

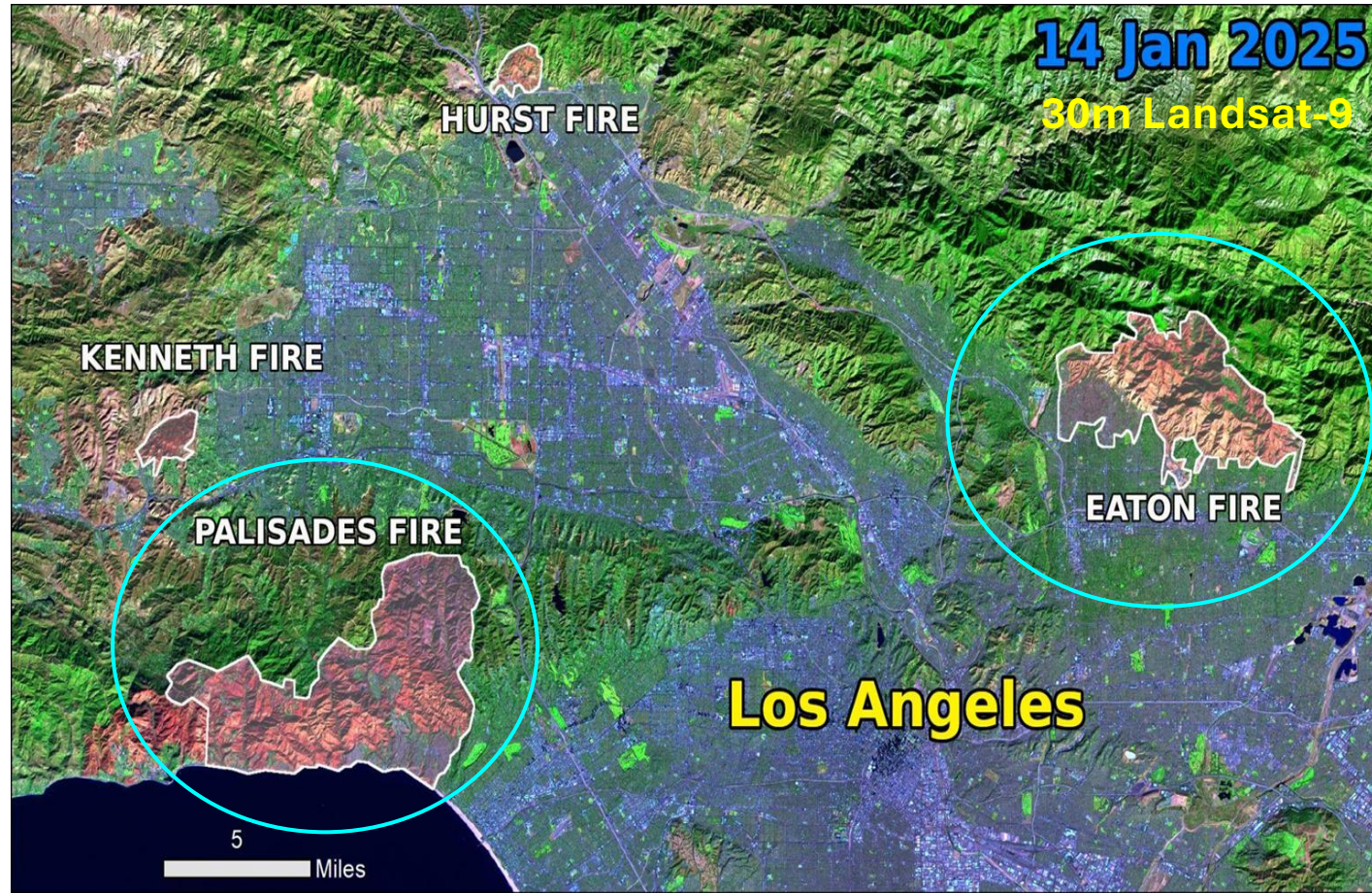
Validation of Hourly RAVE NO_x Emissions Using TEMPO NO₂ in Two Los Angeles Wildfires 2025

