

Utilizing HRRR-Smoke to Infer the Impact of Wildfire Smoke on Solar Energy

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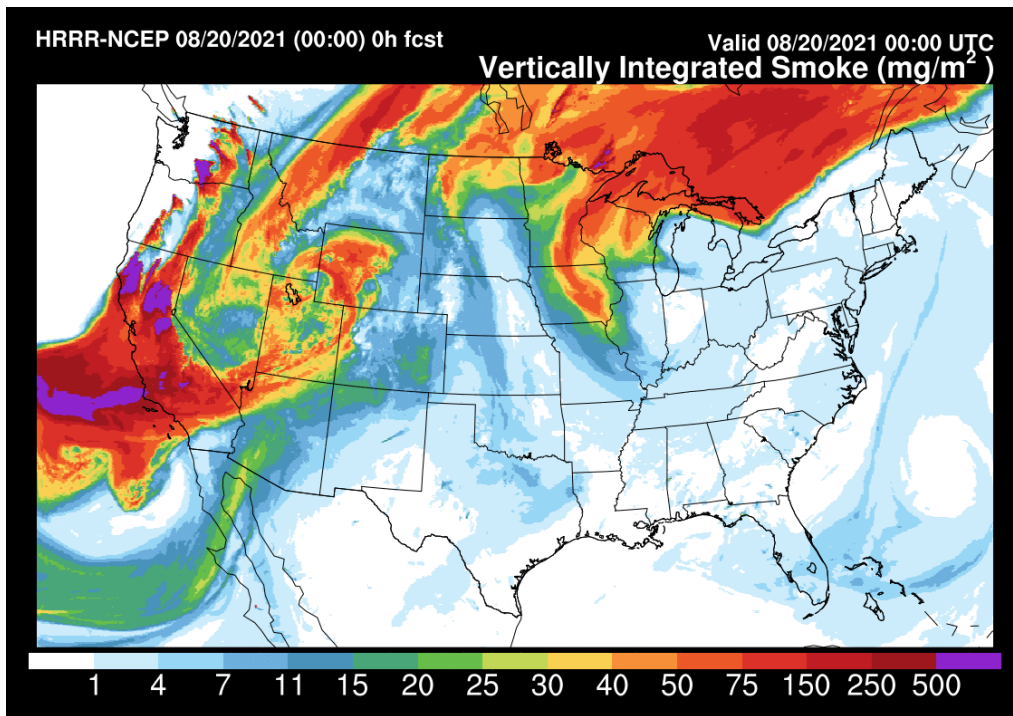
R. Ahmadov, B. Pierce, E. James, J. Schnell,
G. Grell, B. Baker, C. Xu.



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HRRR-Smoke

- Addition of a single smoke tracer to NOAA/GSL's High Resolution Rapid Refresh (HRRR) model
 - 3 km spatial resolution over CONUS
 - neglects aerosol composition, size distribution, hygroscopicity
- Ingests MODIS and VIIRS fire radiative power for calculating biomass burning emissions and initial plume rise.
 - No non-fire pollution sources included
- Forecasts produced hourly
 - 18 hours
 - 48 hour forecasts at 0Z, 6Z, 12Z, 18Z
- AOD calculated for smoke with a constant mass extinction efficiency



HRRR Smoke vertically integrated smoke forecast valid at 8/20/2021 0Z. Obtained from <https://rapidrefresh.noaa.gov/hrrr/HRRRsmoke/>.

