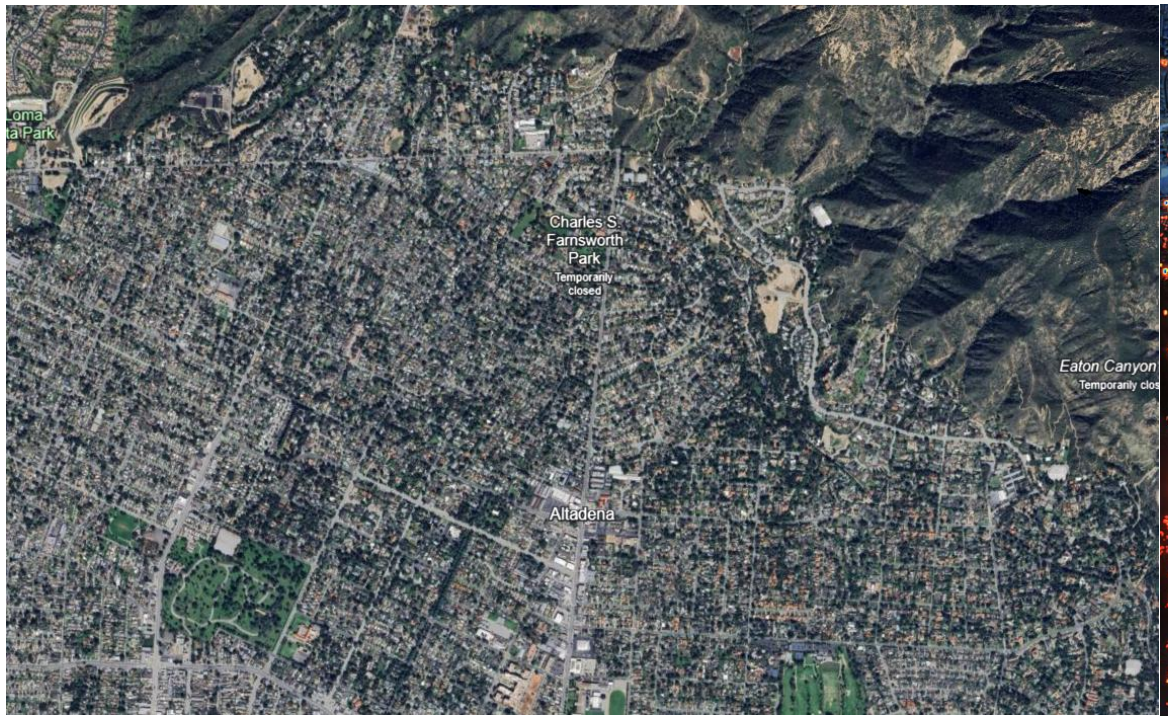
Satellite Monitoring of the Los Angeles Wildfires 2025 – Fire Progression, Spread, Intensity, and Emissions

Fangjun Li [a], Shobha Kondragunta [c], Xiaoyang Zhang [a], Mark Cochrane [b], Shuai An [a]

