Towards Advancing the MJO and 1-30-day Weather Forecasting in the Fully Coupled NGGPS

- Status Update

PI: Joshua Xiouhua Fu (U. Hawaii)

Collaborators: Yuejian Zhu, Cecelia Deluca,
Wei Li, and Xiaqiong (Kate) Zhou

August 29 2018

MJO Sensitivity study in GEFS retrospective forecasts to support SubX project:

- Improved Stochastic Physics,
- 2-tired SST approach
- and Scale-aware Cumulus Parameterization

References:

- Zhou, X., Y. Zhu, D. Hou, Y. Luo, J. Peng and D. Wobus, 2017: *The NCEP Global Ensemble Forecast System with the EnKF Initialization, Wea.* Forecasting, Vol. 32, 1989-200
- Zhu, Y., X. Zhou, M. Pena, W. Li, C. Melhauser and D. Hou, 2017: *Impact of Sea Surface Temperature Forcing on Weeks 3 & 4 Forecast Skill in the NCEP Global Ensemble Forecasting System,* Wea. Forecasting, Vol. 32, 2159-2173
- Zhu, Y., X. Zhou, W. Li, D. Hou, C. Melhauser, E. Sinsky, M. Pena, B. Fu, H. Guan, W. Kolczynski, R. Wobus and V. Tallapragada, 2018:*Towards the Improvement of Sub-Seasonal Prediction in the NCEP Global Ensemble Forecast System (GEFS)"*, JGR, p6732-6745
- Li, W., Y. Zhu, X. Zhou, D. Hou, E. Sinsky, C. Melhauser, M. Pena, H. Guan and R. Wobus, 2018: *Evaluating the MJO Forecast Skill from Different Configurations of NCEP GEFS Extended Forecast, Climate Dynamics* (in review process)

Configuration of Four Sensitivity Experiments

- Mode system – NCEP GEFSv11
- Resolution – 34km (0-8 days); 55km(8-35days)
- Ensemble members – 21 members (20 perturbed forecast + control forecast)
- Period – May 1st 2014 – May 26 2016
- Frequency – every 5-day at 00UTC

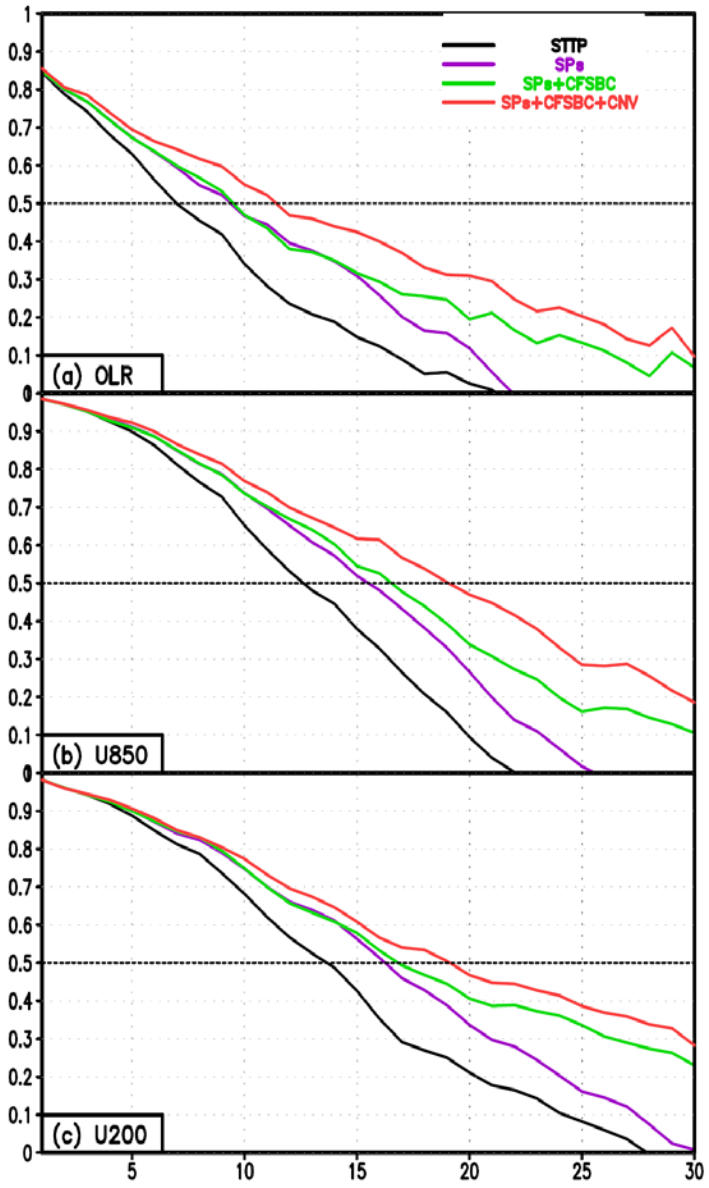
Label	Stochastic Physics Scheme	SST	Cumulus Scheme
STTP	STTP	Relax to Climatology	SAS
SPs (SPSA)	SPPT+SHUM+SKEB	Relax to Climatology	SAS
SPs+CFSBC (SPSB)	SPPT+SHUM+SKEB	Initial analysis+ bias corrected CFS forecast	SAS
SPs+CFSBC+CNV (SPSC)	SPPT+SHUM+SKEB	Initial analysis+ bias corrected CFS forecast	Updated SAS