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

^a Geospatial Science of Excellence, South Dakota State University

^b NOAA/NESDIS/STAR

^c University of Maryland Center for Environmental Science

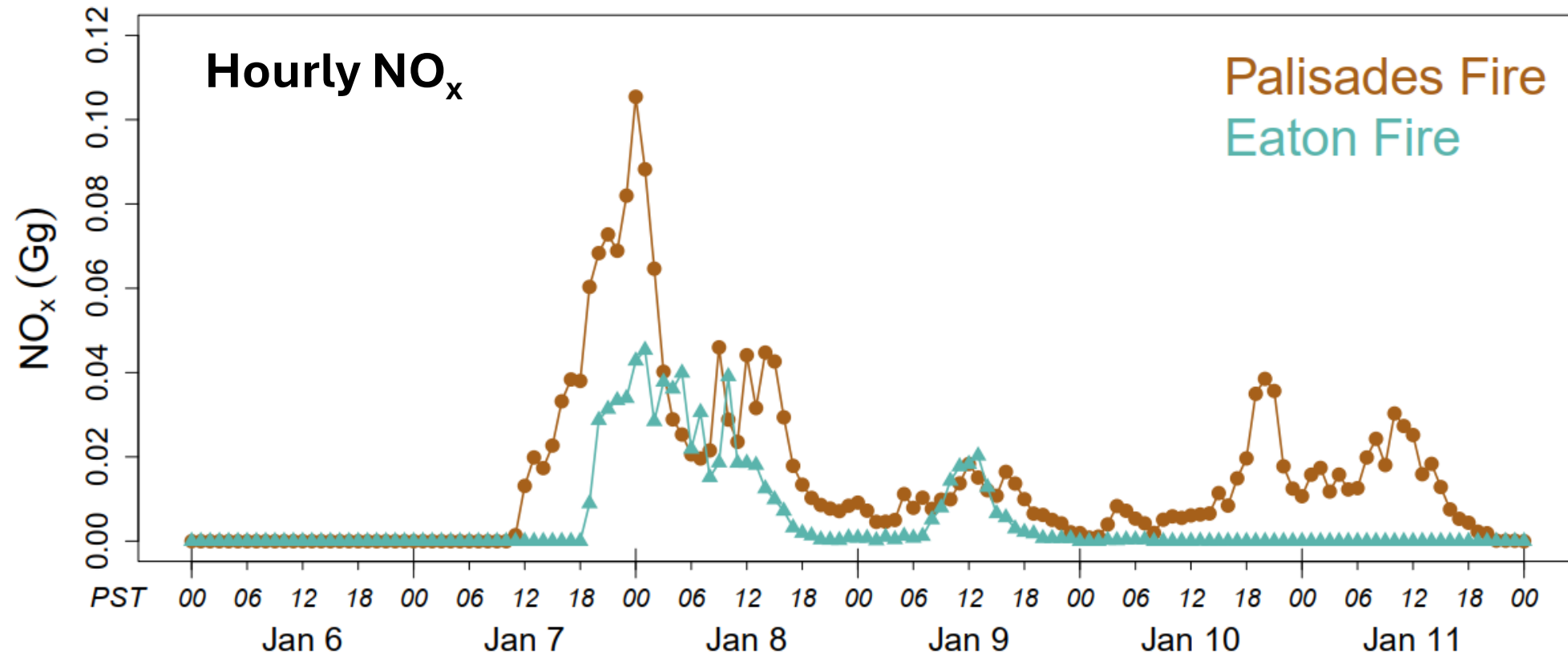


The **Palisades Fire** and the **Eaton Fire** are listed as two of the top ten deadliest & destructive wildfires in California's fire history.

Fire Event	Start Date	Burned Area (acre)	Damaged structures
Palisades Fire	Jan 7	23,707	7,800
Eaton Fire	Jan 7	14,021	10,487