[a] *Geospatial Science of Excellence, South Dakota State University*

[b] *University of Maryland Center for Environmental Science*

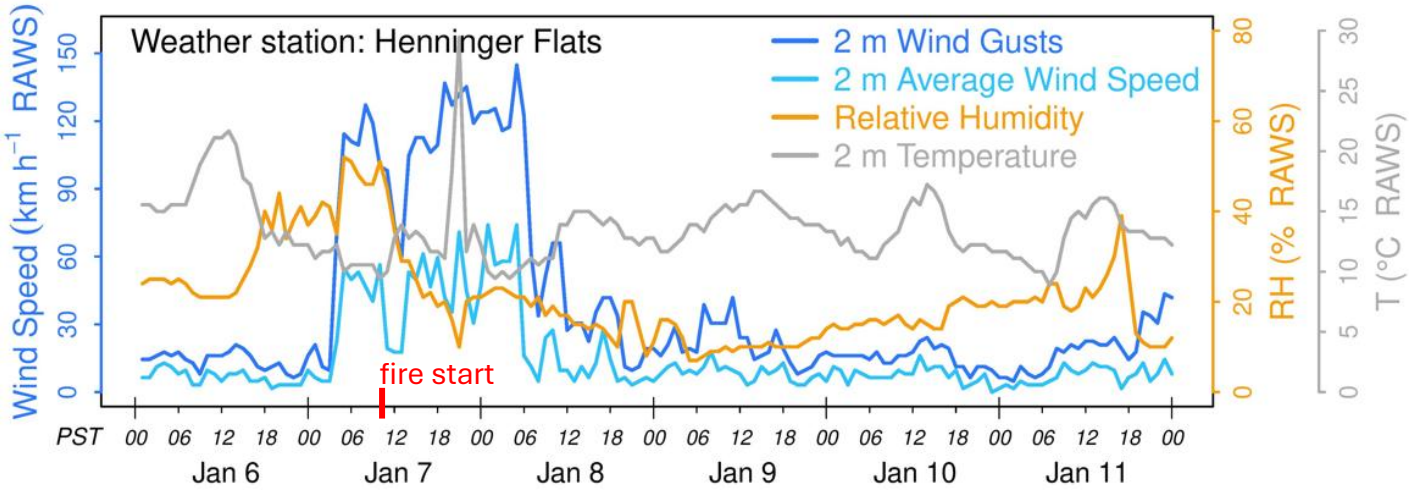
[c] *NOAA/NESDIS/STAR*



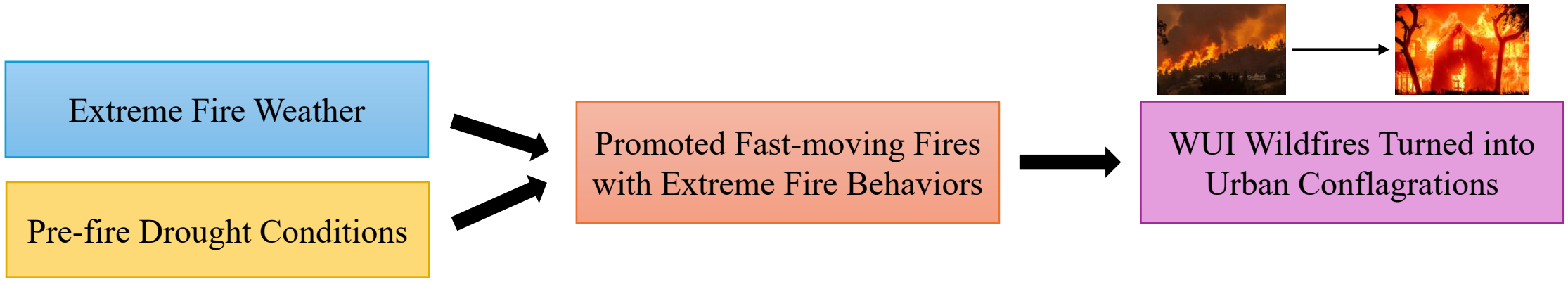
The 22nd meeting of the CEOS Atmospheric Composition Virtual Constellation 6/3/2026

The Los Angeles Wildfires 2025

- Hurricane-force Santa Ana Winds produced extreme fire weather in early January



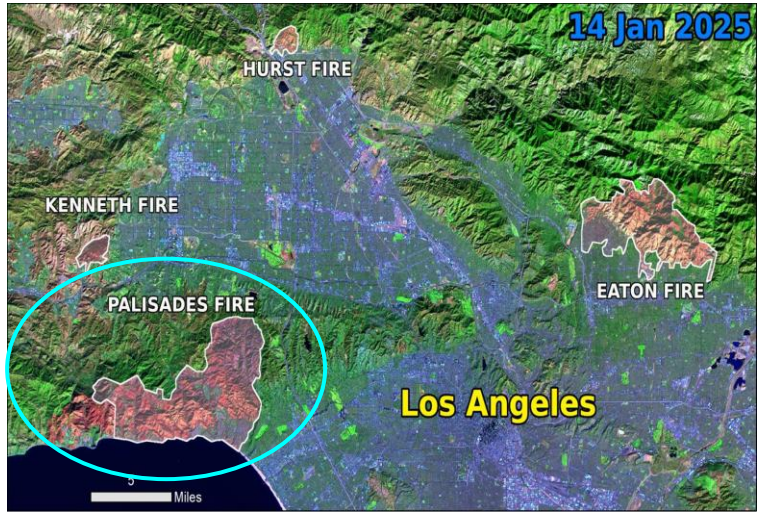
- Fires caused 32 deaths, destroyed more than 16,000 structures, forced ~180,000 residents to evacuate