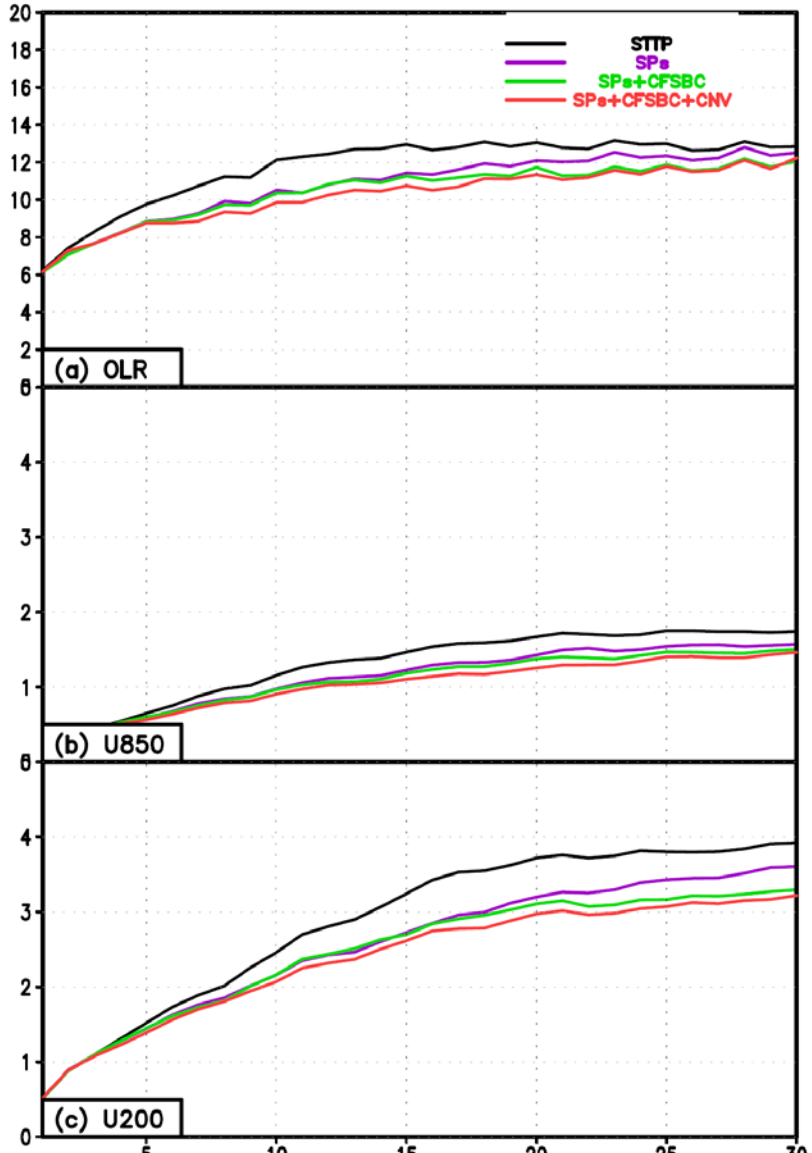
Part I: Overall Skill Assessment

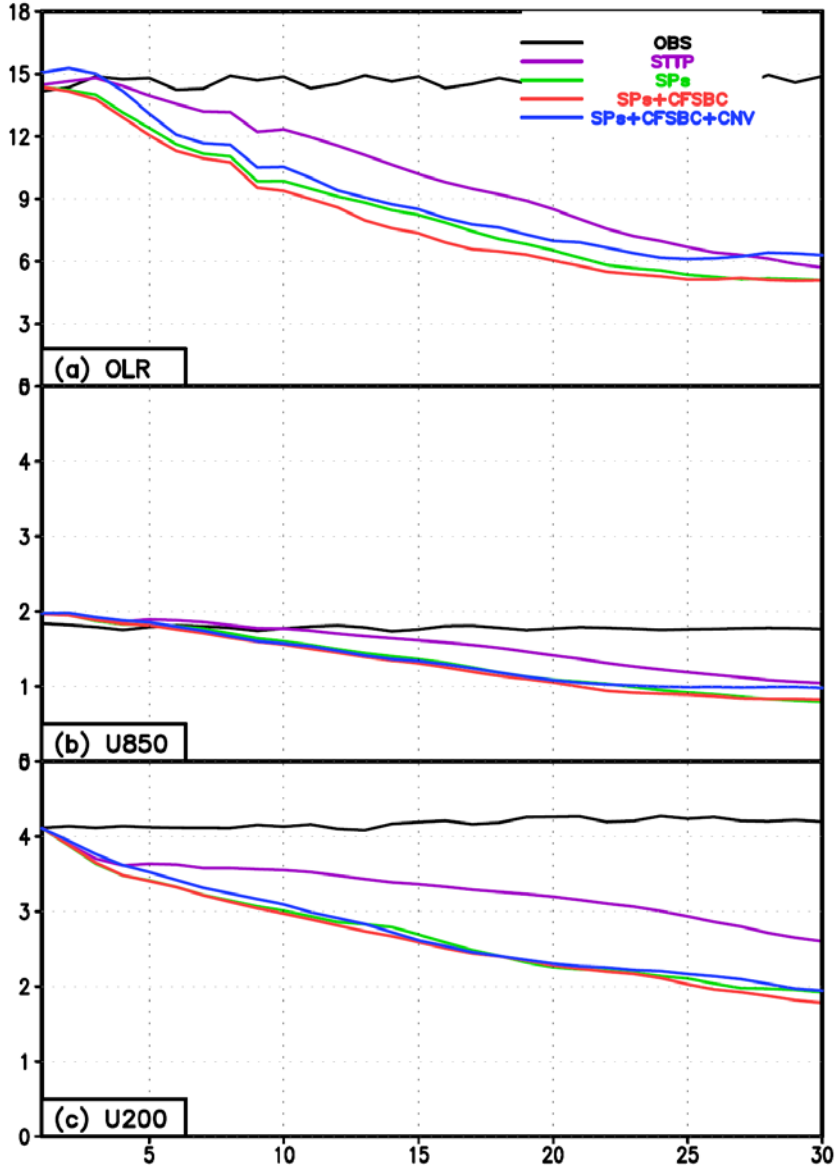
ACC