Hourly NO_x Emissions from 3 km RAVE Product

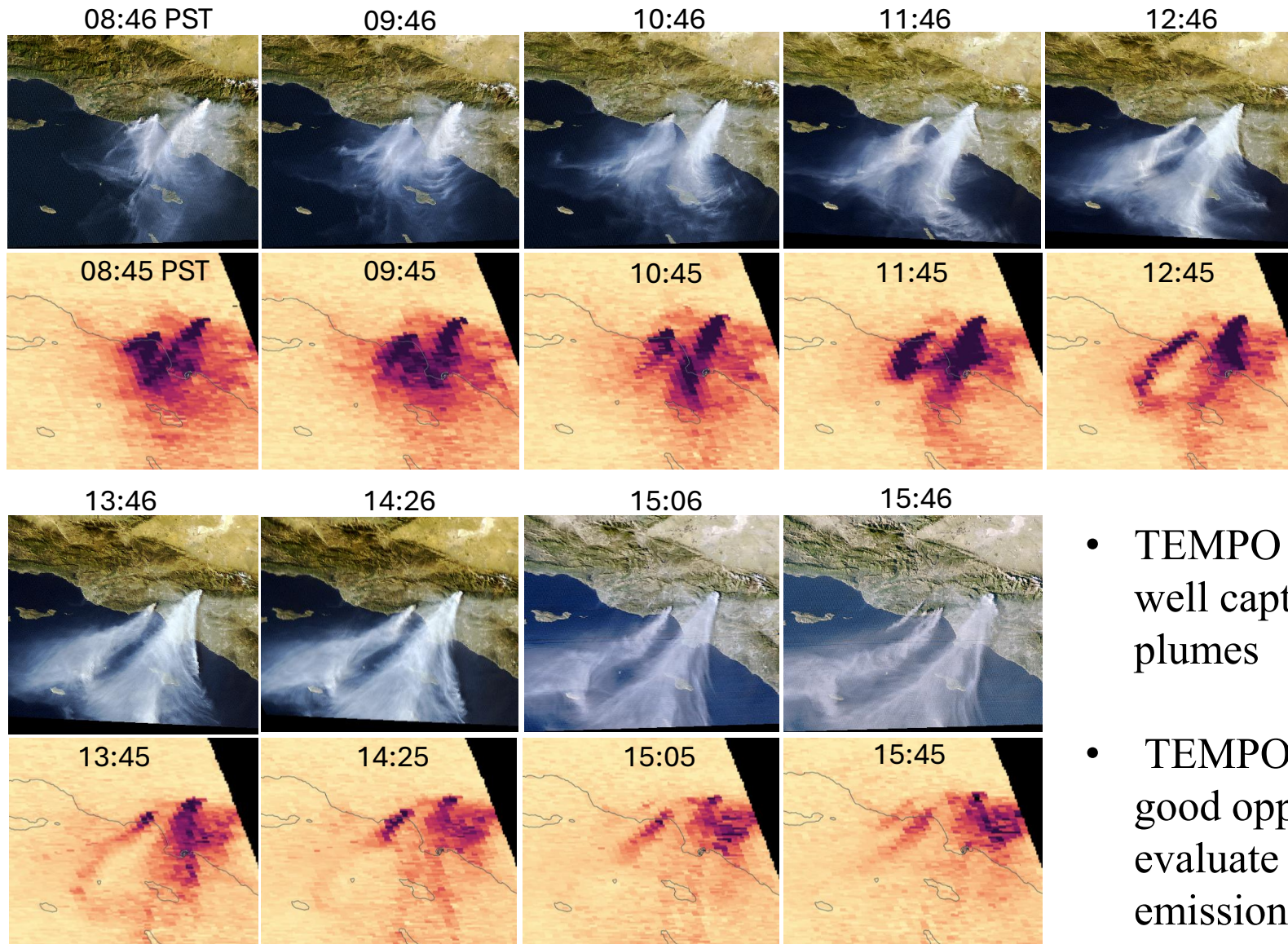
- NOAA's RAVE fire emissions product provides hourly fire radiative power (FRP) and emission estimates for 11 species, including NO_x, across North America in near real time.



TEMPO Troposphere NO₂ Vertical Column (2025-01-09)

GOES-19 ABI
(89.5° W)

TEMPO NO₂
(v003)



- TEMPO NO₂ observations well capture two smoke plumes
- TEMPO NO₂ provides a good opportunity to evaluate hourly RAVE NO_x emissions



Calculate the Rate of NO_x Emissions

- NO_x rate (Φ)