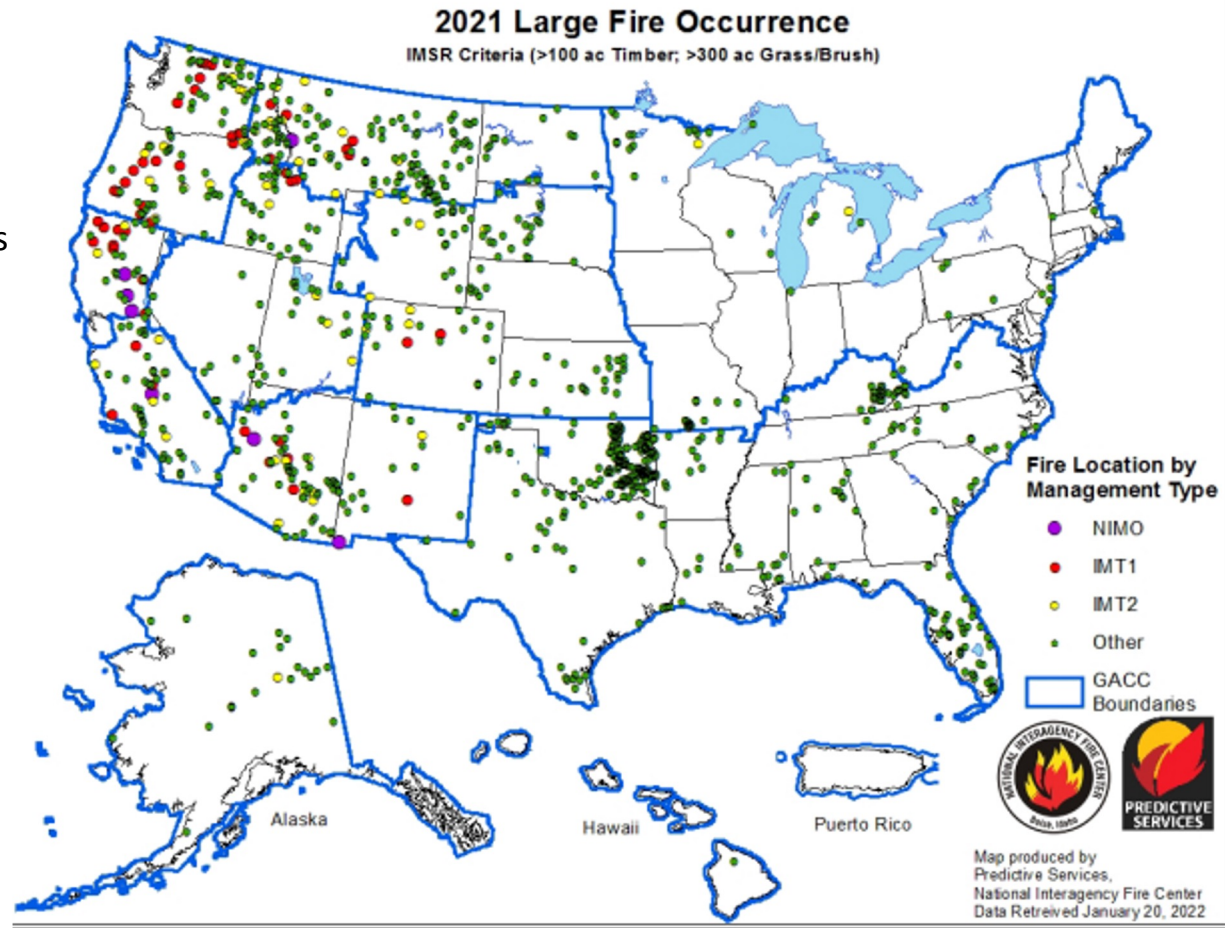
Project evaluates 1st 24 hours of 00Z runs.

