# Mid-latitude response to fast and slow MJO episodes in a very large ensemble of CFSv2 experiments

The Madden Julian Oscillation (MJO) is known to be a potential source of predictability in the extratropics in extended range weather forecasting. The nature of MJO is sporadic and therefore mid-latitude response may depend on the nature of the MJO event. Our recent observational study (Yadav and Straus, 2017, Circulation response to Fast and Slow cases, accepted in MWR) assesses the different remote Northern Hemisphere response to fast and slow MJO episodes in terms of composite maps and frequency of occurrence of robust circulation regimes.

To understand the impact of heating/cooling and to estimate mid-latitude response to Fast and Slow MJO episodes, experiments with CFSv2 coupled model of NOAA in a forecasting environment are carried out using the technique of adding idealized MJO heating for 32 winters (NDJFM from 1980-2011). The added heating technique consists of adding a realistic MJO-like evolution of the three-dimensional diabatic heating to the fully coupled model. The two sets of experiments are designed based on the observational analysis so that the tropical diabatic added heating to produce Fast or Slow MJO episodes with idealized phase speed. The Fast (Slow) experiments use a phase speed of 5 (3) degrees/day.

Initial conditions (from CFS reanalysis) at every 15 days (1st and 15$^{th}$ of Nov, Dec, Jan, February at 00Z) are used thus giving us a large set of forecasts, each of which is repeated with perturbed initial conditions to form an ensemble. The far field response in CFSv2 will be studied using lagged composites of geopotential height field and streamfunction at 200hPa. We will test the observation finding of an increase in the frequency of occurrence of the NAO+ regime 15 days following phase 4 and sharp increase in NAO- regimes following phase 6, with these responses dominated by Slow episodes.

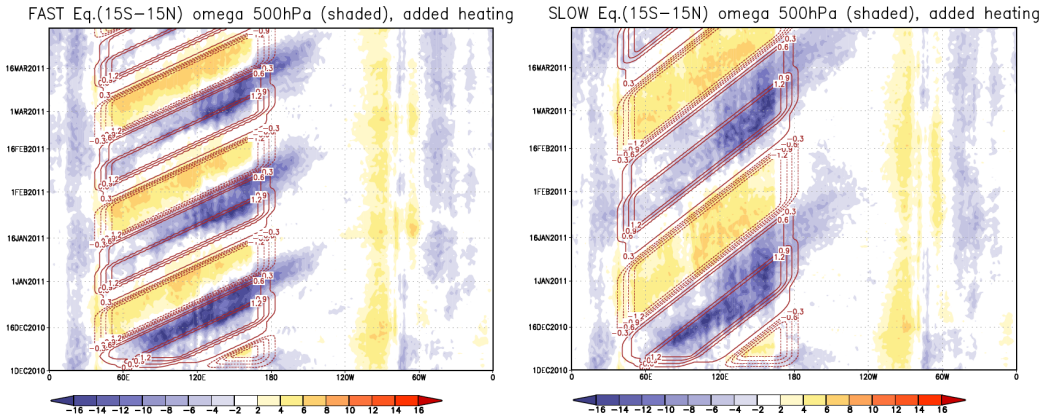


Figure: Added heating (contours in degree/day) alongside the model response (shaded region is vertical pressure velocity in units of 0.01Pa/sec) for Fast (left) and Slow (right) experiments at 500hPa averaged between 15S and 15N.