RMSE

Intensity

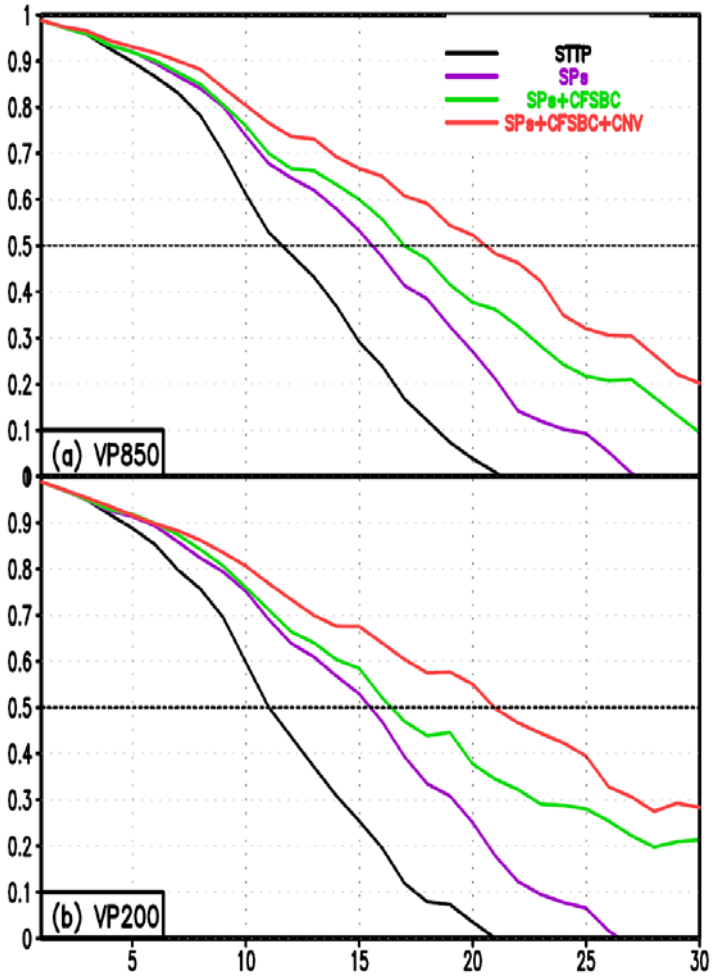




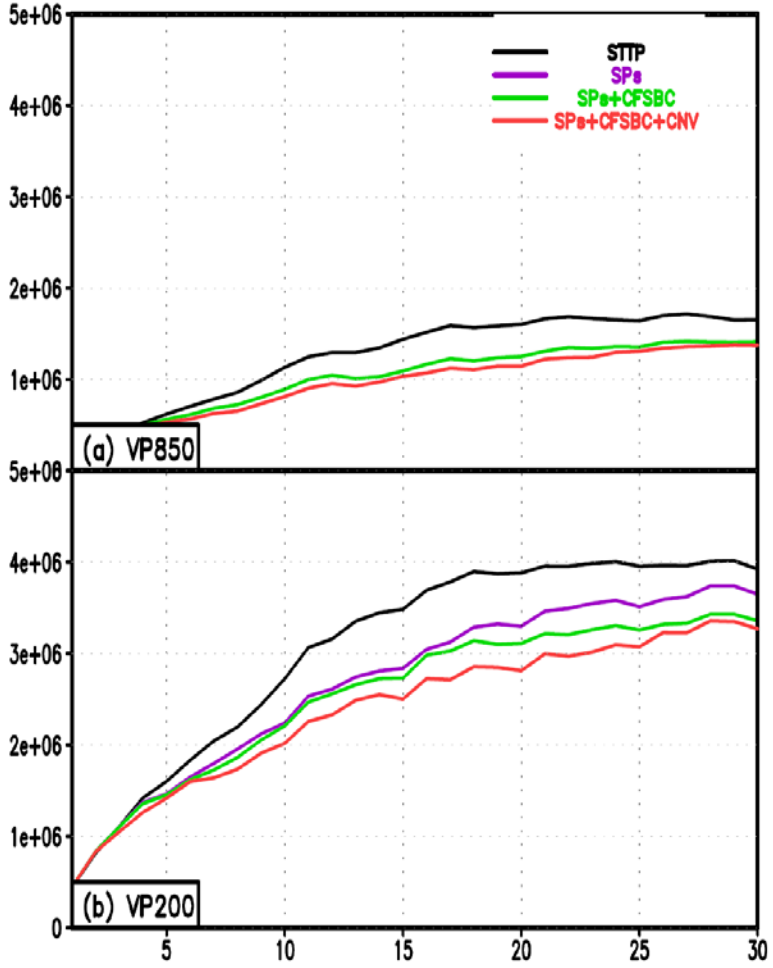


(Standard Deviation)

