Arnold, N. P., W. M. Putman, and S. R. Freitas, 2020: Impact of resolution and parameterized convection on the diurnal cycle of precipitation in a global nonhydrostatic model. *J. Meteor. Soc. Japan*, **98**, 1279-1304. Special Edition on DYAMOND: The DYnamics of the Atmospheric general circulation Modeled On Non-hydrostatic Domains, https://doi.org/10.2151/jmsj.2020-066.

Plain Language Summary:

We evaluate the diurnal cycle of precipitation and organized convection in a set of nonhydrostatic global model runs with horizontal grid spacing ranging from 50 km to 3.5 km, using the NASA GEOS model, with scale-aware Grell-Freitas parameterized convection. The 3.5 km experiments are repeated with Grell-Freitas turned off, and again with scale-awareness disabled, to illustrate the impact of parameterized convection.

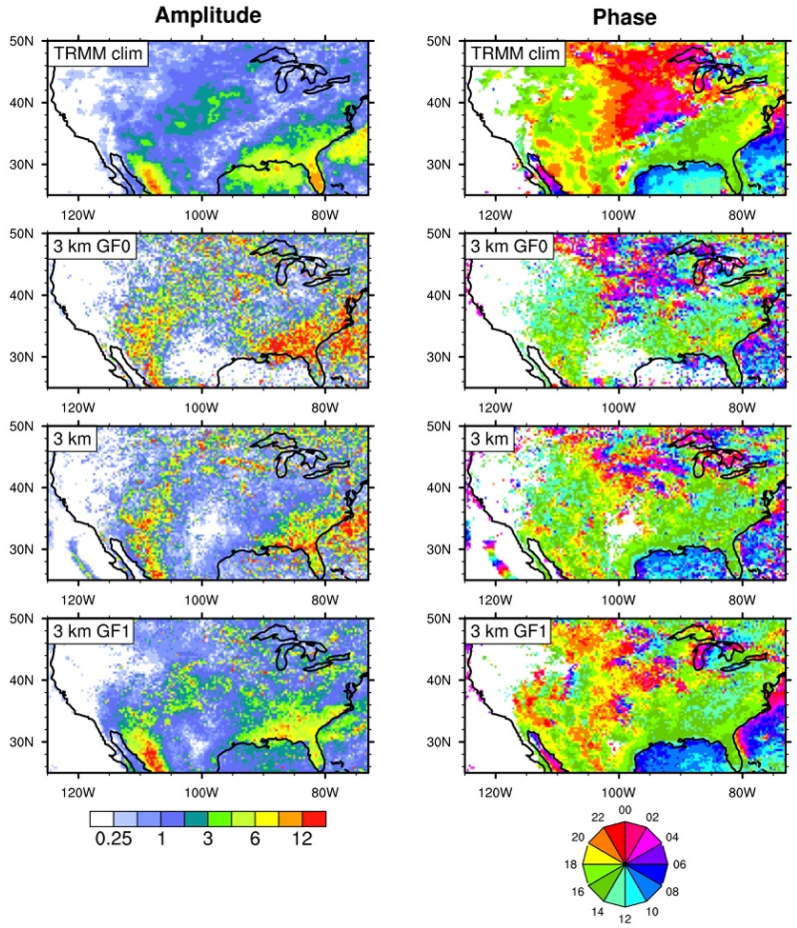

Figure 1. Amplitude and phase of the diurnal harmonic of precipitation over the United States, from TRMM (top) and in 3.5 km GEOS model experiments with Grell-Freitas parameterized convection turned off (3 km GF0), scale-aware (3 km), and not scale-aware (3 km GF1).

- High resolution shows greatest benefit in regions dominated by non-local propagating convection, but produces peaks too early in the day in locally-forced regions.
- Experiments with strong parameterized convection show diurnal amplitudes similar to the observed climatology, whereas those relying on explicit convection develop unrealistic small-scale variability.
- Some parameterized deep convection is beneficial for the diurnal amplitude and phase even with a 3.5 km model grid, but only when throttled with the scale-aware approach.