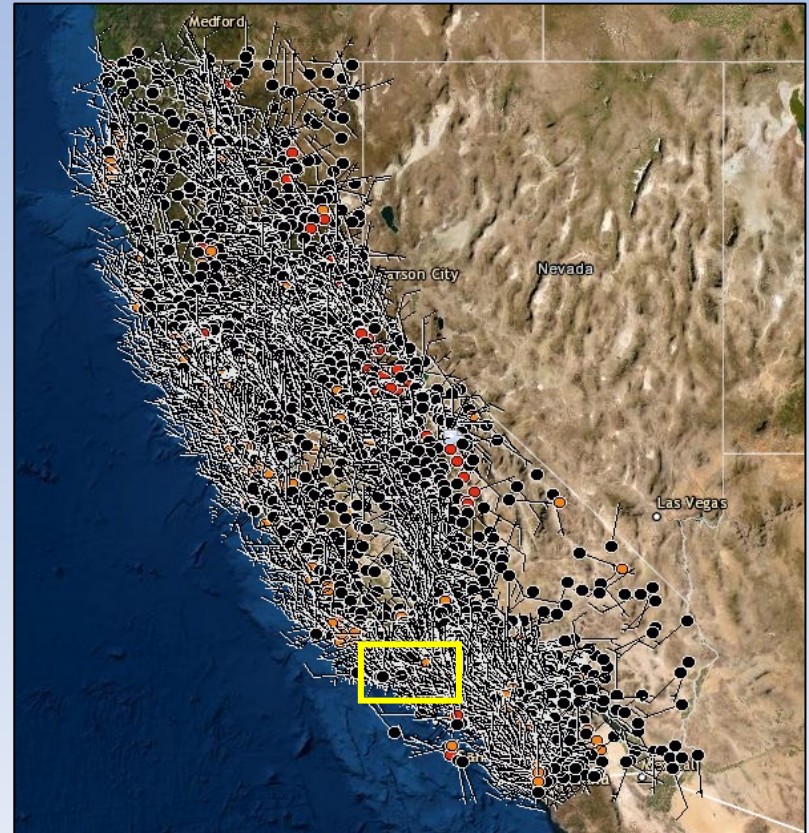
PSPS



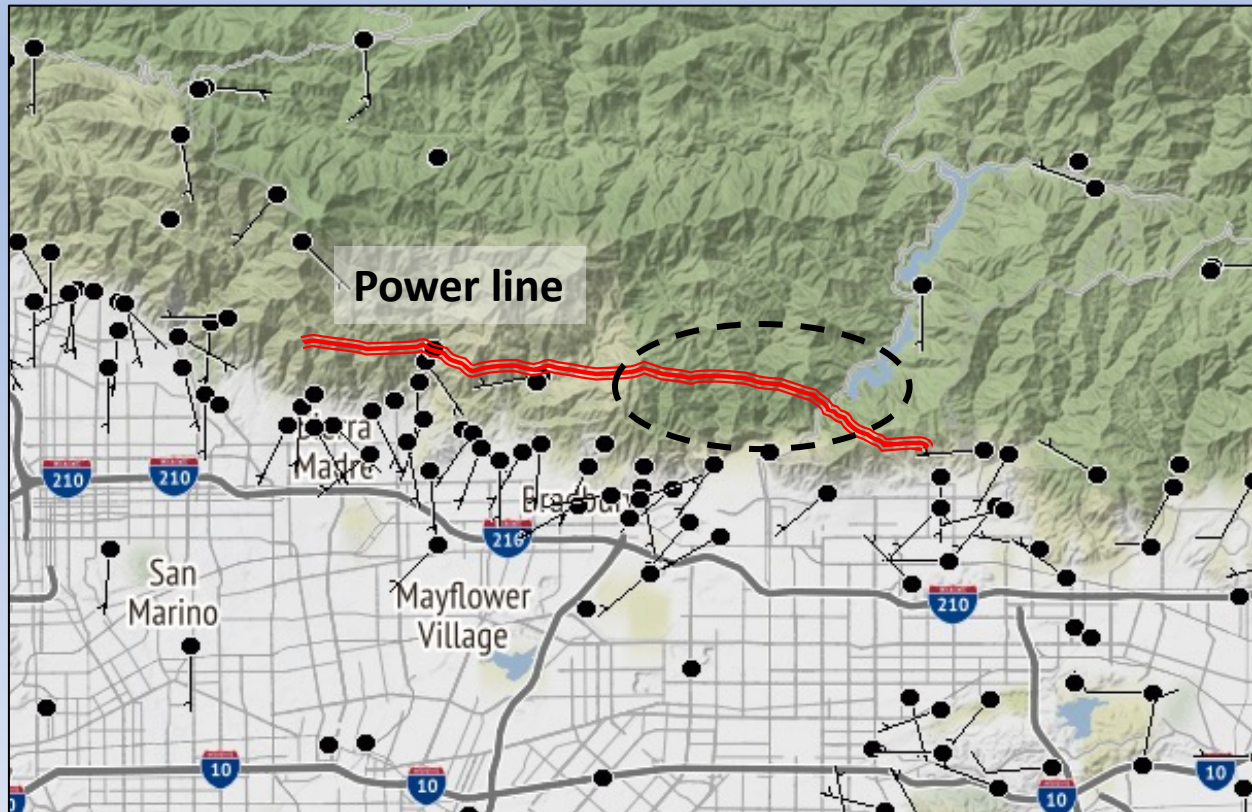
Understanding the variability of and predicting high wind events is critical (but very complicated ☹)