Monitoring the LA Wildfires using Satellite Observations

- High winds and extreme fire behaviors hindered ground and air efforts to collect information on fire progression and fire extents

- We used NOAA-20/21 VIIRS and GOES-18 ABI fire observations and the RAVE* hourly fire emissions to understand extreme fire behaviors (**the Palisades Fire)**:
  - **How the fires progressed spatially? And at what rate?**
  - **What were the fire intensities in the WUI built environment?**
  - **What were the CO emissions in the WUI built environment?**

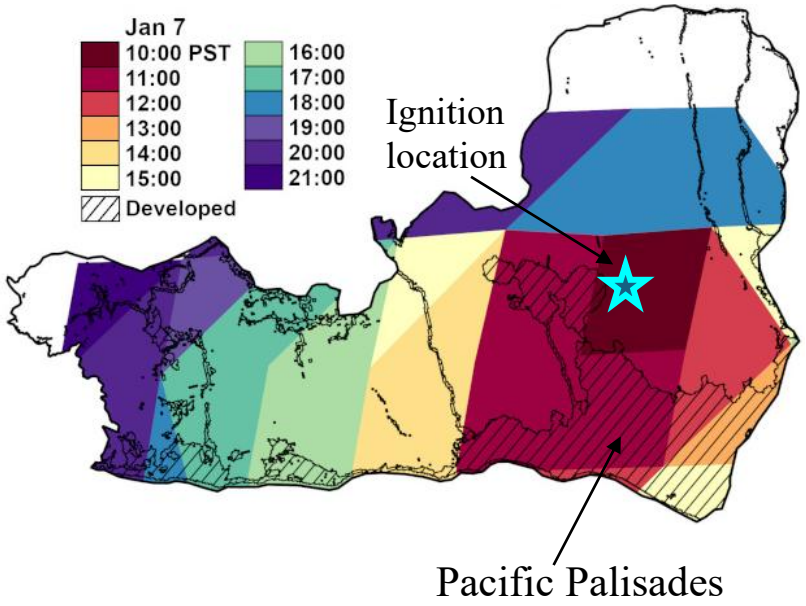


*__RAVE__ - __R__egional __A__BI and __V__IIRS __E__missions algorithm

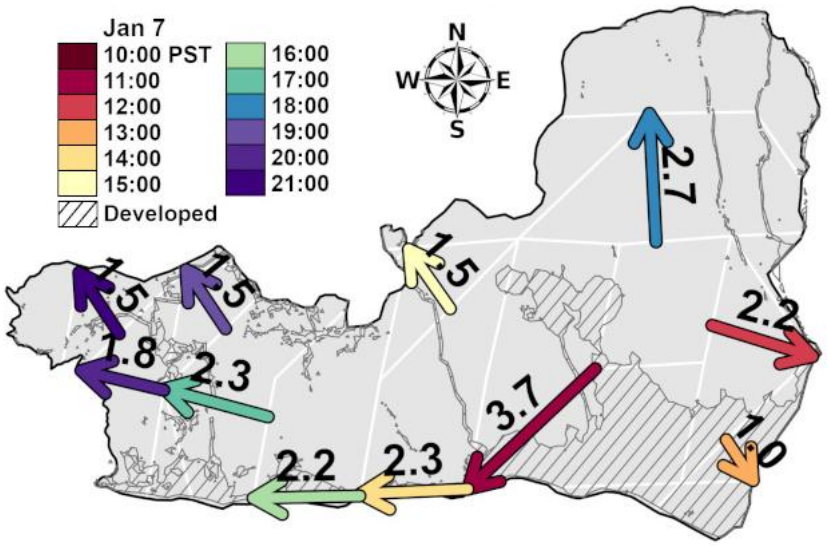
Fire Progression and Spread Rate

- The Palisades Fire started around 10:30 AM on January 7, and GOES-18 ABI detected it a few minutes after the ignition
- Fire spread into most of Pacific Palisades residential areas within the first 5 hours and reached the westernmost neighborhoods by 8:00 PM, with the maximum spread rate of up to 3.7 km/h
- Commonly used sub-daily progression maps cannot provide hourly dynamics of fast-moving fires