$$\Phi = \frac{\sum_{i=1}^n \Delta NO_2 \times A_{pixel}}{t}$$

$$t = \frac{L_{smoke}}{v_{wind}}$$

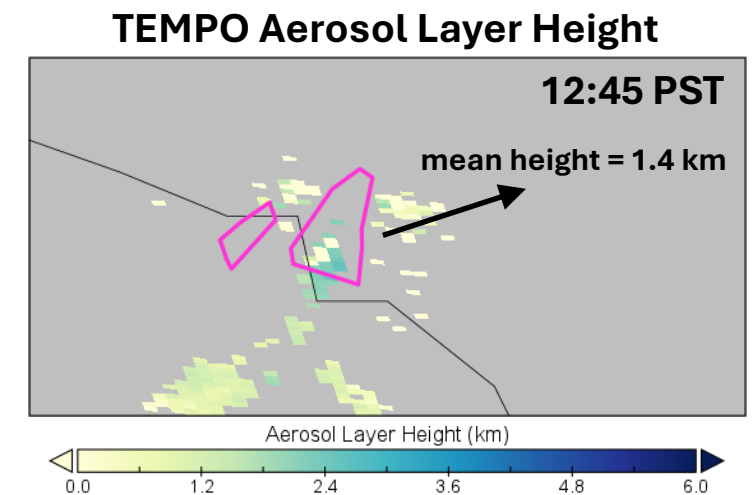
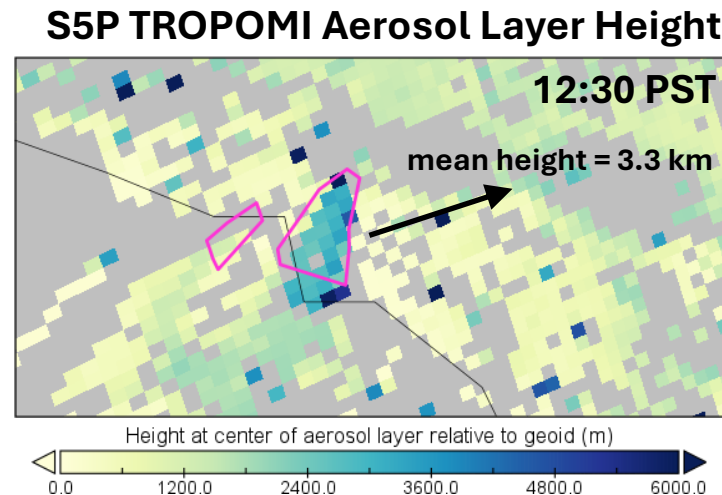
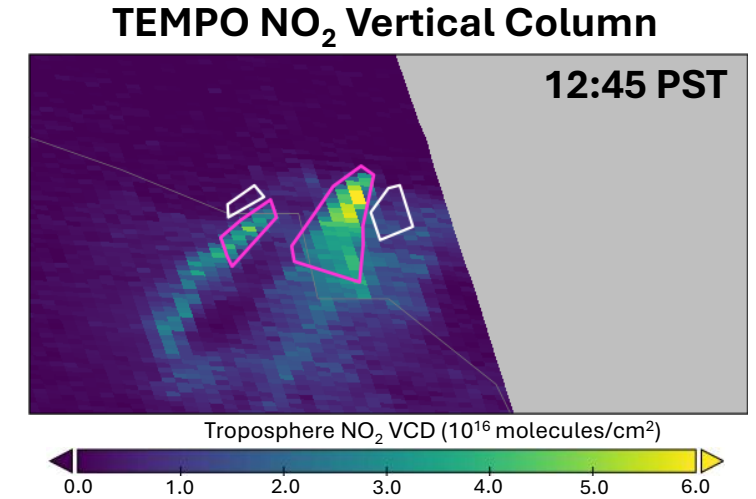
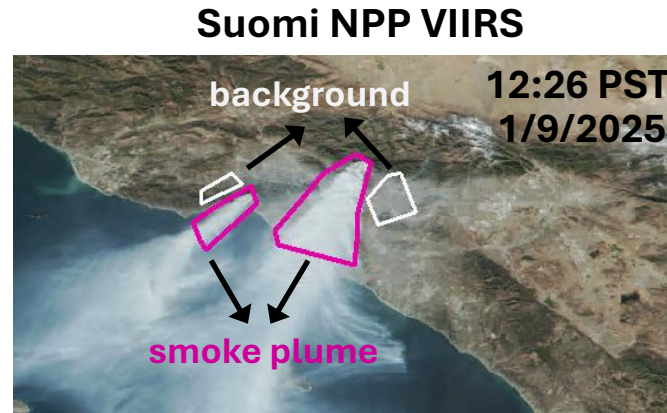
A_{pixel} - pixel area

