

Local and Transported Wildfire Smoke's Impact on U.S. Solar Energy Resources under Extreme and Historical Conditions

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Personal image

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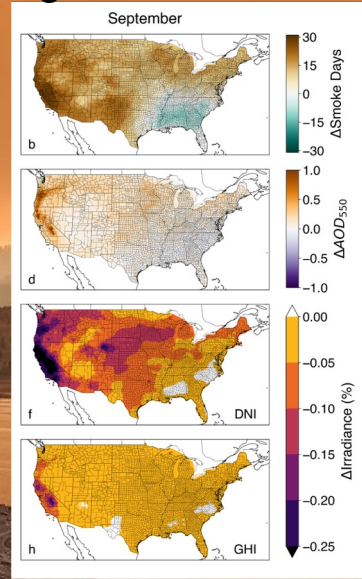
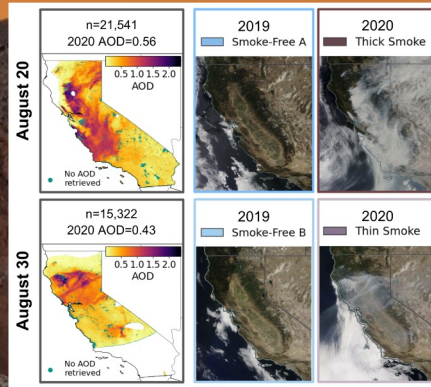
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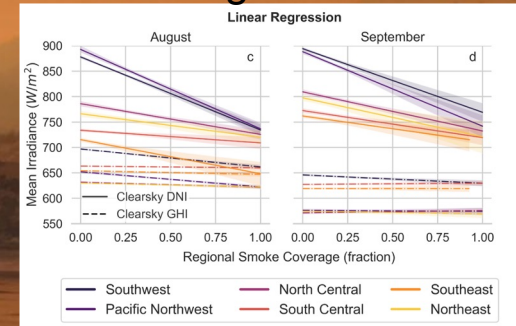
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High vs. Low Smoke