Meteorological station



Zooming in any given area



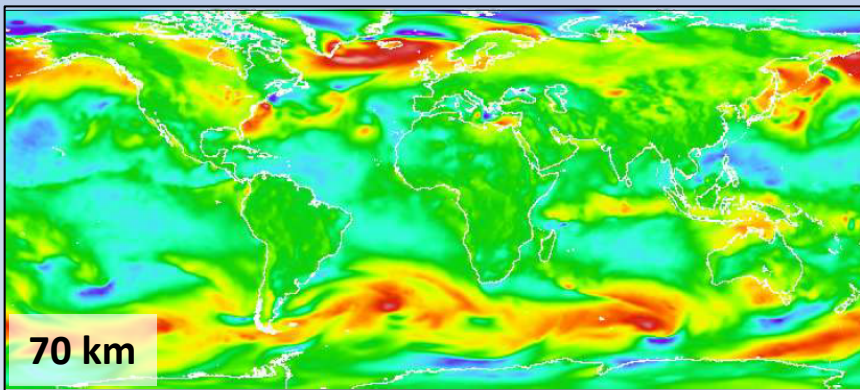
**Insufficient density of
meteorological observations**

Understanding Extreme Fire Weather Hazards and Improving Resilience in Coastal Santa Barbara, California

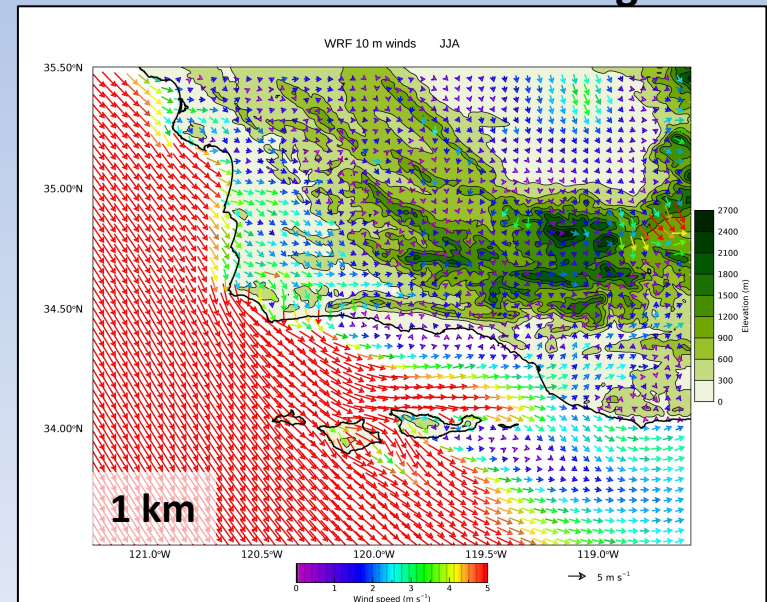
Carvalho, Church, Jones, Murry, Roberts, Moritz, Clements, Fujioka

Developed a 30-yr high resolution meteorological dataset

Global coarse resolution data



WRF Model Downscaling



Jones et al. 2020: Climatology of Sundowner winds in Coastal Santa Barbara, California, based on 30-yr high resolution WRF downscaling. *Atmospheric Research*, doi: [10.1016/j.atmosres.2020.105305](https://doi.org/10.1016/j.atmosres.2020.105305)