L_{smoke} - plume length

v_{wind} - wind speed at plume height

- NO₂ to NO_x

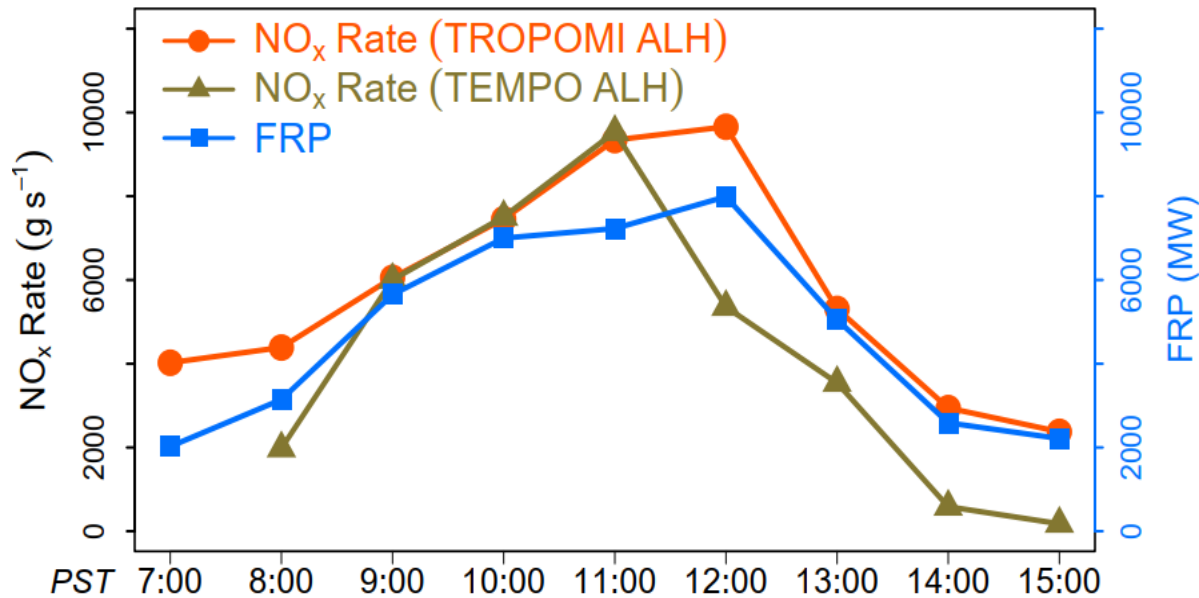
NO_x : NO₂ = 1.5 (Akagi et al. 2012)



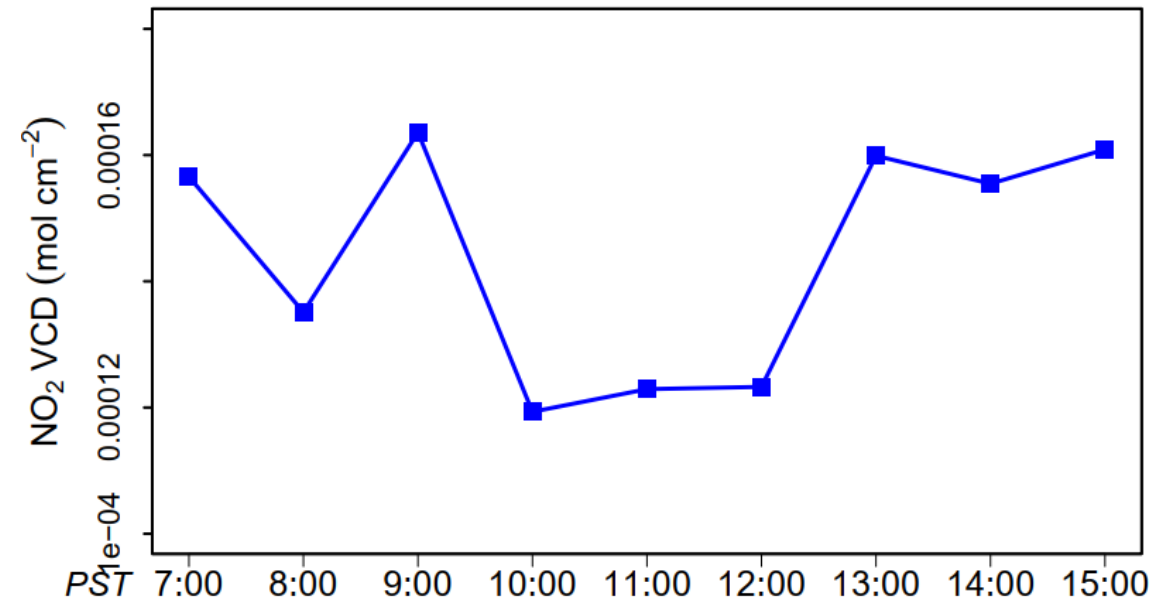
Hourly Variations of NO_x Rate and Fire Intensity

(Eaton Fire on January 9th)