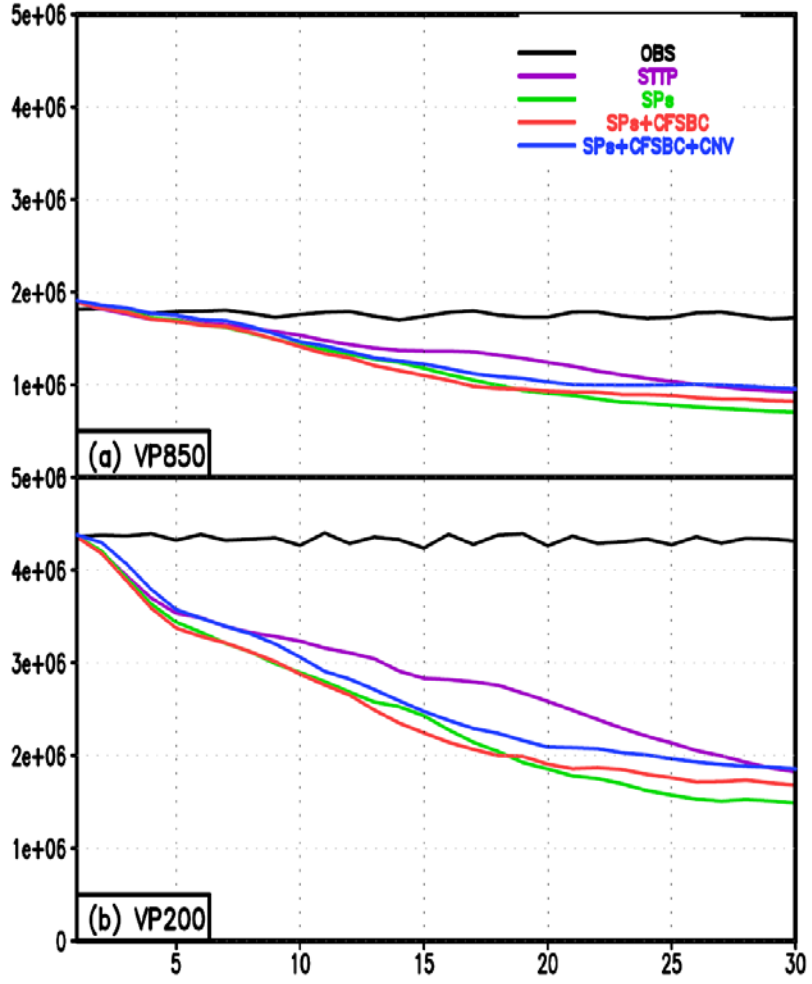
ACC



RMSE



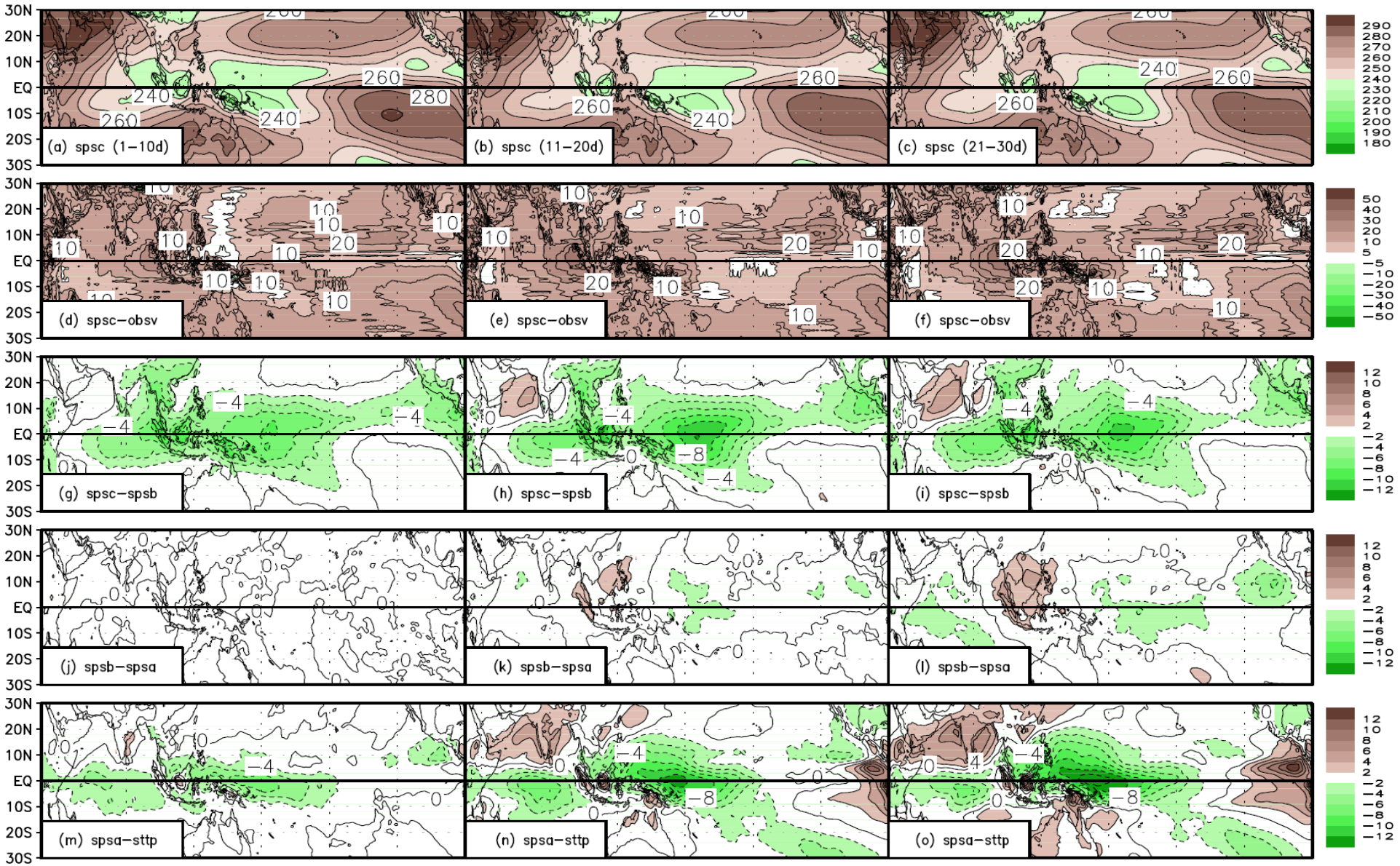
Intensity



(Standard Deviation)

Part II: Mean States

OLR Means, Biases, and Mean-differences among Four Different Experiments (STTP, SPSA, SPSB, SPSC)



