Evaluation of the Tropical TOA Flux Diurnal Cycle in Reanalysis Models
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1. Introduction and Motivation

- The diurnal cycle is an oscillation in a physical variable with a 24-hour period in response to the daily solar cycle.

2. Errors in Reanalysis TOA flux diurnal cycle

- The variability in the TOA flux diurnal cycle is quantified using a relative metric, eq. (1) normalized by eq. (2).

3. How well do the models capture the diurnal cycle amplitude?

- MERRA and ERA reanalysis models are able to reproduce large-scale features of the TOA flux diurnal cycle climatology.
- The CLR and RSW diurnal cycle errors convective regions are 5-10 times larger than in non-convective regions.
- Reanalysis models show a complete misrepresentation of the cloud diurnal evolution over tropical convective oceans.
- Overall, the intermodel differences in the TOA flux diurnal cycle are smaller than the differences with observations.

4. Why are LW TOA flux errors so large over convective regions?

- Reanalysis models produce a LW TOA flux diurnal cycle amplitude that is too weak.

5. How are reanalysis TOA flux errors influenced by season?

- To analyze the influence of seasons, errors in OLRGC and LWCGC are sorted into 3-month seasons (left to right). Seasonal patterns are immediately apparent (i.e., largest errors in hemispheric summer).

At the largest OLR NRMSE values are found in the season with highest values of solar insolation. Some exceptions include: ocean nonconvective regions and areas where local effects dominate.