2021 Fire Season

- 58,985 wildfires
- 943 large wildfires and complexes
- 7,125,643 acres burned

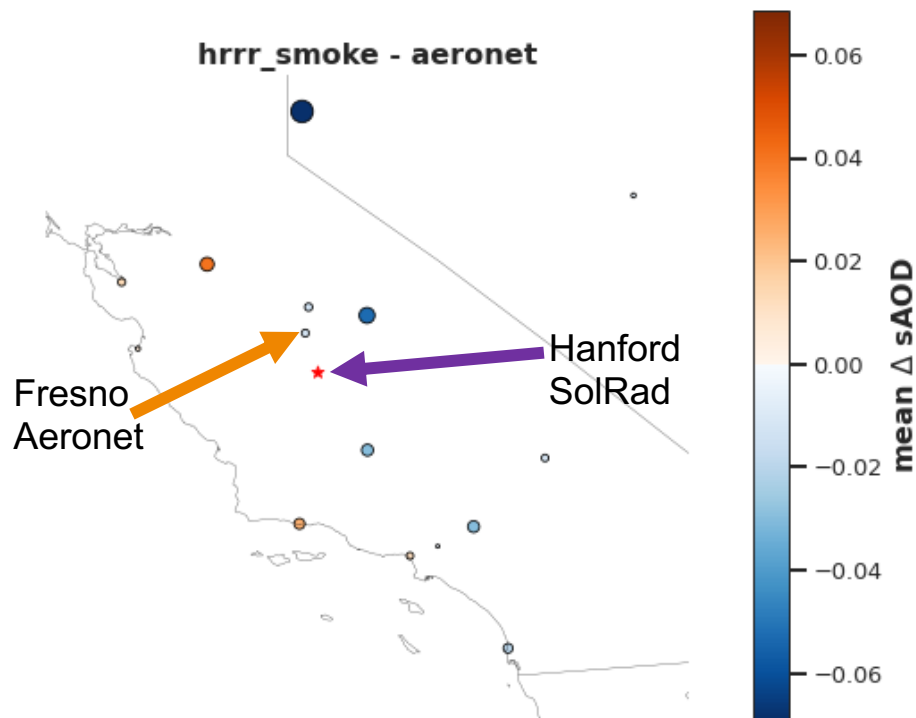


September 2021 Terra MODIS True Color and Fire Detects. Obtained from NASA Worldview

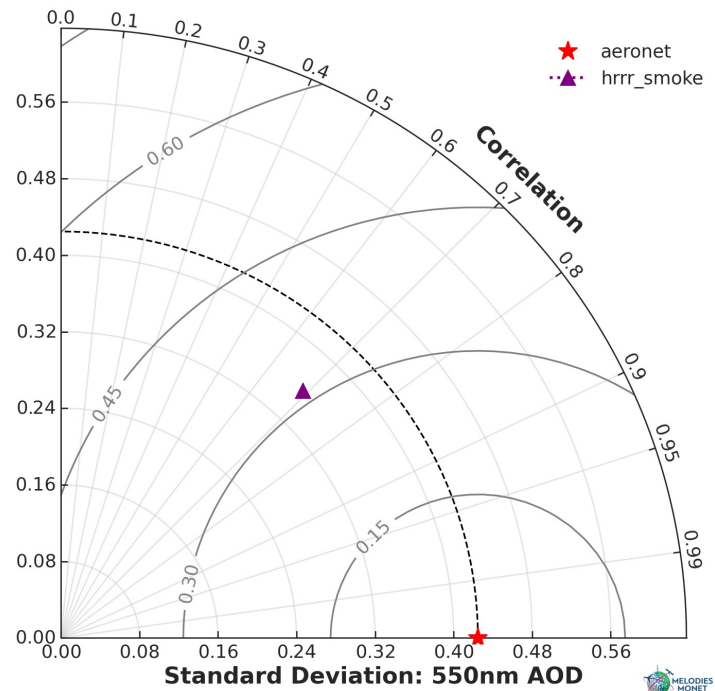


National Interagency Coordination Center. 2021. Wildland Fire Summary and Statistics Annual Report.