Case Studies

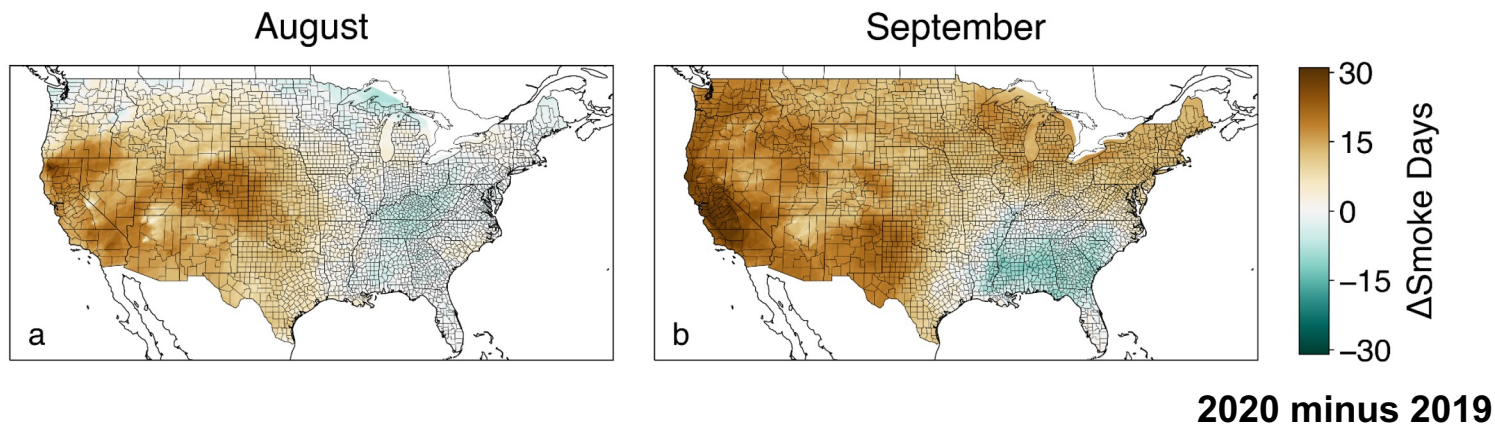


Longitudinal

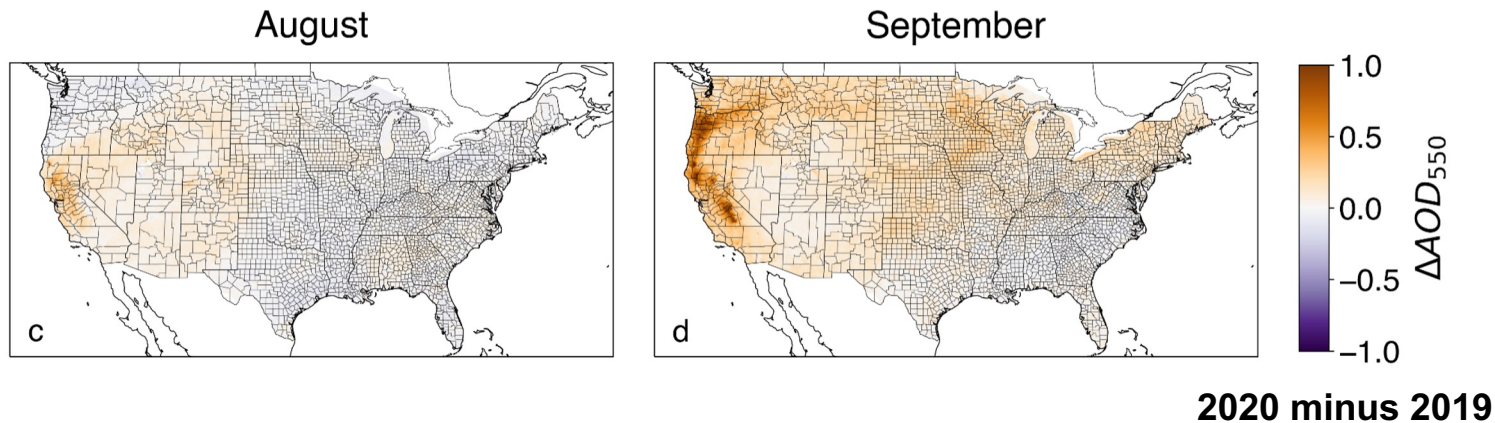


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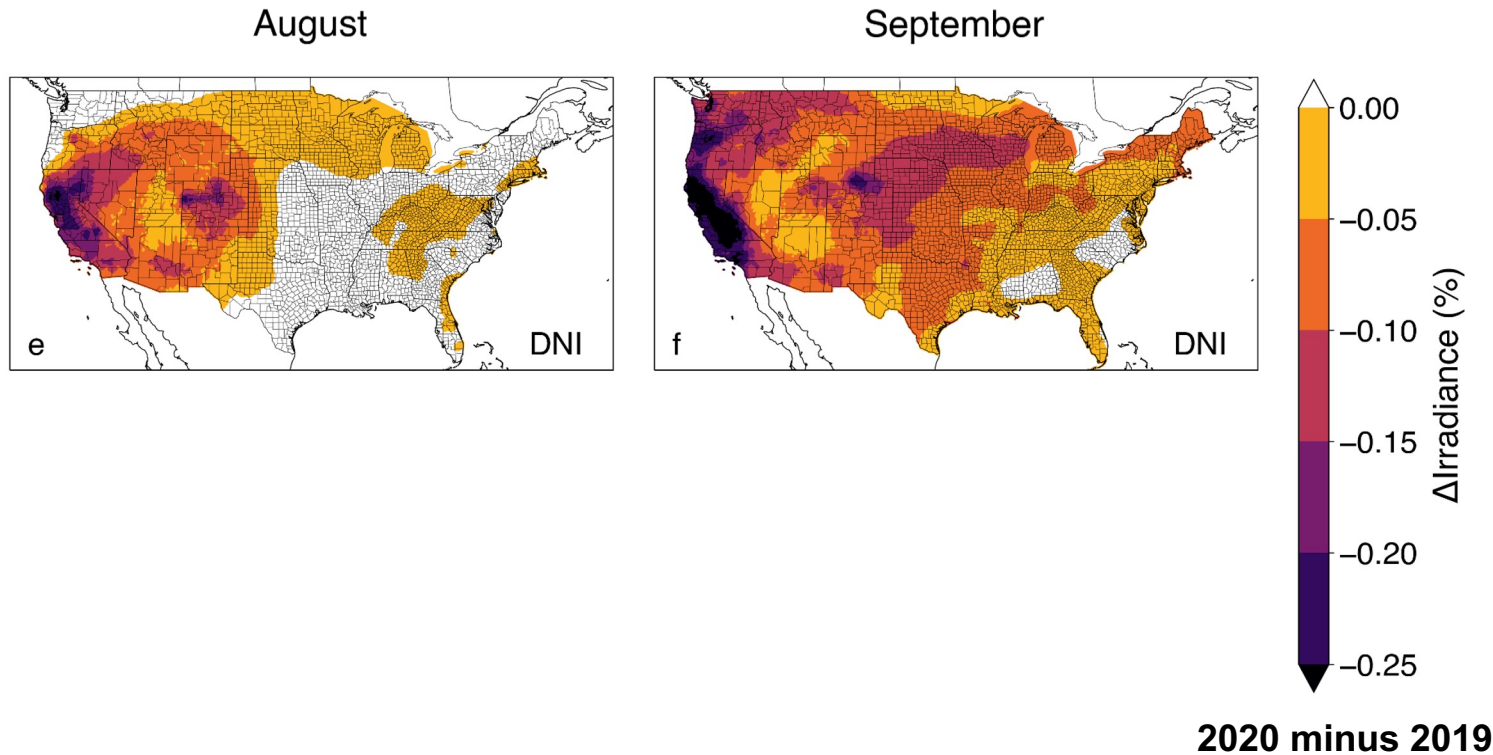
Smoke-impacted days increased from 2019 to 2020 across 72% of CONUS in Aug and 88% in Sept.