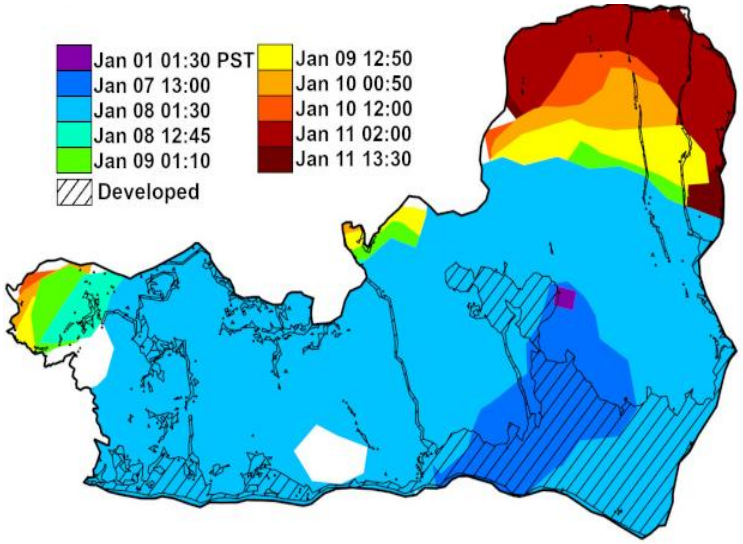
Hourly Progression(ABI)



Maximum Spread Rate (km/h)



Subdaily Progression (VIIRS)



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