NO_x Rate and Fire Intensity



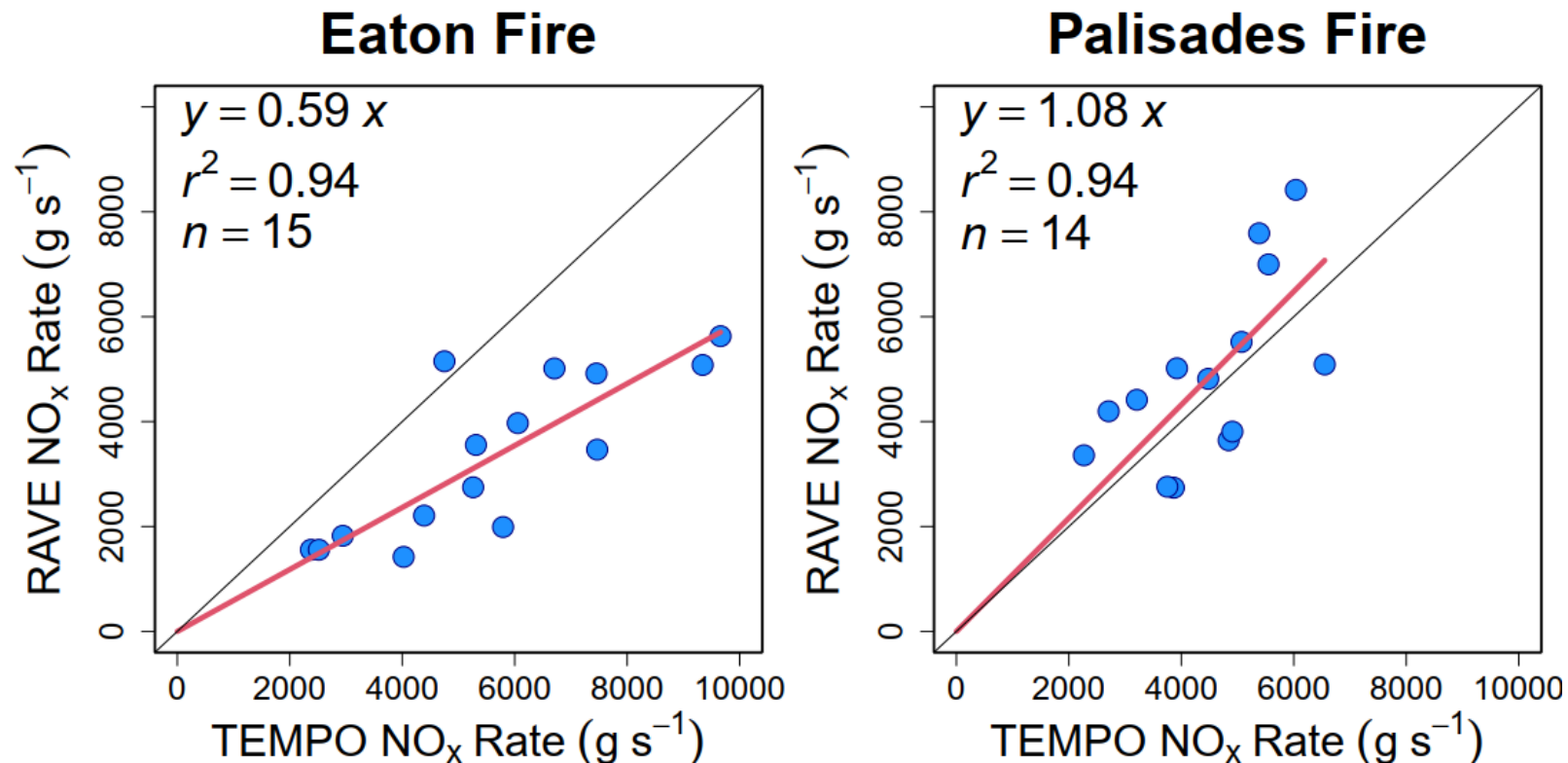
Background NO₂ VCD



- NO_x rate and fire intensity share similar temporal patterns
- Background NO₂ shows strong hourly variations

NO_x Emissions: RAVE vs. TEMPO

- Compare NO_x rates over 29 plume samples during January 7 – 11
- RAVE and TEMPO NO_x rates are significantly correlated
- Both are generally comparable in the Palisades Fire, but RAVE NO_x is underestimated by ~40% in the Eaton Fire



Summary

- TEMPO NO_2 observations well capture two smoke plumes
- NO_x rate and fire intensity share similar temporal patterns
- RAVE and TEMPO NO_x rates are generally comparable in the Palisades Fire, but RAVE NO_x rates are underestimated by $\sim 40\%$