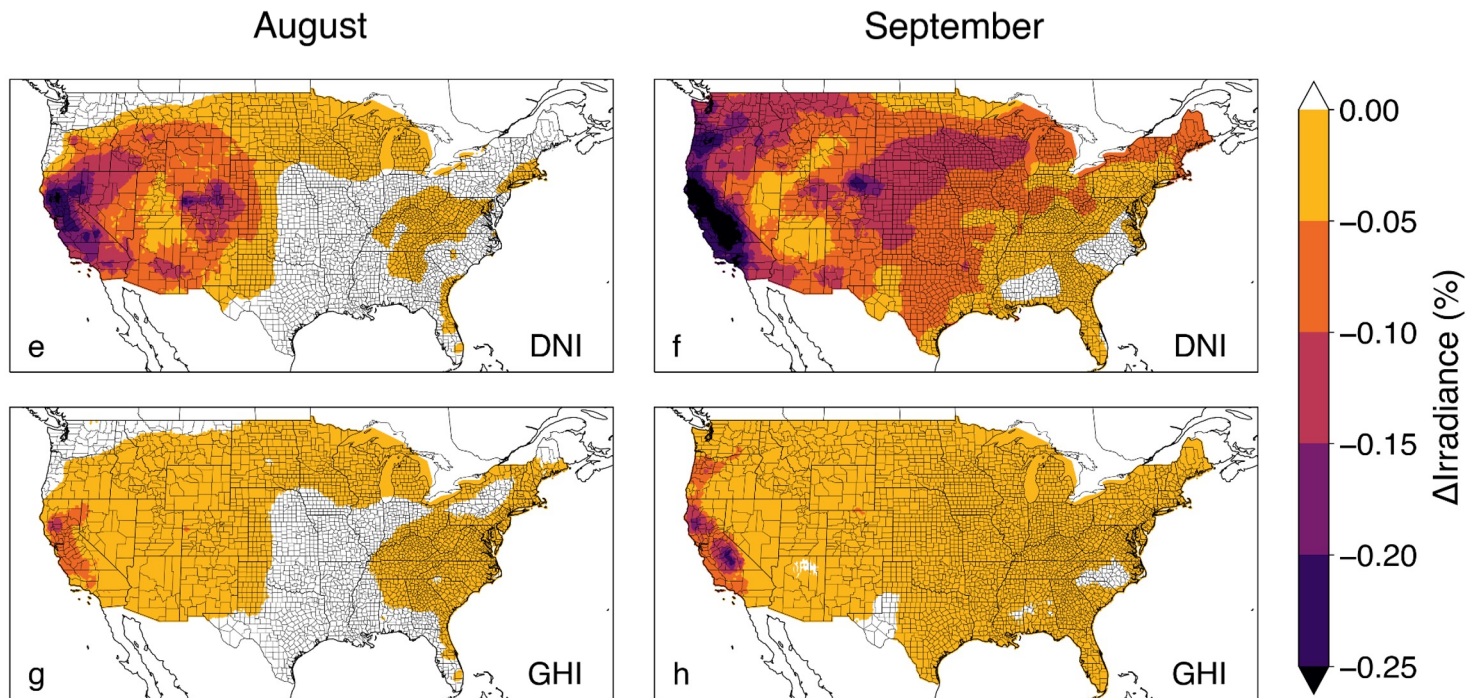
Smoke increased CONUS mean AOD by 23% in Aug (0.13 to 0.16) and 127% in Sept (0.11 to 0.25).



Local smoke severely decreased ($>25\%$) monthly mean **DNI** and losses persisted downwind, particularly in Sept.