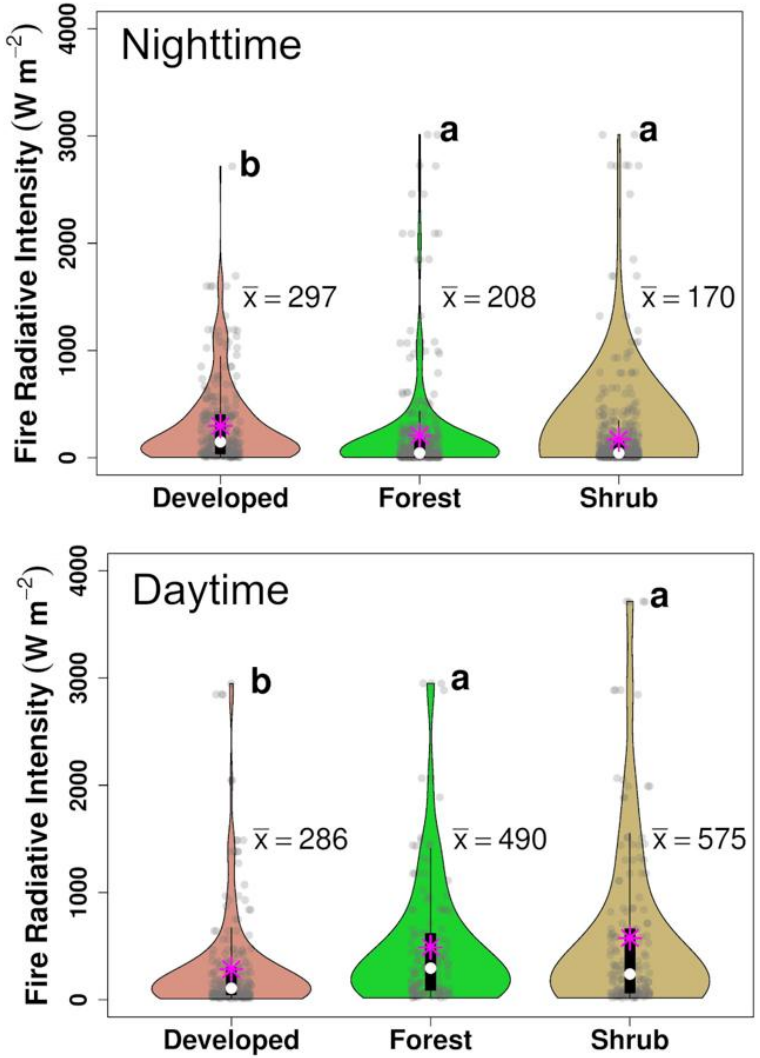
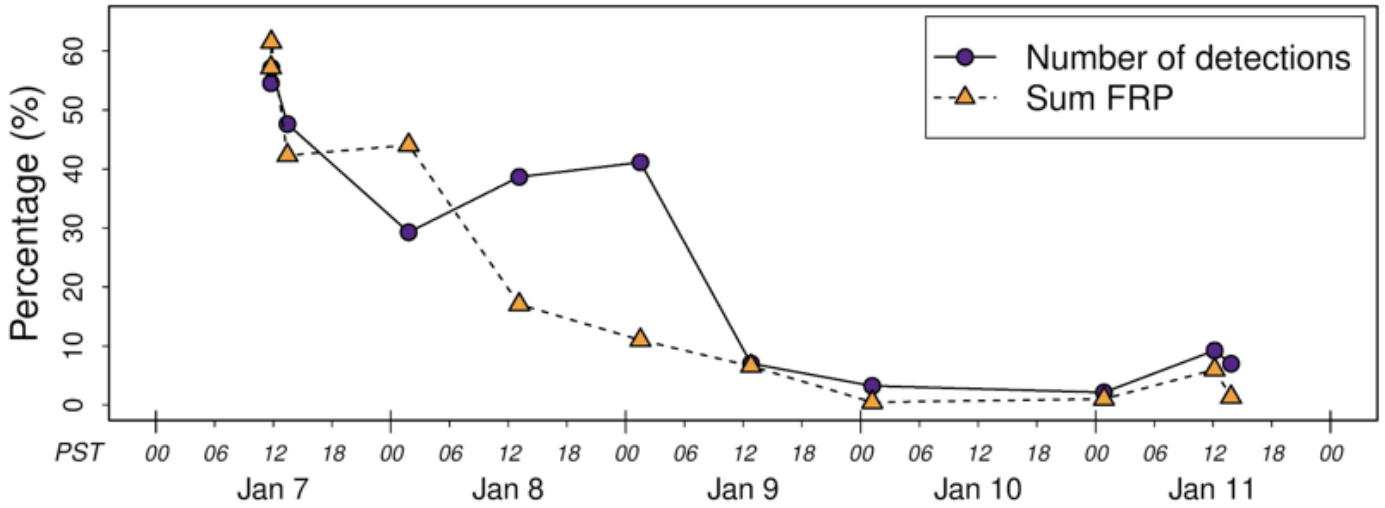
Fire Intensity: *Built Environment vs. Natural Vegetation*

