Evaluating the MJO forecast skill in the NCEP GEFS 35-day Experiments

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Introduction

NOAA is accelerating its efforts to improve the numerical guidance and prediction capability for extended range (week3&4) prediction in its seamless forecast system. As a dominant mode and potential source of predictability in the sub-seasonal time range, Madden-Julian Oscillation (MJO) forecast skill is investigated in this work.

The NCEP Global Ensemble Forecast System (GEFS) based on the Global Forecast System (GFS) model is used to perform the experiments. We evaluated the Wheeler Hendon MJO forecast skill and examined the performance of the forecast system on the forecast skill of the MJO key components. We found that using the updated stochastic scheme (SPs) improved the MJO forecast skill for about 4 days. Further updating the underlying SST with the bias corrected CFSv2 forecast improved the MJO skill for another 1.7 day. The best configuration of the four experiments is the SPs+CFSBC+CNV with a MJO forecast skill increased ~9 days. The upper and lower level wind has larger contribution than the convection represented by the outgoing longwave radiation (OLR). The improvement of the WH MJO forecast skill is mainly due to the improvement in the circulation and convection representation over the tropical west Pacific especially in SPs+CFSBC+CNV..

Experimental Design

- **Forecast System:**
  GEFS, 20 members + control, integrated to 35 days

- **Resolution:**
  T574L64 (33 km); 0-8 days; T574L64 (33 km); 8 to 35 days; T382L64 (55 km)

- **Initialization:**
  May 1, 2014 - May 26, 2016, 00Z, every 5 days.

- **Configurations**
  - **STTP:** Operational version of GEFS.
  - **SPs:** Updated stochastic physics
  - **SPs+CFSBC:** Updated stochastic physics (SPPT+SHUM+SKEB); forced with analysis and bias-corrected CFSv2 SST
  - **SPs+CFSBC+CNV:** Updated stochastic physics; updated convection scheme in GSM and bias-corrected CFSv2 SST