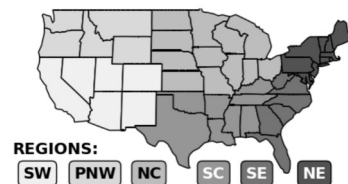
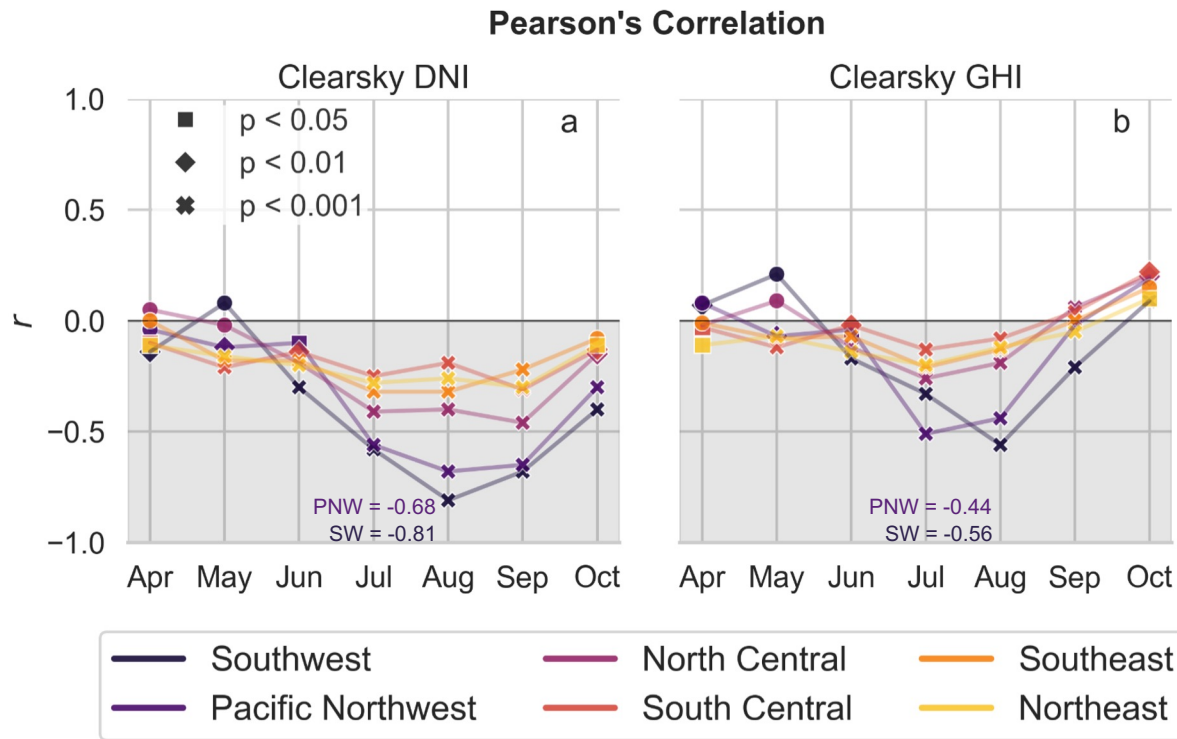


GHI losses were large near major fires but minimal (<5%) in areas primarily affected by transported smoke.

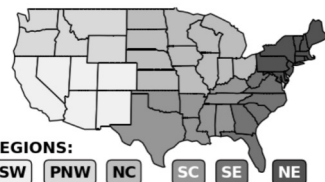
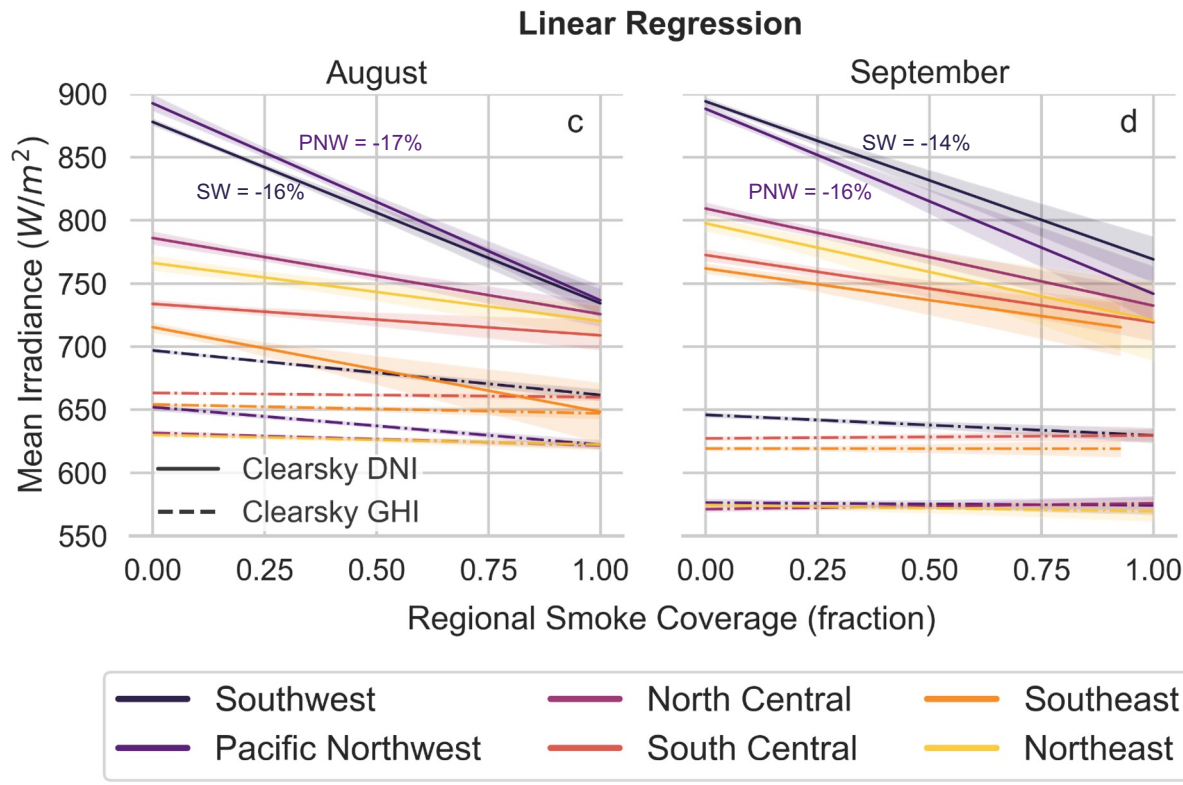


