A new method for diagnosing effective radiative forcing from aerosol-cloud interactions in climate models

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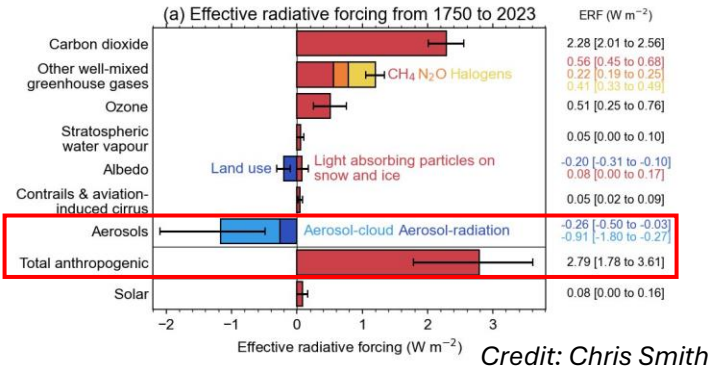
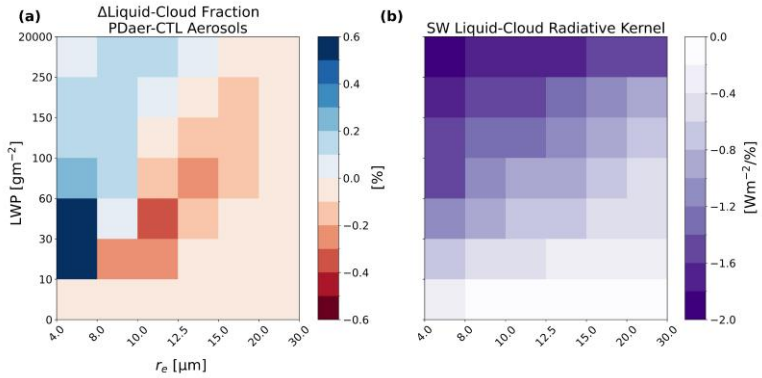
Motivation



Credit: Chris Smith

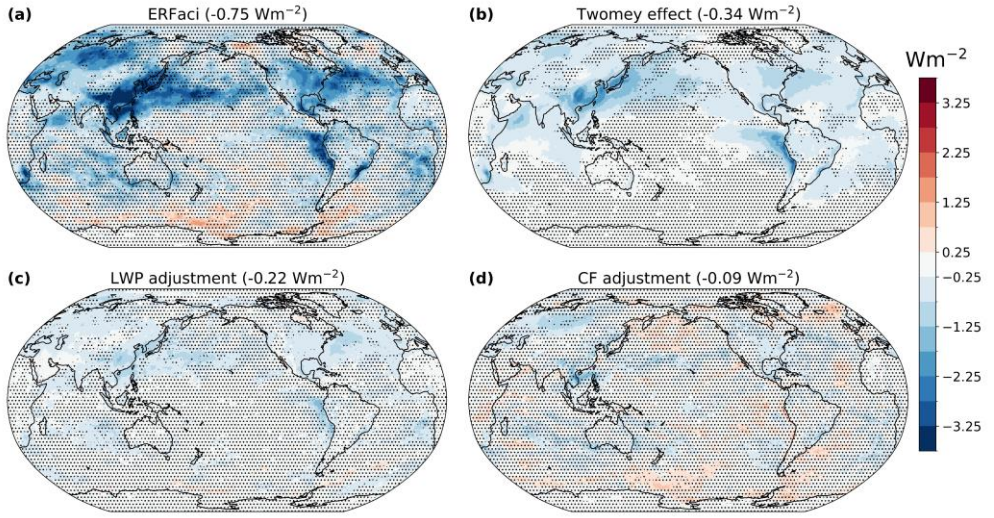
Aerosol-cloud interactions (ACI) are a leading source of uncertainty in estimates of historical effective radiative forcing (ERF)

Cloud Radiative Kernels

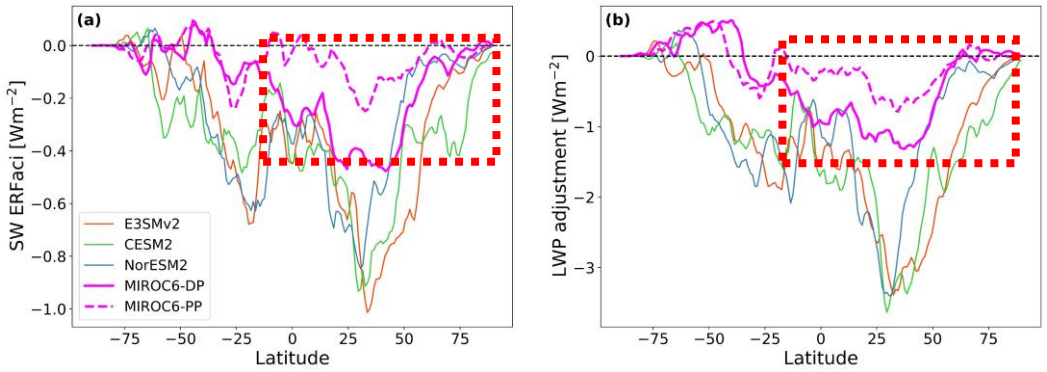


New MODIS joint histograms of liquid water path and effective radius + adaptation of decomposition from cloud feedback literature (Zelinka et al., 2012, 2013)

Twomey effect, LWP adjustment induce strong cooling; CF adjustment varies strongly

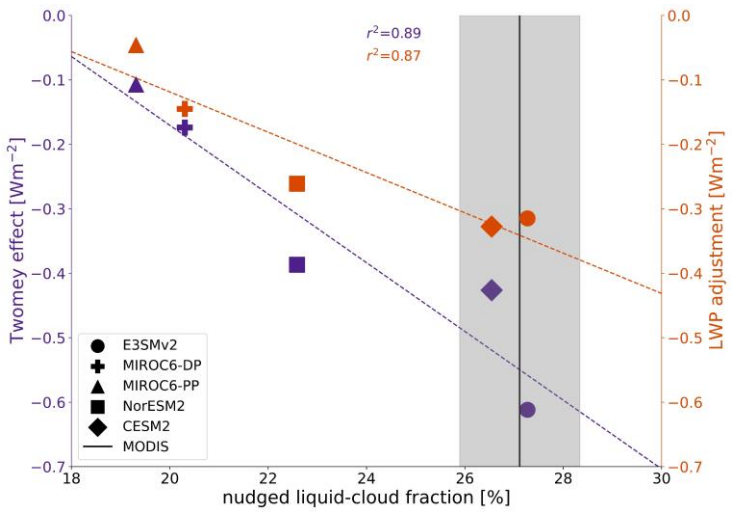


Impact of Precipitation Scheme



Prognostic precipitation reduces ERFaci, LWP adjustment in the Northern Hemisphere, as in Michibata et al. (2019)

Use Case: Mean State Biases & Emergent Constraints



Global-mean liquid-cloud fraction as a first-order control on Twomey effect and LWP adjustment

Website & Preprint:

References

Zelinka et al. (2012): https://doi.org/10.1175/JCLI-D-11-00248.1.
Zelinka et al. (2013): https://doi.org/10.1175/JCLI-D-12-00555.1.
Michibata et al. (2019): https://doi.org/10.1029/2018MS001596.