Means

Biases

SPSC-SPSB

SPSB-SPSA

SPSA-STTP

1st 10-d

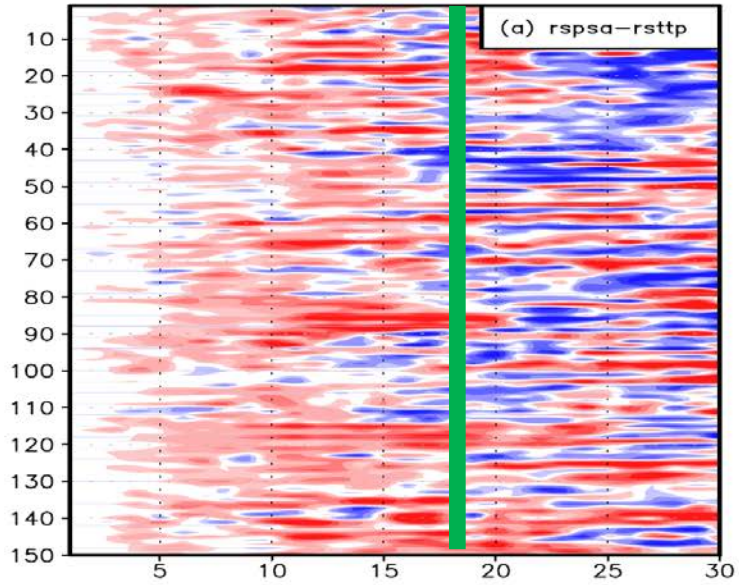
2nd 10-d

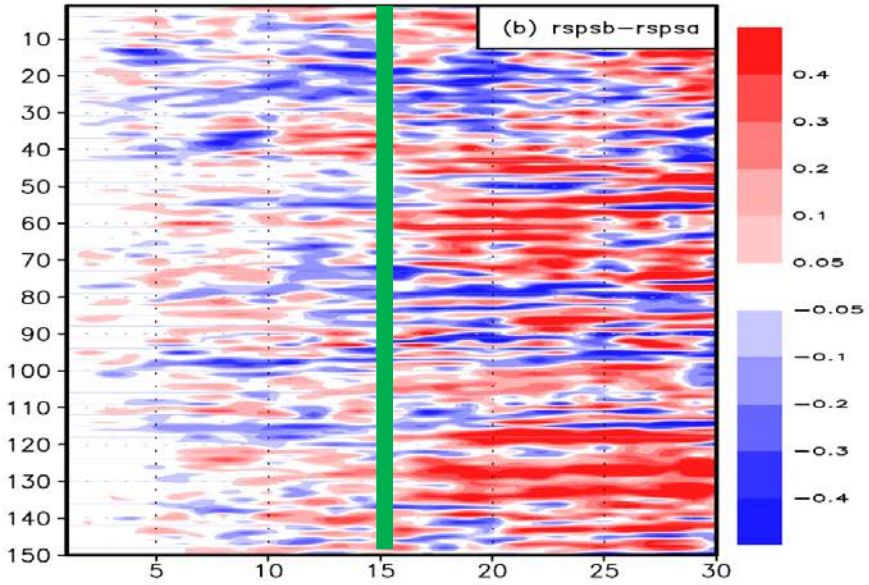
3rd 10-d

Part III: Spatial-Temporal Distributions of Skill Changes in the Four Sensitivity Experiments