- **Analysis Data**
  - NCEP GFS analysis
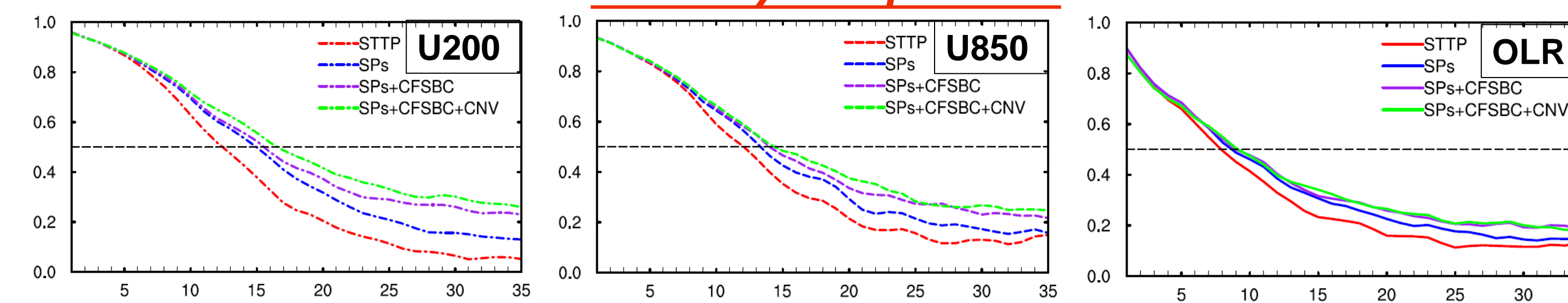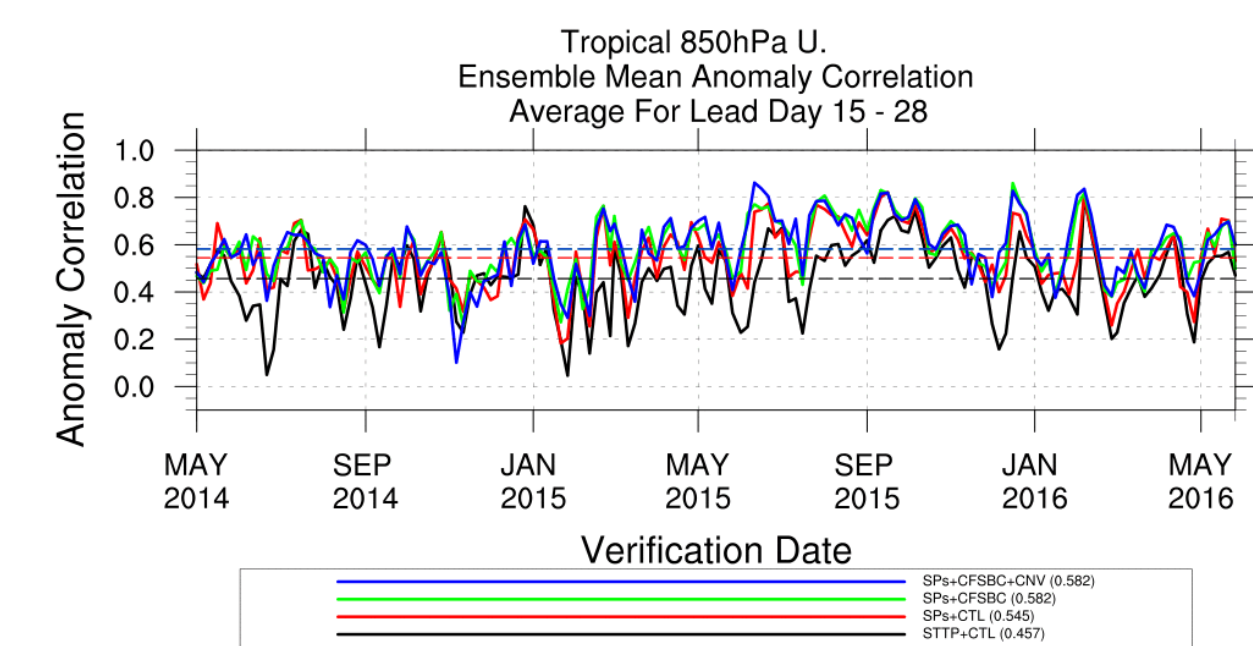