2020 minus 2019

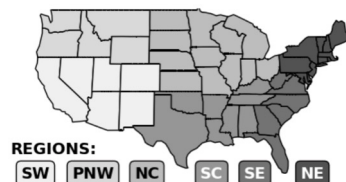
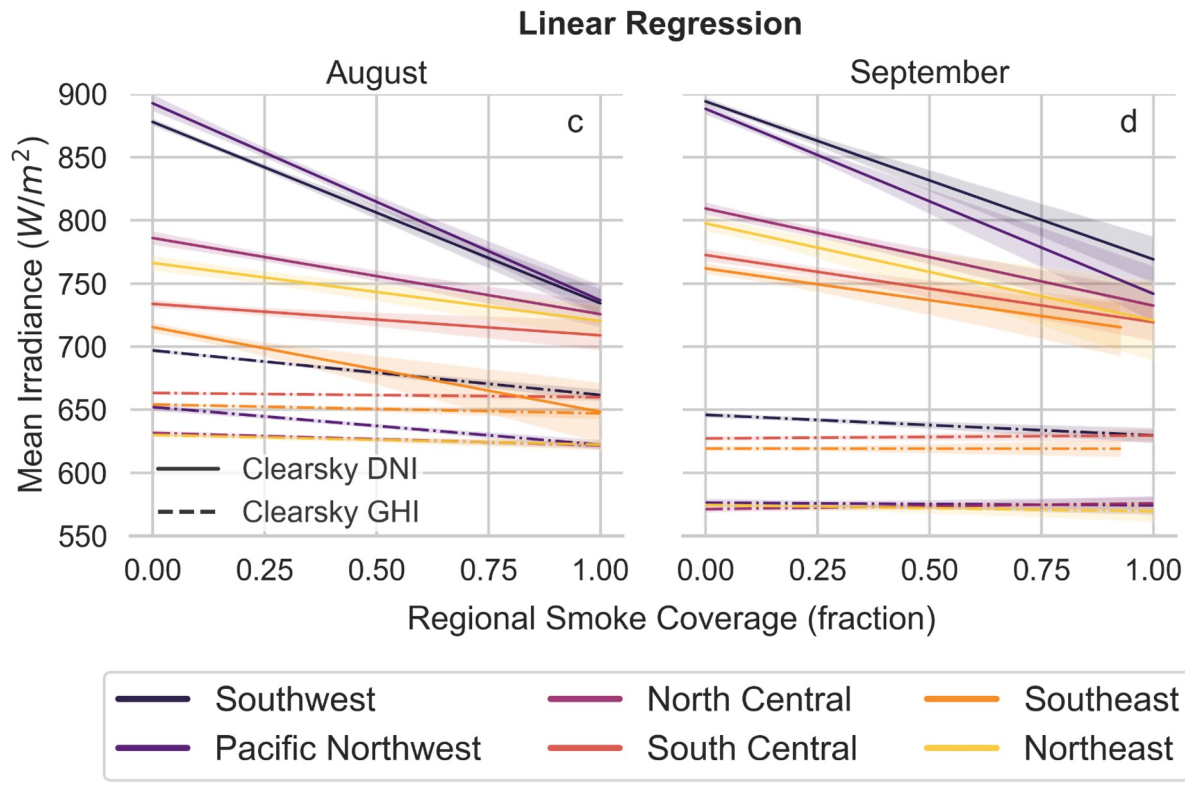
Regional smoke-irradiance correlations exhibit seasonality, peaking in Aug and Sept, particularly in the SW and PNW.



Regional mean **DNI** is more sensitive to the size of local, fresh, dense plumes than transported, aged, dilute plumes.



Regional mean **GHI** changes little with increasing smoke coverage, decreasing by <5% at 100% smoke coverage.



- 1) **Local** optically thick smoke can drive **large declines** in monthly mean **DNI and GHI**.
- 2) **Transported smoke** also leads to large declines in DNI, but the **loss of GHI is minimal** (<5%) even during extreme fire seasons.
- 3) Results support **photovoltaic development** alongside increased **battery storage** to provide stability during local smoke events.