OLR ACC Differences among Four Experiments as Functions of Initial Dates and Lead Times

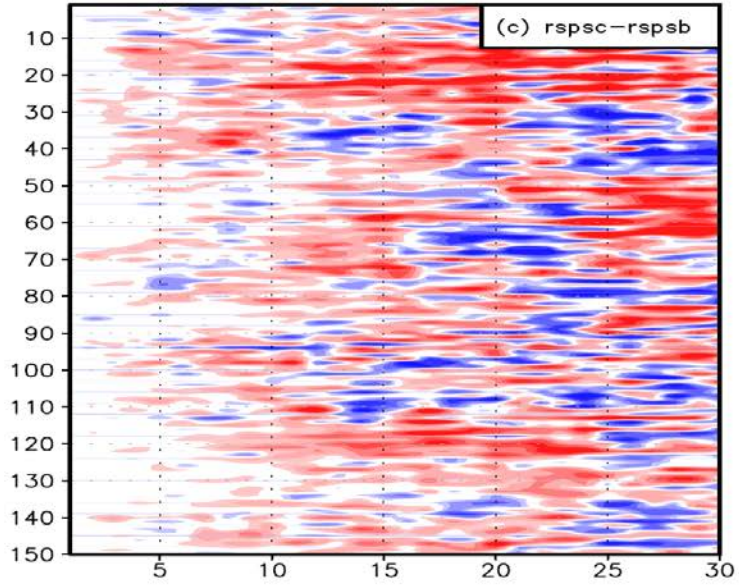
SPSA-STTP

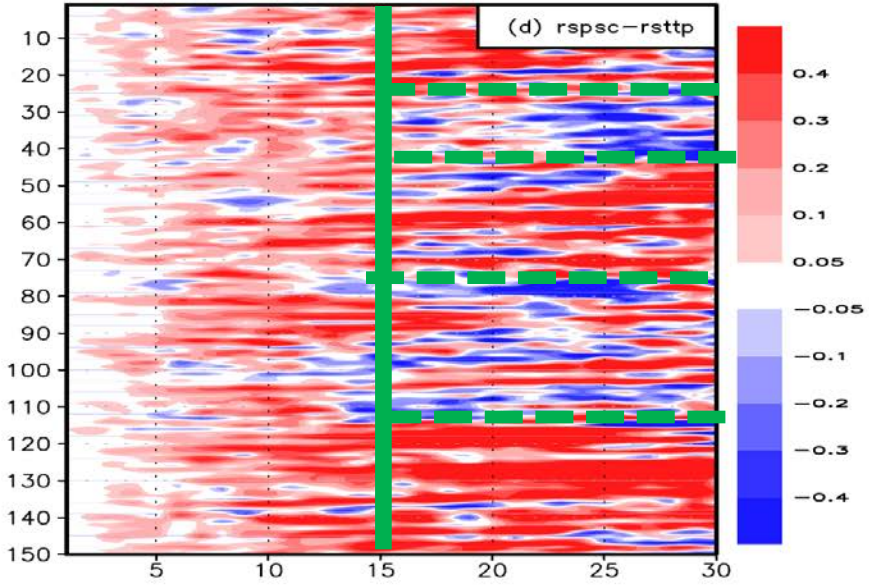




SPSB-SPSA

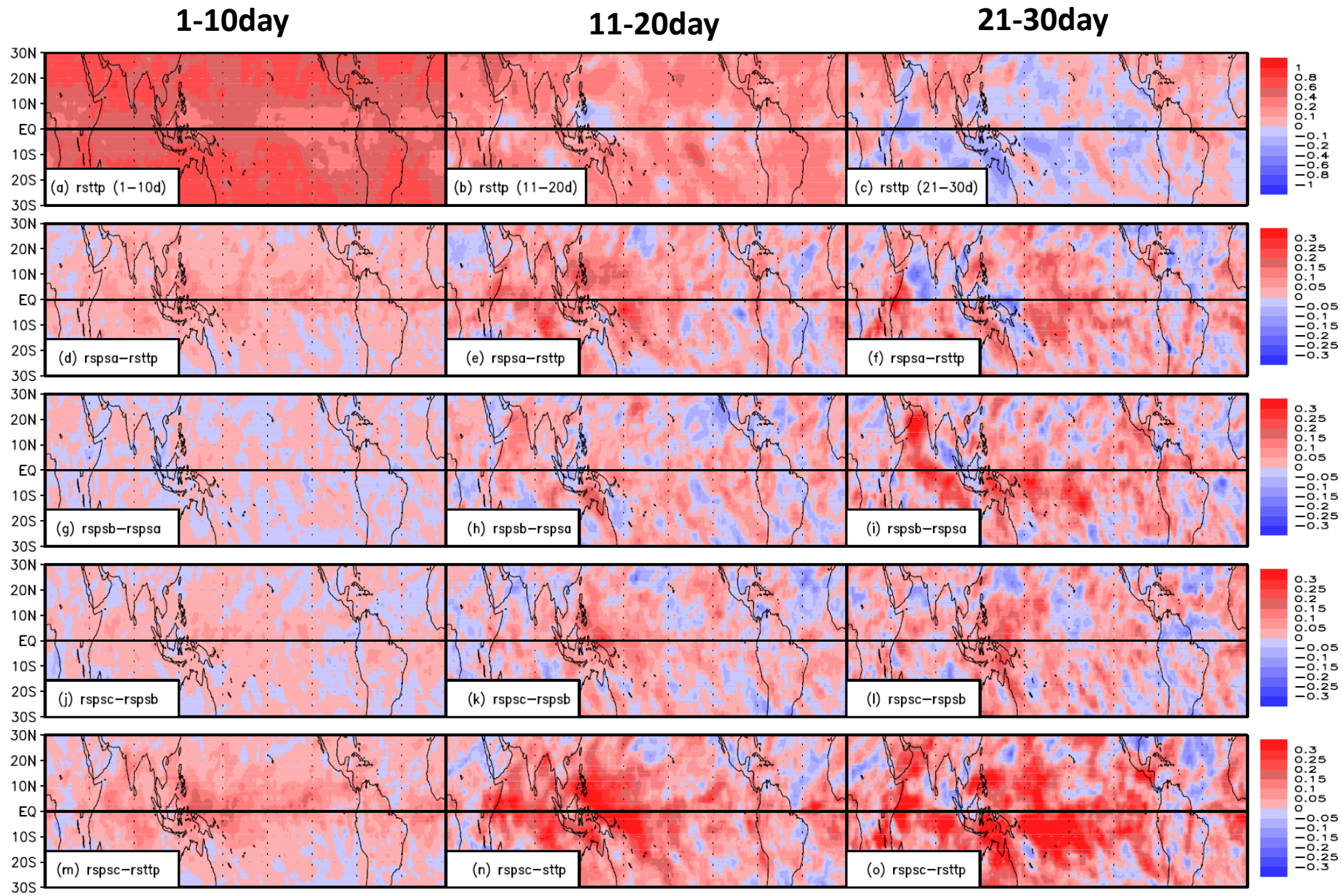
SPSC-SPSB



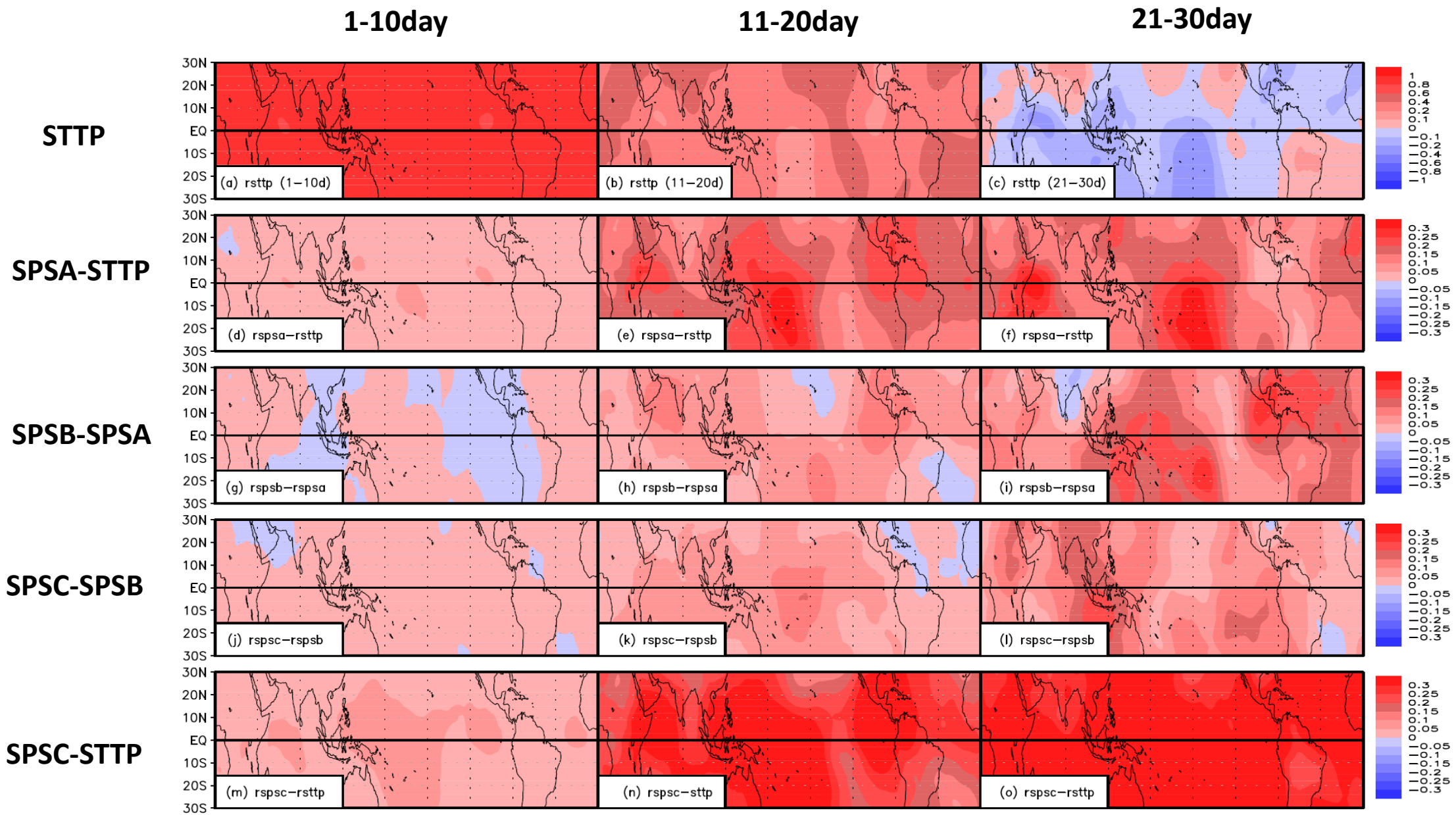


SPSC-STTP

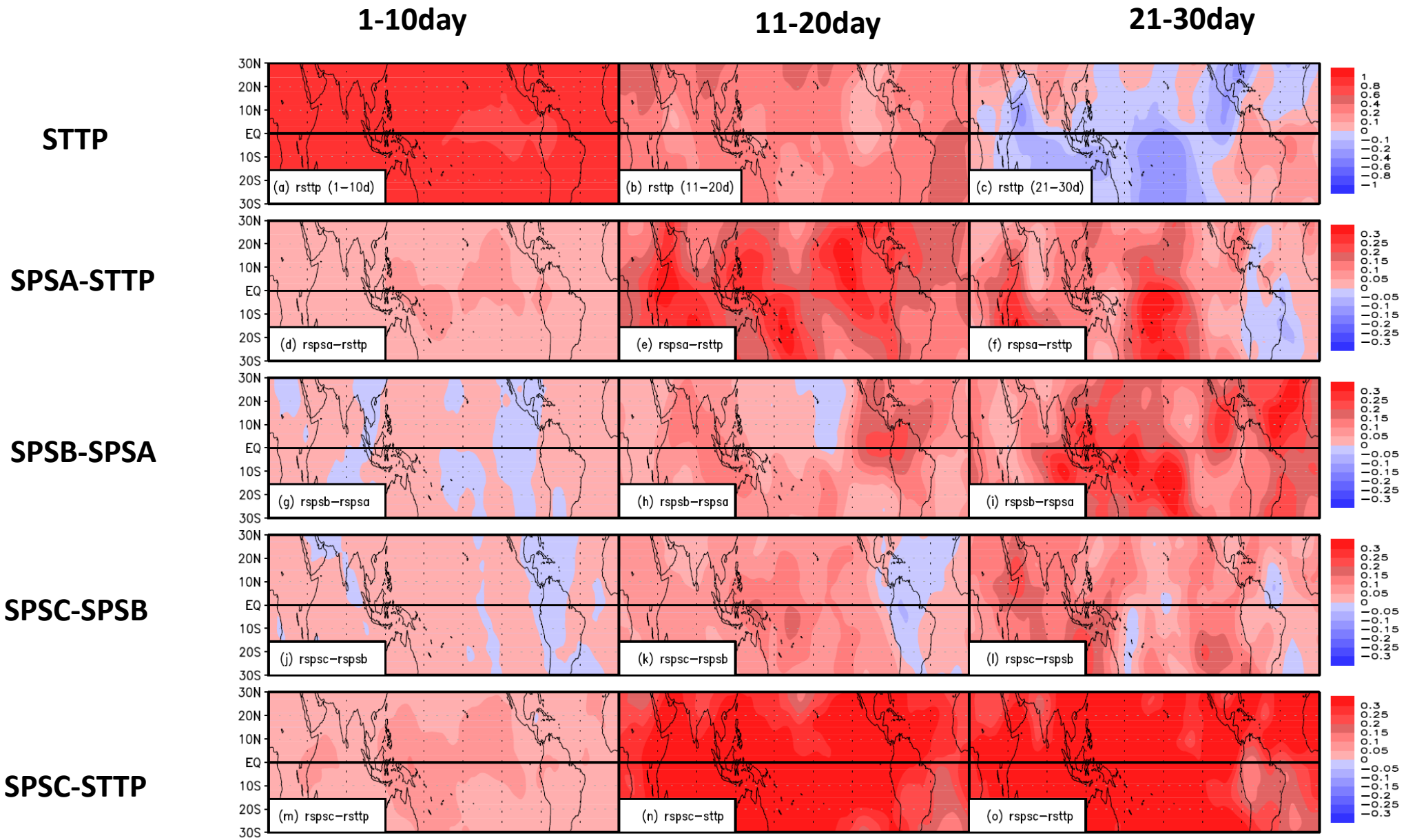
OLR TCC and Differences among Four Experiments at Different Lead Times



VP850 TCC and Differences among Four Experiments at Different Lead Times



VP200 TCC and Differences among Four Experiments at Different Lead Times



Preliminary summary

- MJO related sensitivity study has been carried out from NCEP GEFS 35-d retrospective forecasts for four difference configuration.
- The main MJO skills are similar to EMC's evaluation – SPSC has best skill score for all lead times.
- Individual variables - OLR, U850, U200, VP850 and VP200 have also indicated better ACC and less RMS error for SPSC configuration, however, the intensity of these variables shows weaker than "control" with increasing forecast lead-time
- Through OLR analysis, all three configurations have systematic drier with increasing forecast lead-time, this could explain why the intensity is weaker.
- TCC has also indicated excellent improvement from all enhanced sciences (SPs, 2-tired SST and SA-convection parameterization.
- In order to dig out specific processes responsible for specific improvements, in-depth analyses are still going on (e.g., the regression analyses and degree of organization etc.).
- Ongoing – 2-d and 3-d regression for all these tropical key variables.