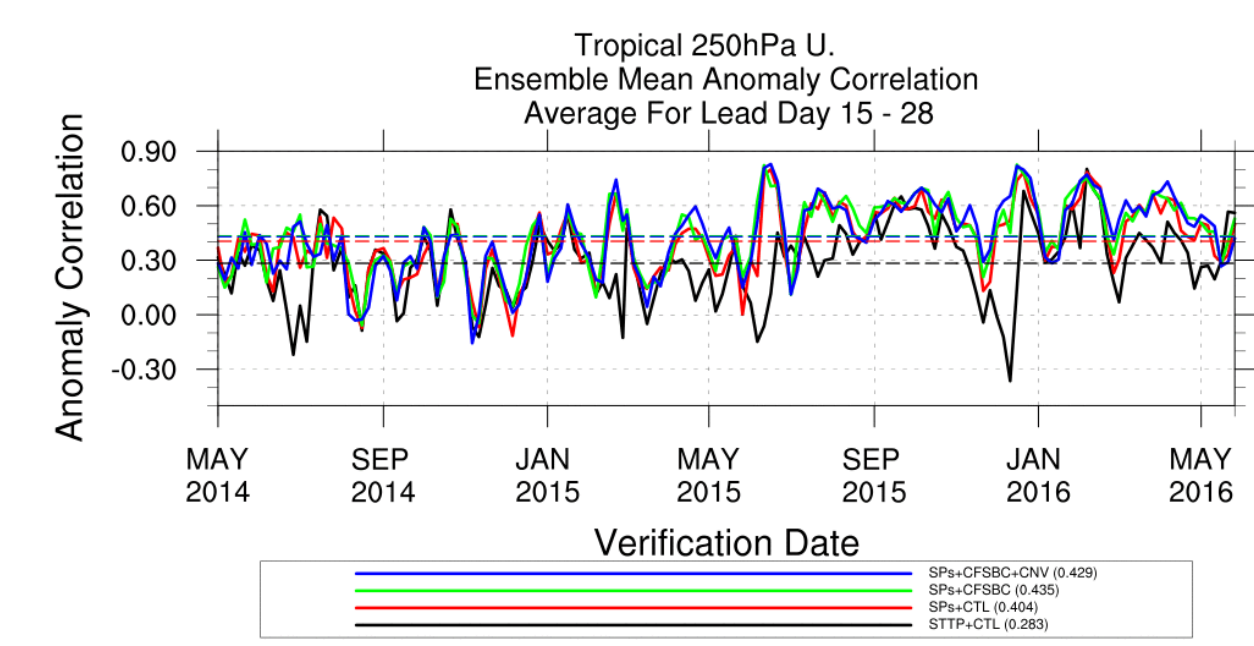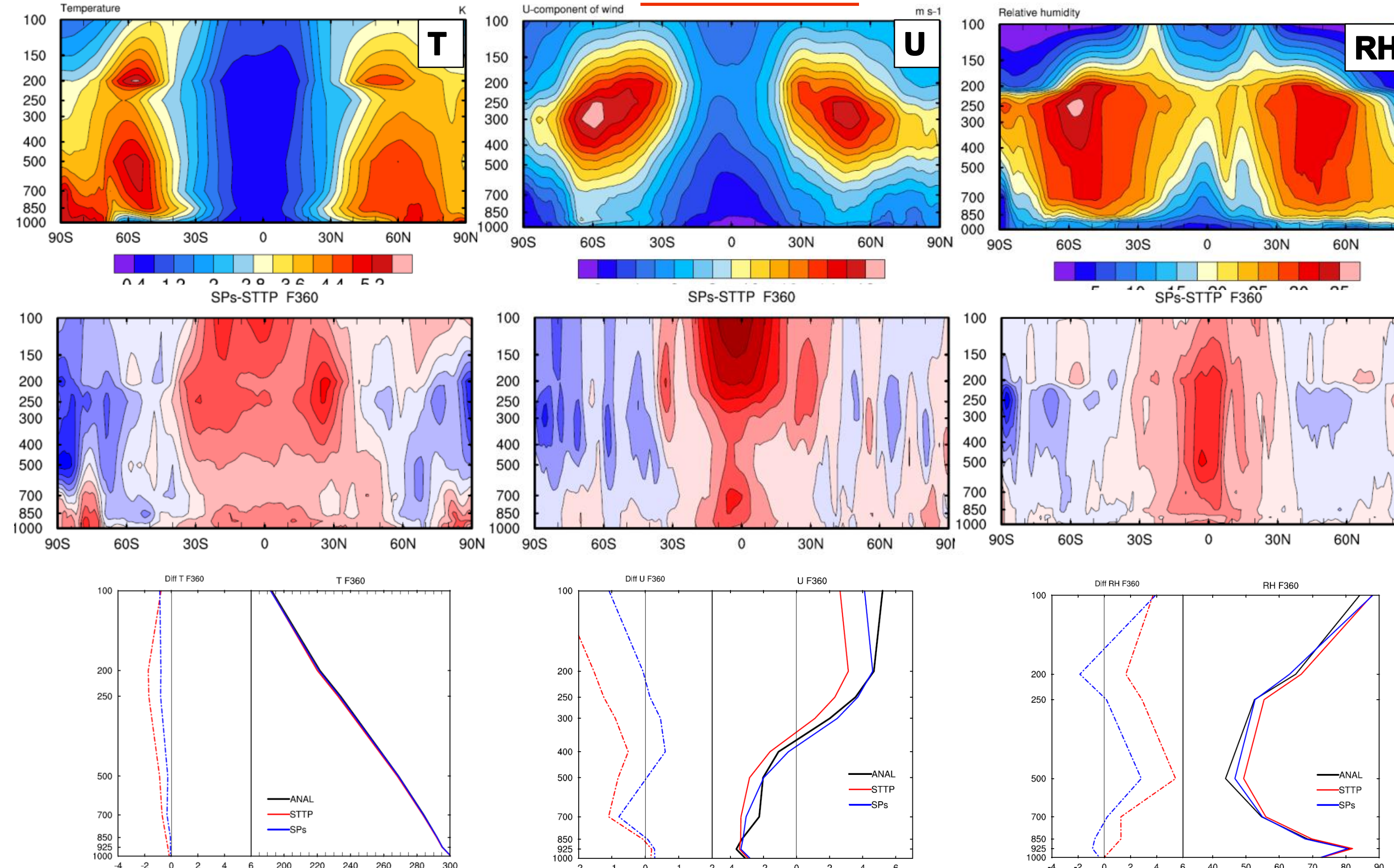 - Both analysis and forecast data is daily mean.