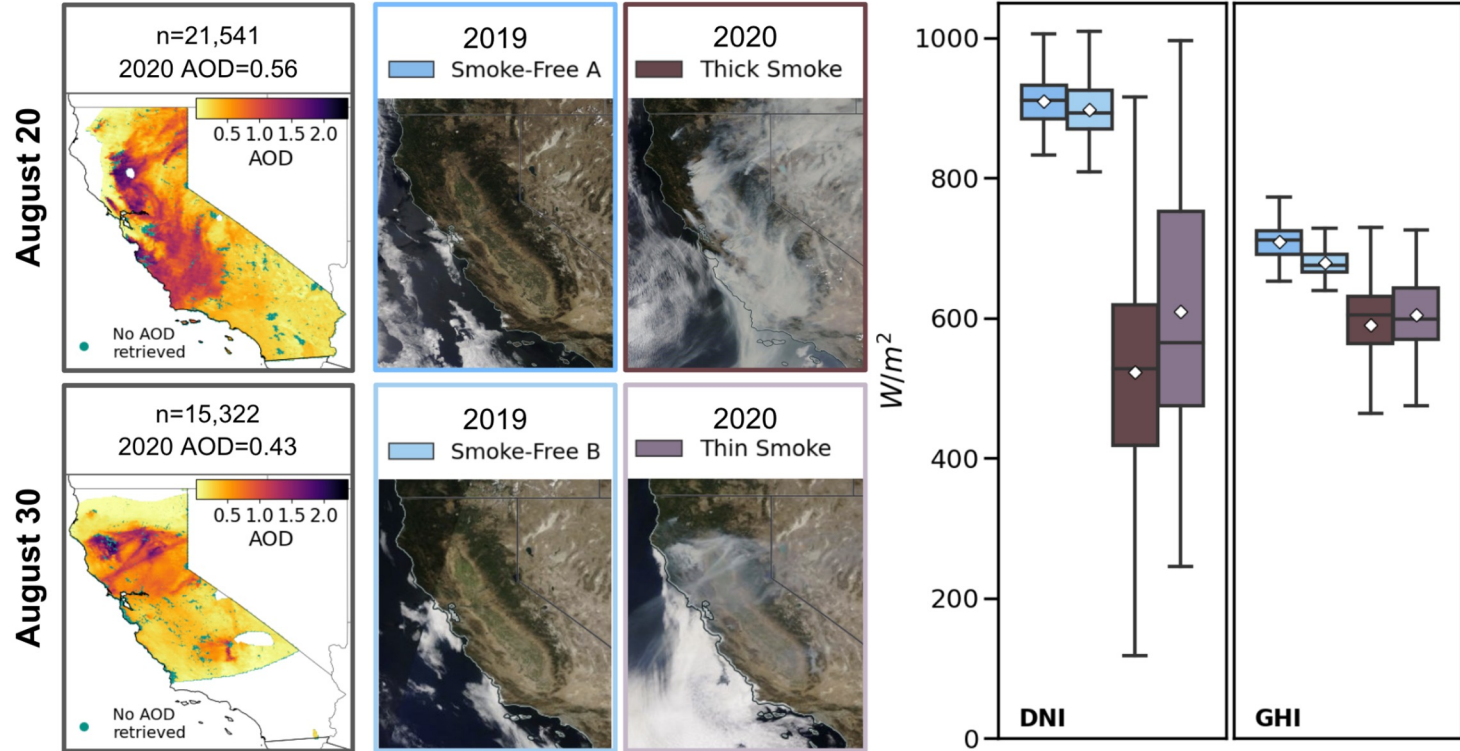


Questions?