HRRR-Smoke AOD Validation

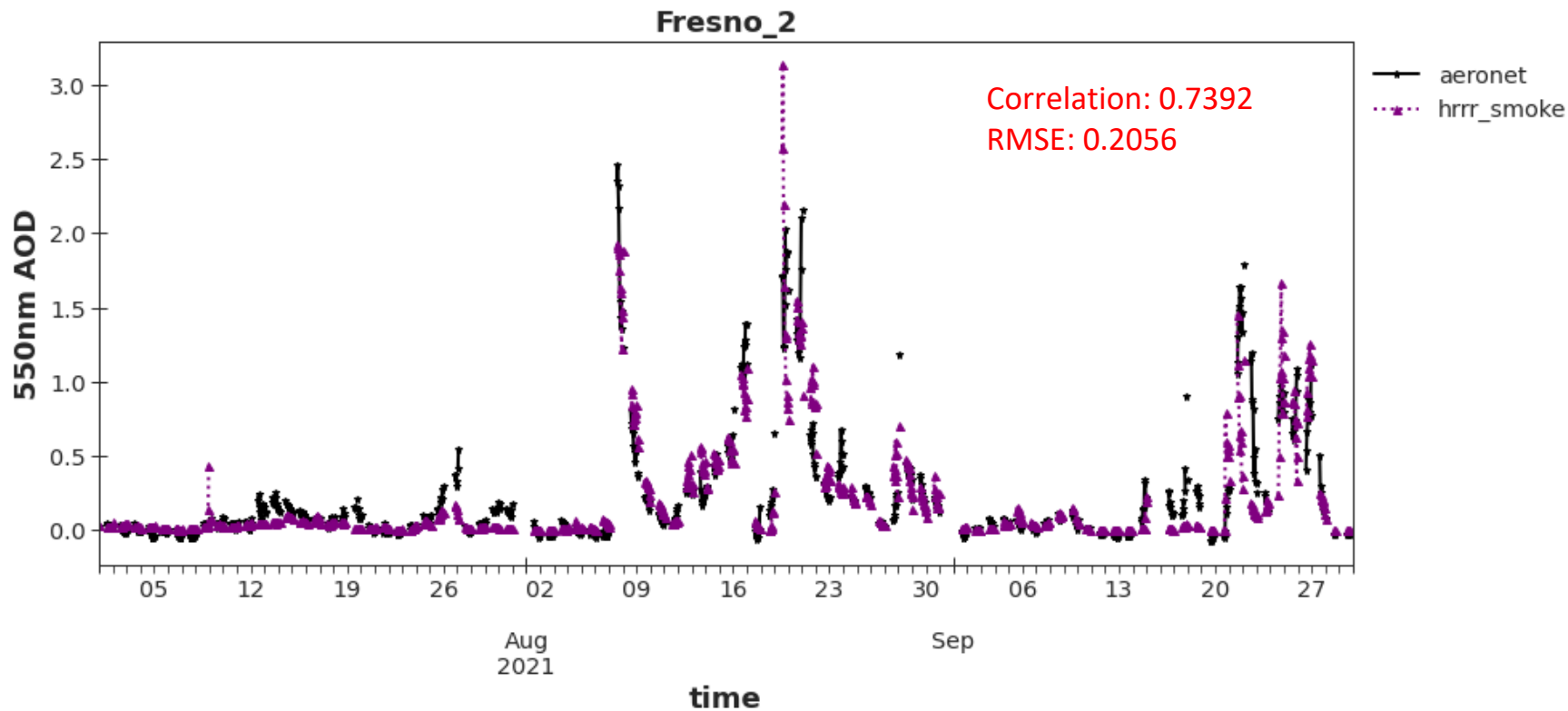


Average bias July-Sept. 2021.