Results

MJO Skill
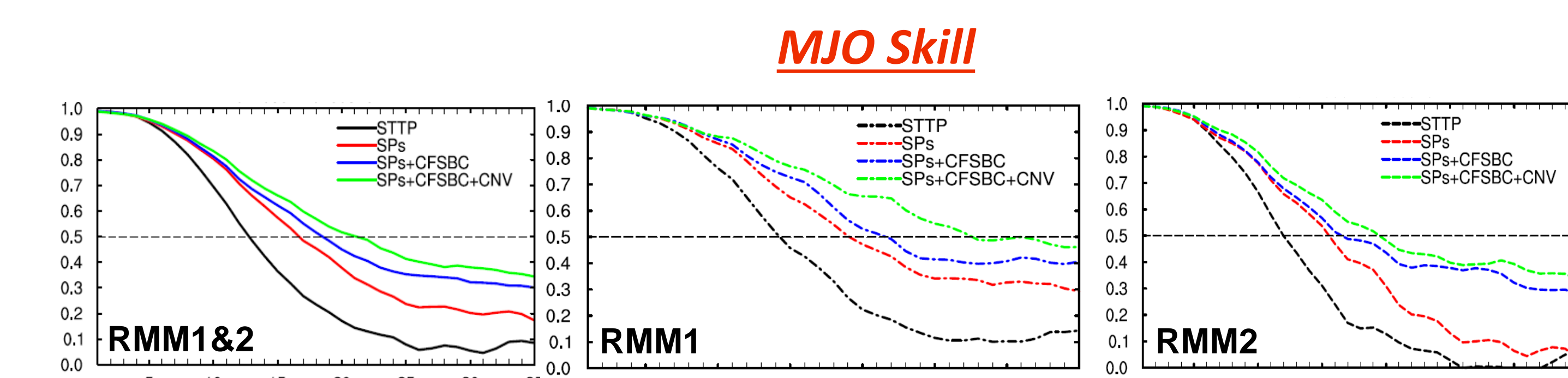
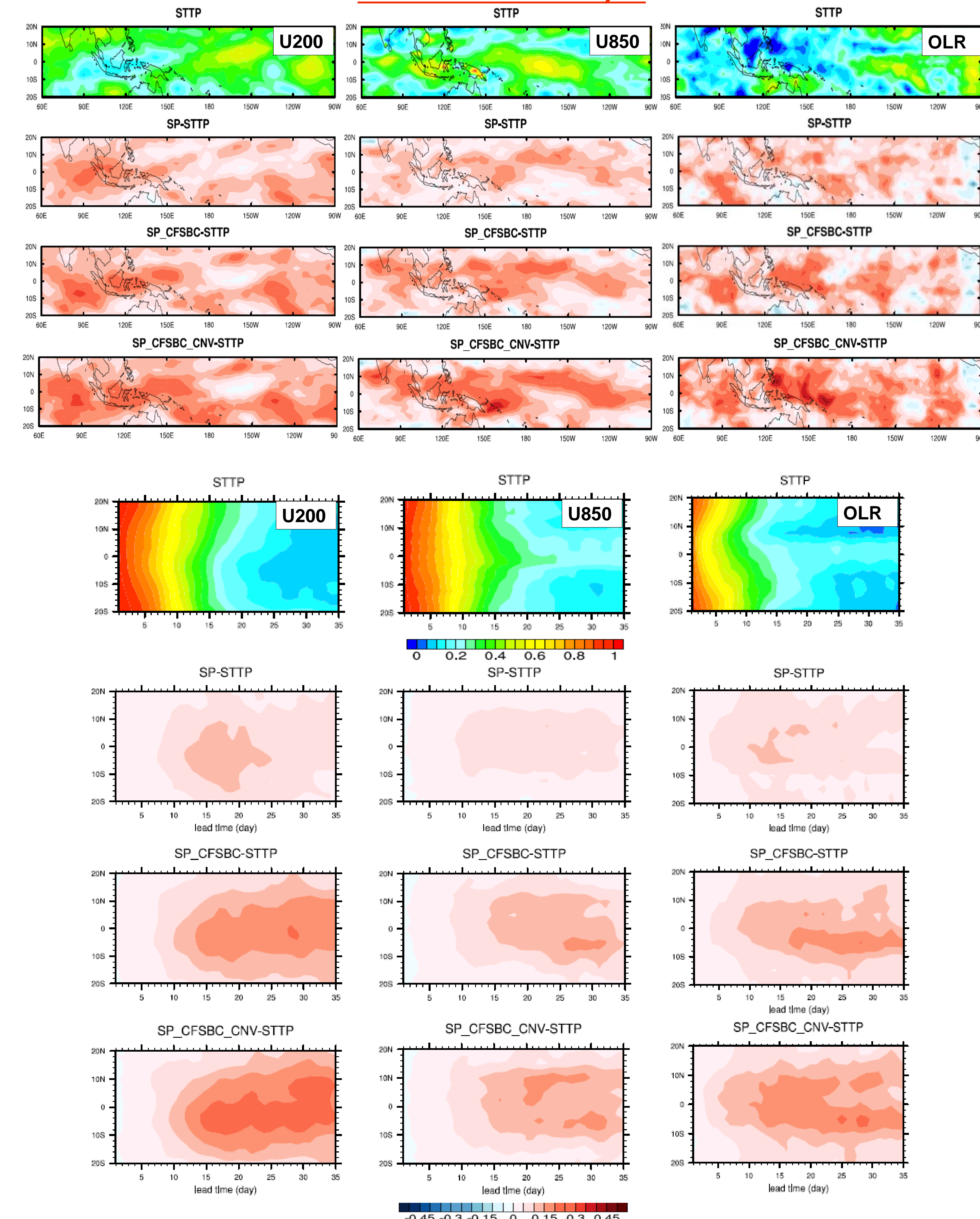### *MJO Index and Evolution*
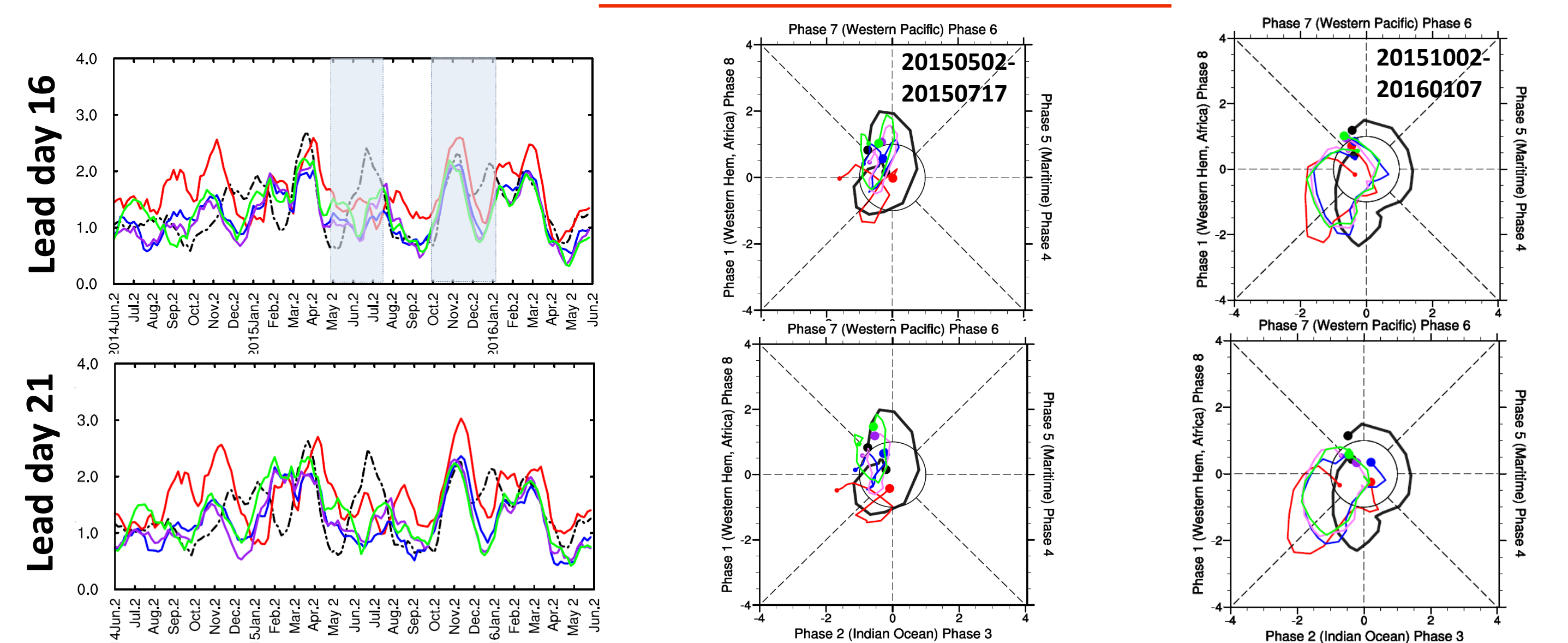
MJO Key Components

STTP vs SPs

Correlation with Analysis

Summary and Future Work

- MJO forecast skill : SPs +CFSBC+CNV (22 days) > SPs+CFSBC (18.5 days) > SPs (16.8 days) > STTP (12.5 days)
- Component Forecast skill: U200 > U850 > OLR
- Tropical west Pacific and Indian Ocean show the most evident improvement
- Bias-corrected MJO variables will be evaluated in future work.