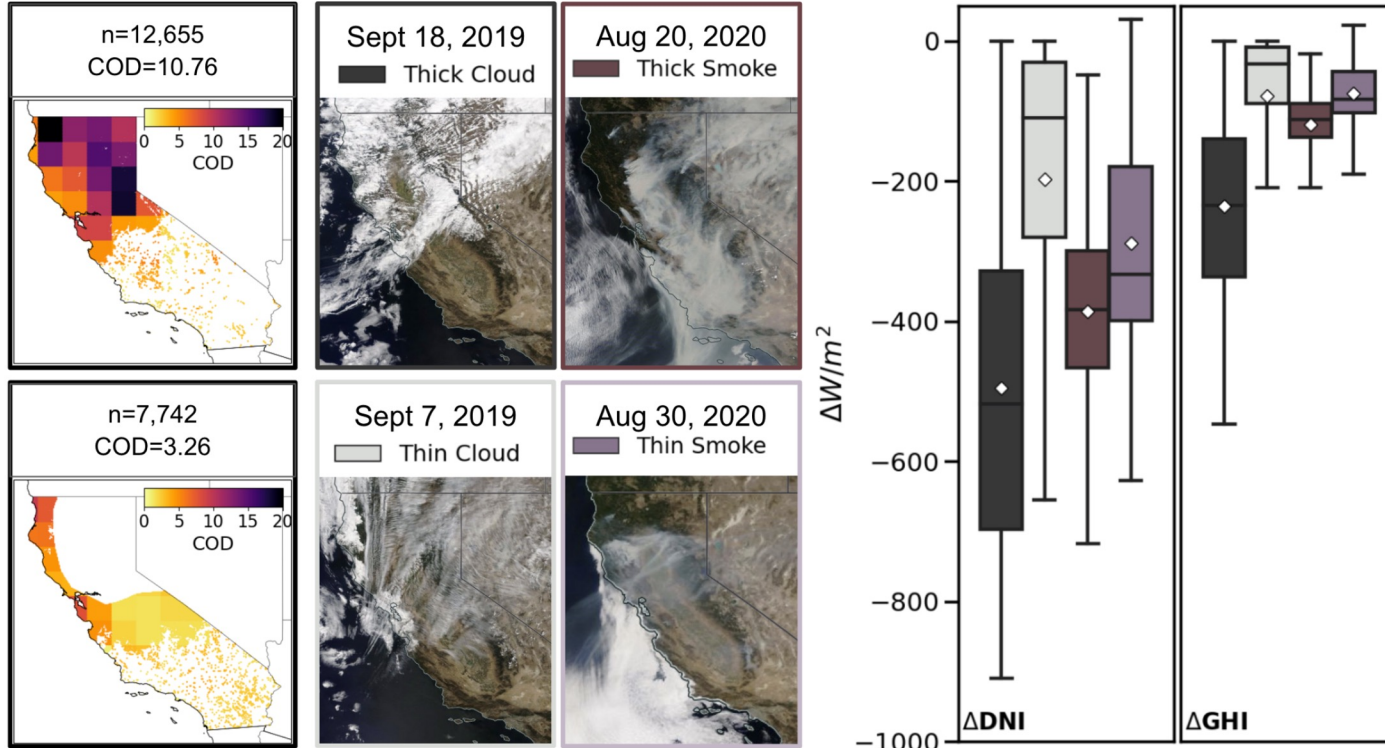
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Additional Slides

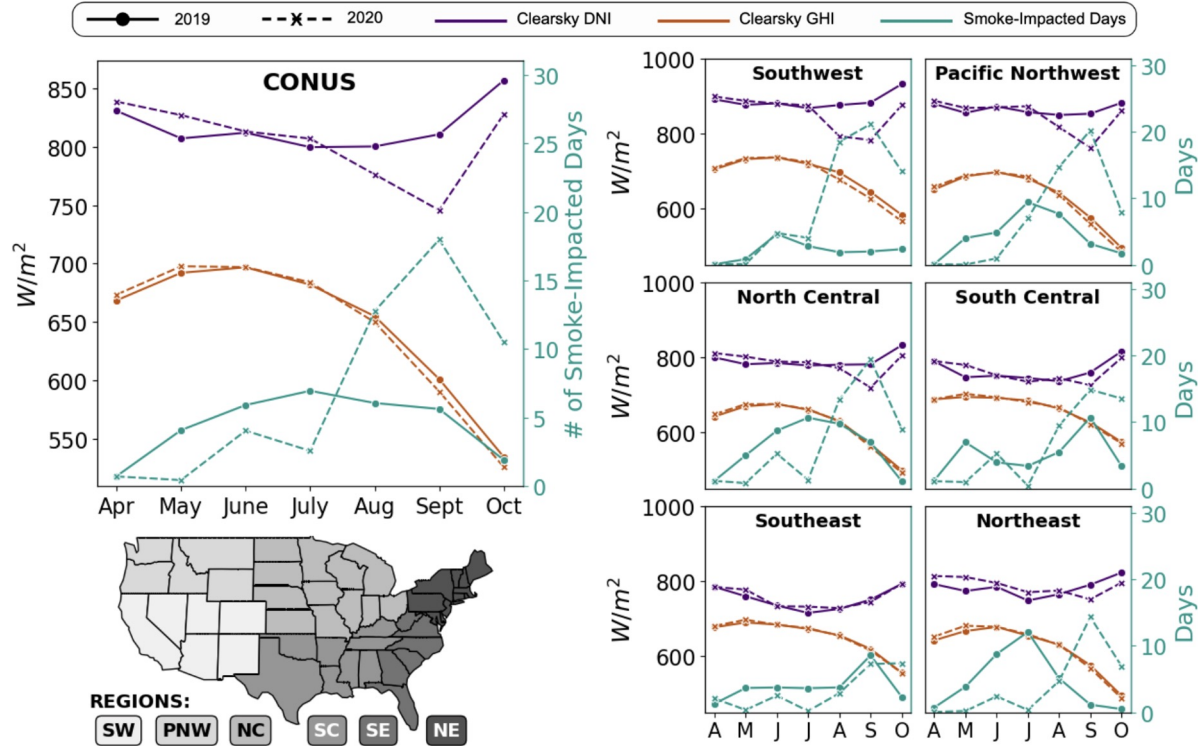
Across smoke-impacted locations in CA, mean DNI decreased 32-40% while GHI declined 13-14%.