- 30-yr Downscaling
- High temporal (1-hr), spatial (1 km) resolution



Mitigating and Managing Extreme Wildfire Risk in California



University of California Lab Fees Program



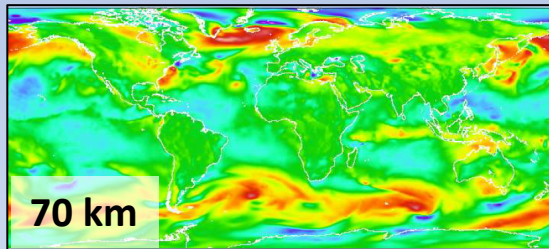
- ☐ **Climate change** modifying extreme fire weather
- ☐ Wildfire risks and **electric power grid** infrastructure
- ☐ Reliability of energy supply, wildfire risks and **PSPS**
- ☐ **Vegetation management** and wildfire risks in the electric grid infrastructure

★ Climate change, extreme fire weather and fire behavior

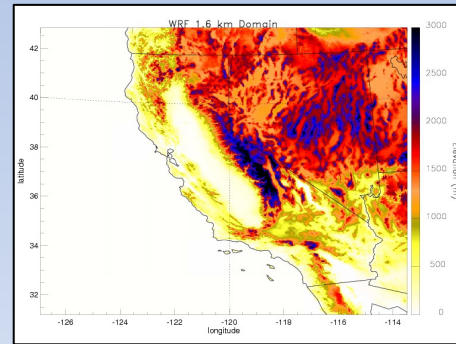
Planned Activities

⇒ Develop high resolution WRF model downscaling (30-yr, 1 km grid, hourly outputs), LLNL HPC systems: *big data*

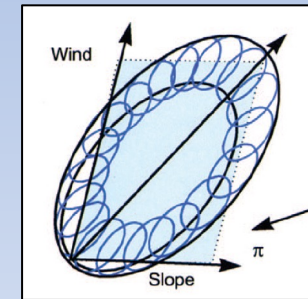
Global coarse resolution data



WRF Model Downscaling



Fire Spread Models



⇒ Use machine learning methods to construct databases of:

- ☐ Extreme fire weather, wind gusts
- ☐ Wildfire risks, emphasis on electric power grid, WUI

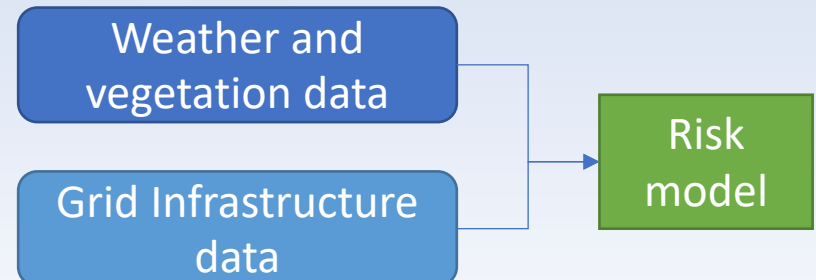
⇒ Uncoupled and coupled fire spread models studies

★ Risk modeling and de-energization decision making

Planned activities

⇒ Risk model:

- Goal: Predict **power-grid-induced** wildfire probability to inform better de-energization strategies
- Methodology: Machine learning tools to leverage enormous data sets on weather and infrastructure.
- Decision-making:
 - Balance the desire to maximize electricity delivery with minimizing network upgrade costs
 - Develop optimization models to capture wildfire ignition risks and complexities of infrastructure investment

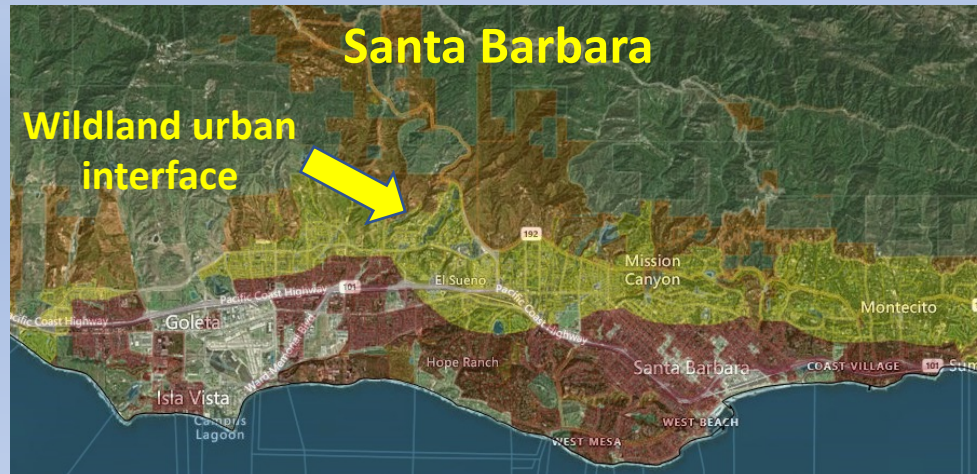




**Thanks for your
attention!**

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Wildfires at the Wildland Urban Interface (WUI)