HRRR-Smoke AOD is on average biased **low** relative to Aeronet observations

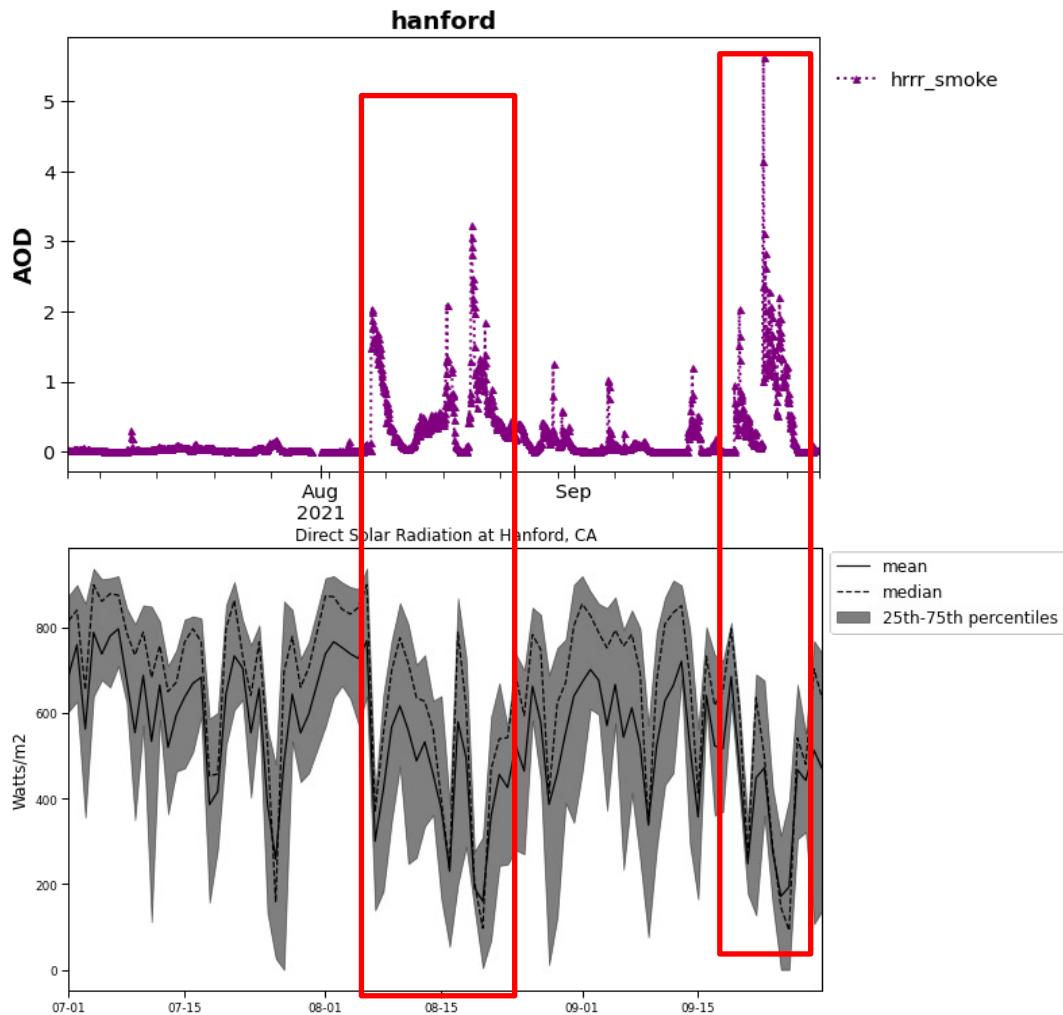
HRRR-Smoke AOD Validation



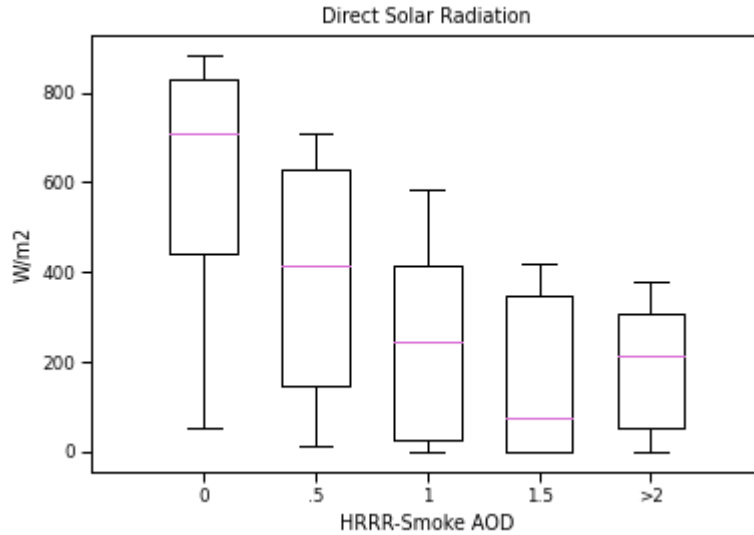
Results: HRRR-Smoke at SOLRAD Site

HRRR-Smoke sampled at NOAA SOLRAD Hanford, CA site.

Direct Solar Radiation is decreased during higher AOD periods



Results: HRRR-Smoke at SOLRAD Site



Direct Solar Radiation decreases with increasing smoke AOD

Conclusions

- Results indicate HRRR-Smoke tends to underestimate AOD, due to non-fire sources and lack of chemistry in the model. Captures timing of AOD enhancement due to smoke plumes well.
 - As smoke becomes the dominating aerosol, Aeronet AOD and HRRR-Smoke AOD forecasts increase in agreement.
- Higher smoke AODs result in decreased direct solar radiation.

Questions?

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