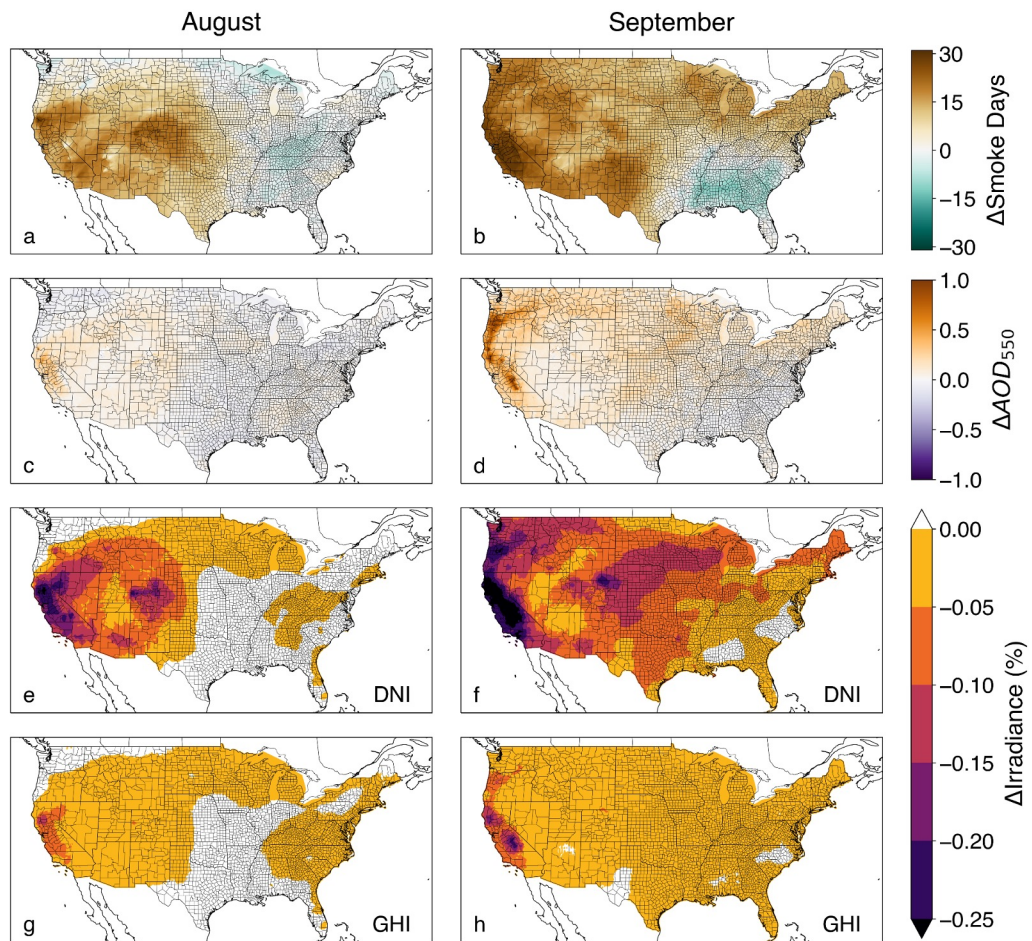


Smoke and optically thinner clouds produce similar changes, but thick cloud impacts can far exceed smoke.

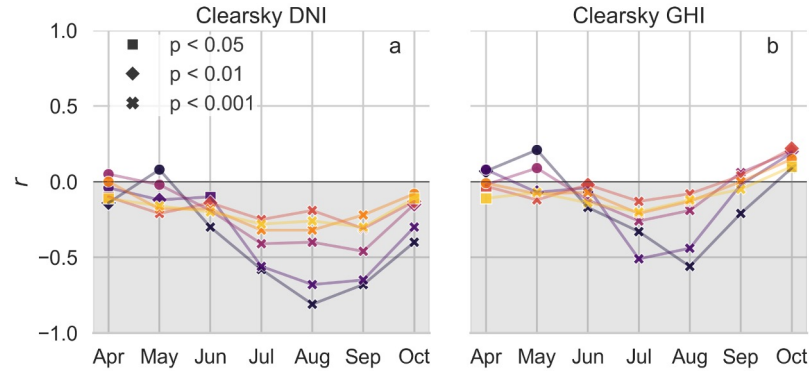


On average, more smoke days are associated with lower DNI, but changes to GHI are minimal. SW, PNW, and NC trends drive CONUS means.





Pearson's Correlation



Linear Regression

