Examine MJO Precipitation Signal Simulated by NCEP GFS and CFS Models

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The Madden-Julian Oscillation (MJO) is the dominant tropical intraseasonal mode and a potential source of untapped predictability in both the tropics and extratropics. Though many general circulation models (GCMs), including the NCEP Global Forecast System (GFS) and Climate Forecast System (CFS) model, have been found to be capable of capturing some observed dynamical features of the MJO, a realistic representation of the observed precipitation variability associated with MJO, which is more desirable because of the latent heat released by precipitation driving teleconnections and leading to useful predictability, remains to be a common difficulty in the GCM simulations.

A recent study by Jia-Lin Lin of NOAA-CIRES Climate Diagnostics Center and Wanqiu Wang of NCEP/Climate Prediction Center evaluated the MJO simulations in terms of precipitation variability by the NCEP GFS and CFS models with vertical resolutions of 28- and 64- atmospheric layers. Eight years of daily precipitation from each model simulations were analyzed and compared with two observational datasets, i.e. GOES Precipitation Index (GPI) and Global Precipitation Climatology Project (GPCP) One-Degree-Daily (1DD) Precipitation. The MJO was defined as the tropical eastward propagating waves with wavenumber 1-6 and period 30-70 days. The results showed that the MJO precipitation signals in the NCEP models had too weak variance (Fig.1) and lacked a pronounced spectral peak (Fig. 2) for overly strong persistence.

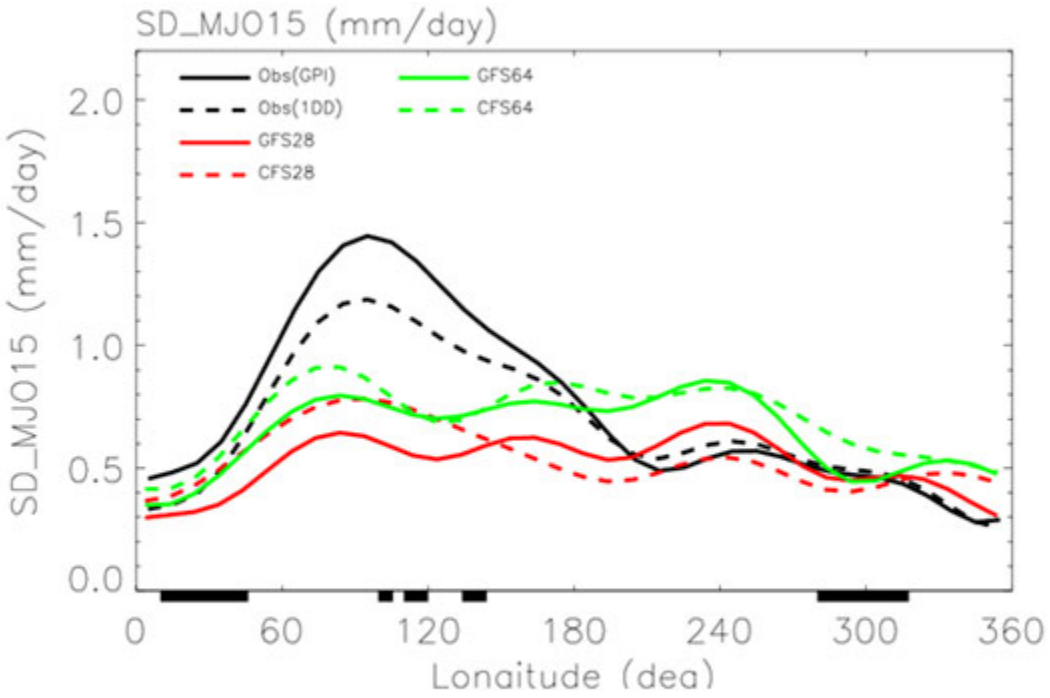

Fig. 1 Standard deviation of the MJO precipitation anomaly averaged between 15N and 15S for the two observational datasets and the four NCEP model simulations. The NCEP models have too weak MJO variance.

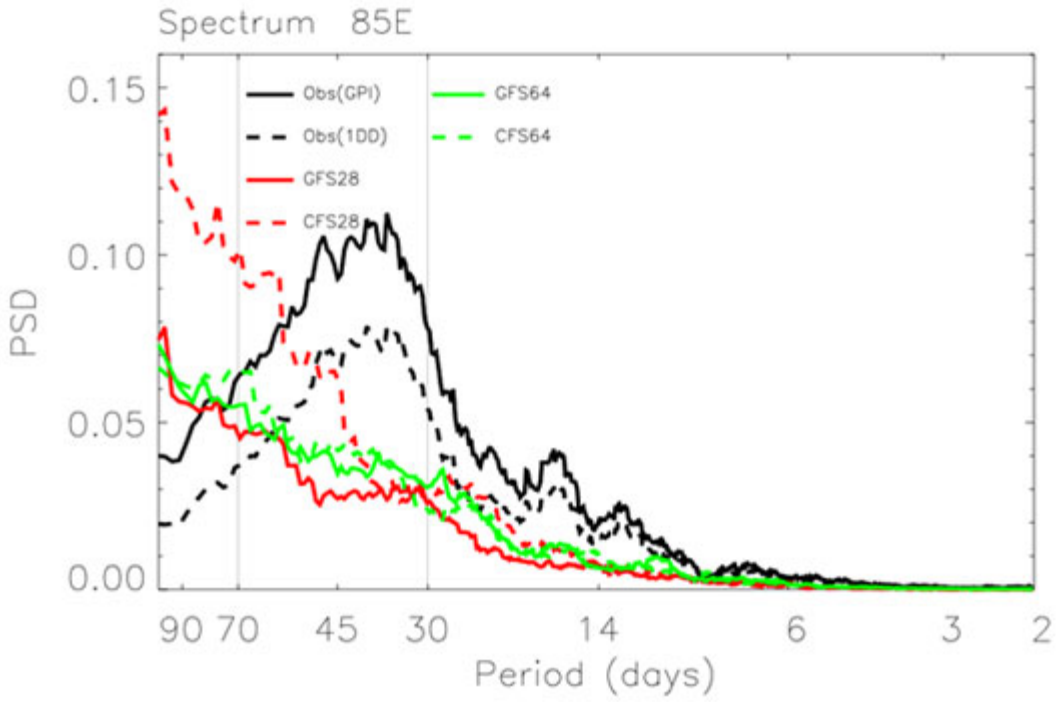

Fig. 2 Spectrum of the precipitation with the eastward component and the wavenumber 1-6 at 0N85E. The NCEP models lack the pronounced spectral peak in the 30-70 day frequency band, which is evident in the observation.

The MJO encompasses many key physical processes, such as convection, clouds, and planetary boundary layer etc. Further analysis at the process level to explore the reasons for the weakness is in progress.

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