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Plain Language Summary: A 3.5-km mesh Non-hydrostatic Icosahedral Atmospheric Model (NICAM) for 26–31 December 2006 simulates the dual peak semidiurnal variation in surface rainfall rate over the tropics. We confirmed this semidiurnal variation of surface rainfall rate from 17-year winter precipitation climatology of Tropical Rainfall Measuring Mission (TRMM) TMI (TRMM Microwave Imager), Precipitation Radar (PR), and the same 6-day data of Global Satellite Mapping of Precipitation (GSMaP), as well as infrared data from geostationary satellites.

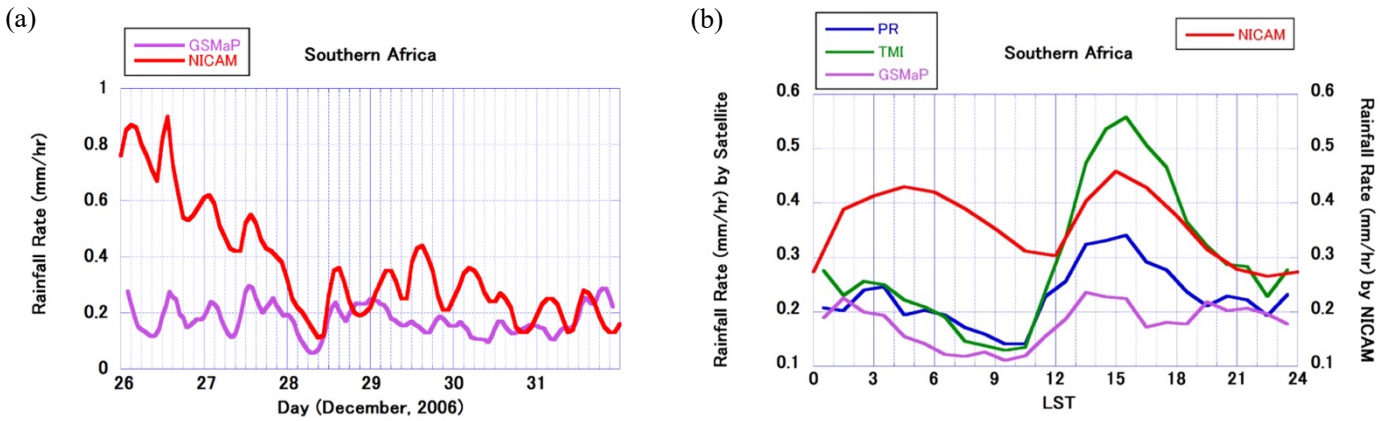

Figure 1. (a) Daily variation of mean rainfall rate over the southern Africa (15°-28°E, Eq.-20°S) by the NICAM simulation (red), and GSMaP (purple) (left). (b) Diurnal variation of rainfall rate averaged over the southern Africa by PR (blue), TMI (green), GSMaP (purple), and the NICAM simulation (red) (right).

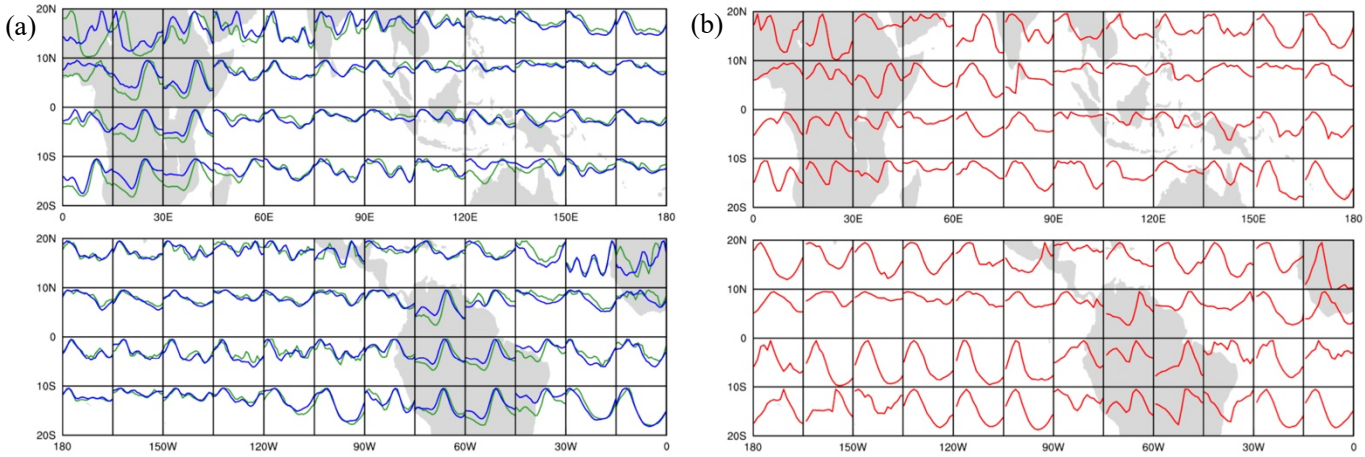

Figure 2. (a) Map of the time series of mean rainfall over the 10° × 15° latitude-longitude grid arrays (boxes) over the tropics (20°N-20°S) constructed from NICAM simulation. In each grid box, x-axis spans 0-23 LST, and the y-axis is rainfall rate normalized to the maximum rainfall rate that box. (b) Same as (a) but for the TMI (green) and PR (blue) observations.

Highlights:

- Over southern Africa and the Amazon, the NICAM simulation captures the primary peak in the afternoon and the secondary peak in the early morning, at similar times to those captured by TRMM data.
- In the PR observation, the primary peak of rainfall is mainly due to convective rain, whereas the secondary peak is due to stratiform rain. In the NICAM simulation, if a simple method is used for classification of convective/stratiform rain, convective rain is dominant all day long and the rainfall rate is generally higher than the PR observation.
- In the NICAM simulation, the relative magnitudes of the two peaks are not represented well, and the contribution of the stratiform rain is underestimated.