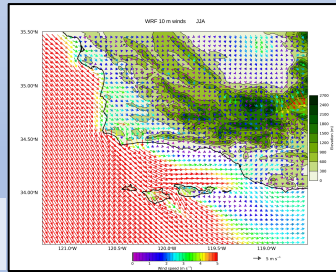


All major wildfires
enhanced by strong
Sundowner winds



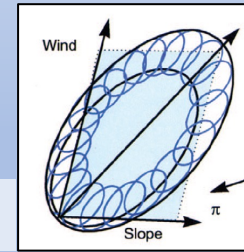
WRF Model

1 km



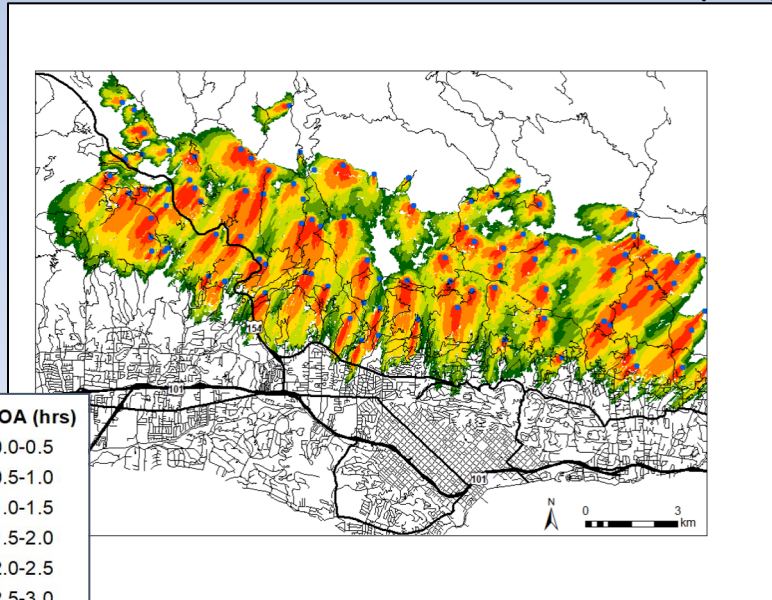
Fire Spread Model

30 m



Wildfire risk assessment at the WUI

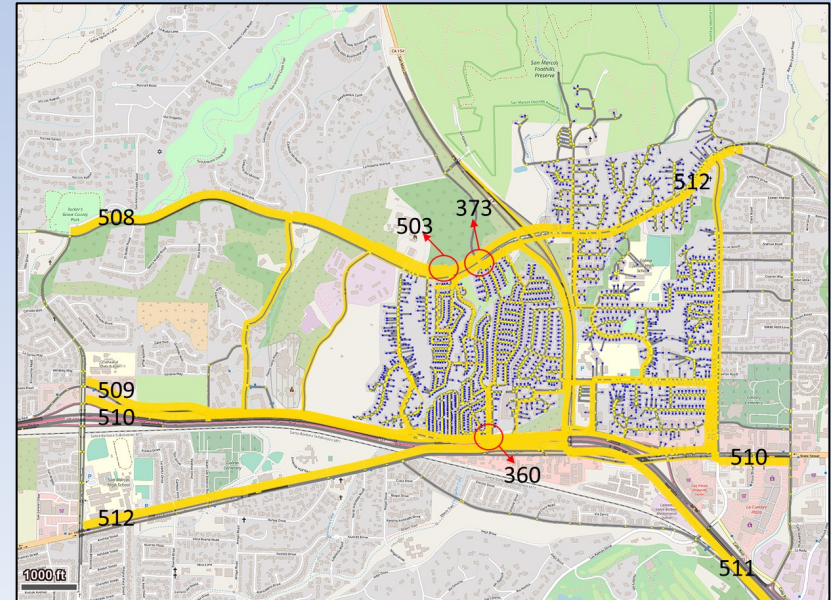
Minimum time of arrival of the fire (hrs)



K. Zigner, PhD student

Evacuation modeling for wildfire scenarios

Number indicates vehicles exiting the area



A. Murray, R. Church