- **Proxy of Fire Intensity**
  - VIIRS fire radiative power (FRP) per area unit (W m^{-2})
- **Fire intensity** during January 7 – 8
  - Nighttime: built environment fires > vegetation fires
  - Daytime: built environment fires < vegetation fires
  - Mean fire intensity in the built environment was similar during day and night

Fire intensity



Percentages of NOAA-20 VIIRS fire detections and FRP in the built environment



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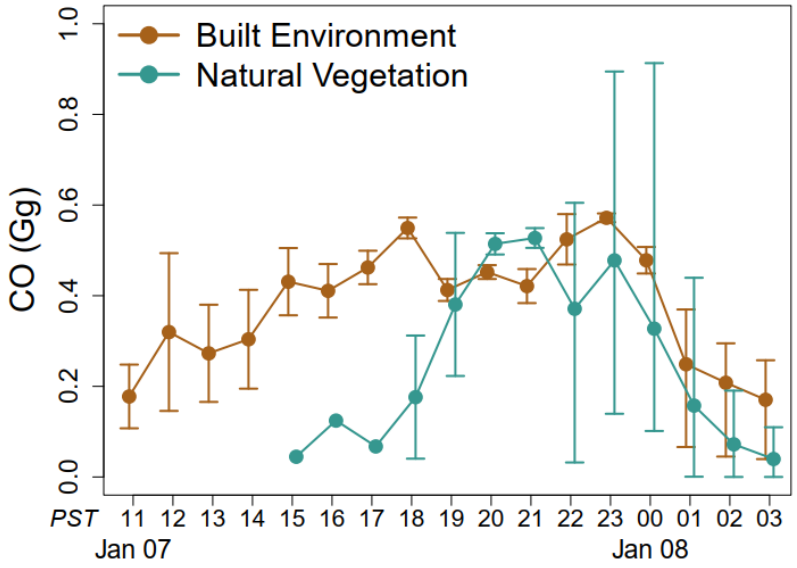
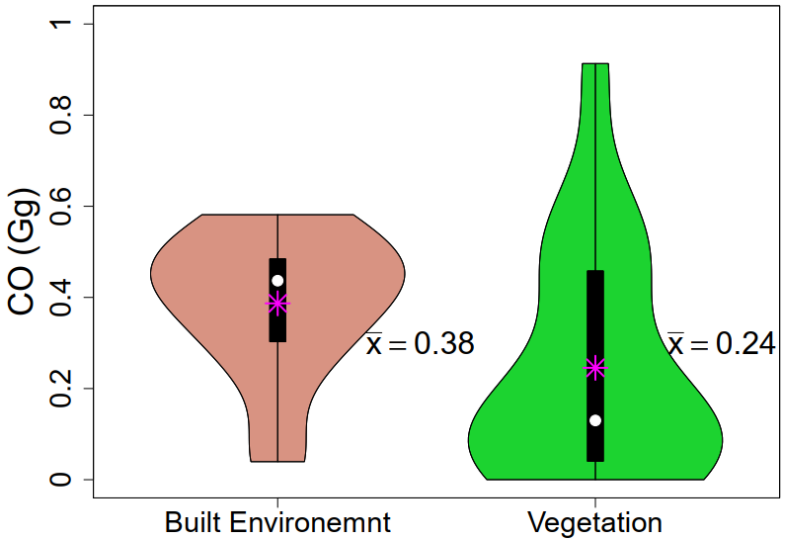
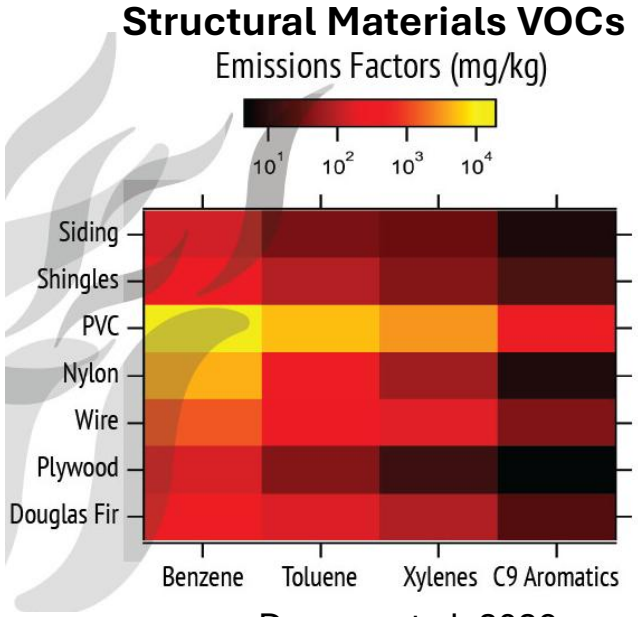
CO Emissions : *Built Environment vs. Natural Vegetation*

- **NOAA RAVE Hourly 3 km Fire Emissions**
  - Lack of emission factors (EFs) for built environment fire emissions; Uses cropland EF
- **CO Emissions** During the First 18 Hours (3 km grids with both types were not included)
  - Hourly CO emissions (per 3 km grid) from vegetation fires had large variations
  - Hourly CO emissions (per 3 km grid) from built environment fires were relatively higher
- **Other toxic emissions** can be estimated when EFs are available for built environment fires







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Summary

- Satellite fire observations can provide critical fire information to support first responders, especially in those destructive, fast-moving WUI fires (e.g., Palisades fire spread rate was up to 3.7 km/hour).

- Fire intensity and emissions from fires in built environment and natural vegetation are very different.
  - Incident meteorologists and first responders on the ground need smoke exposure information. **Particularly, toxicity of the smoke plume?**
  - **Recent studies have shed light on the chemical morphology of smoke plumes**
  - **We plan to incorporate EFs for structures into RAVE and develop a new "toxicity index"**

- More details can be found in our recent paper:
  - Li, F., Zhang, X., Cochrane, M., Kondragunta, S., & An, S. (2026). Fire spread, intensity, and emissions observations by multiple satellites: The southern California wildfires of January 2025. AGU Advances, 7(1), e2025AV002064. https://doi.org/10.1029/2025AV002064