



Convectively Coupled Equatorial Waves and the MJO in Subseasonal Forecasts

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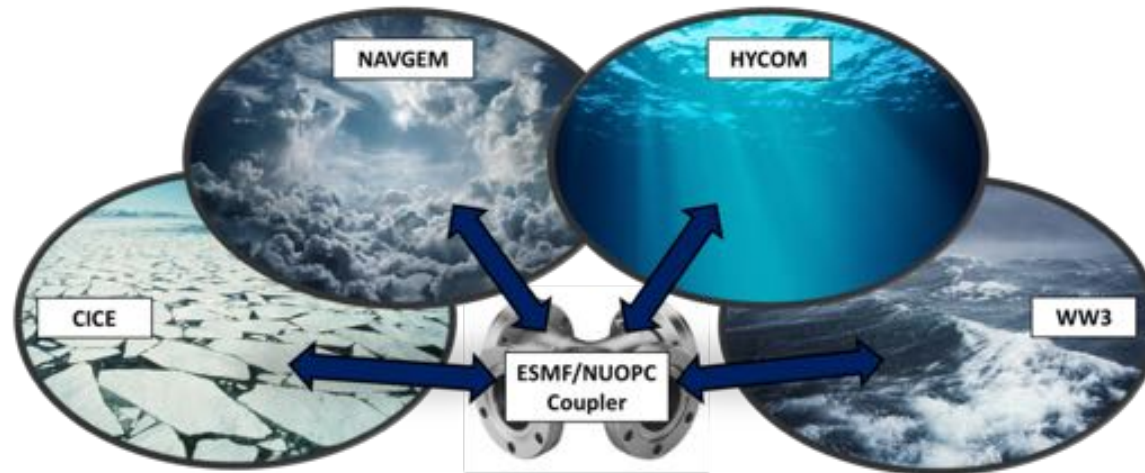
North Carolina State University²

Naval Research Laboratory (NRL)³

**Metrics, Post-Processing, and
Products for S2S Workshop**

03/01/2018

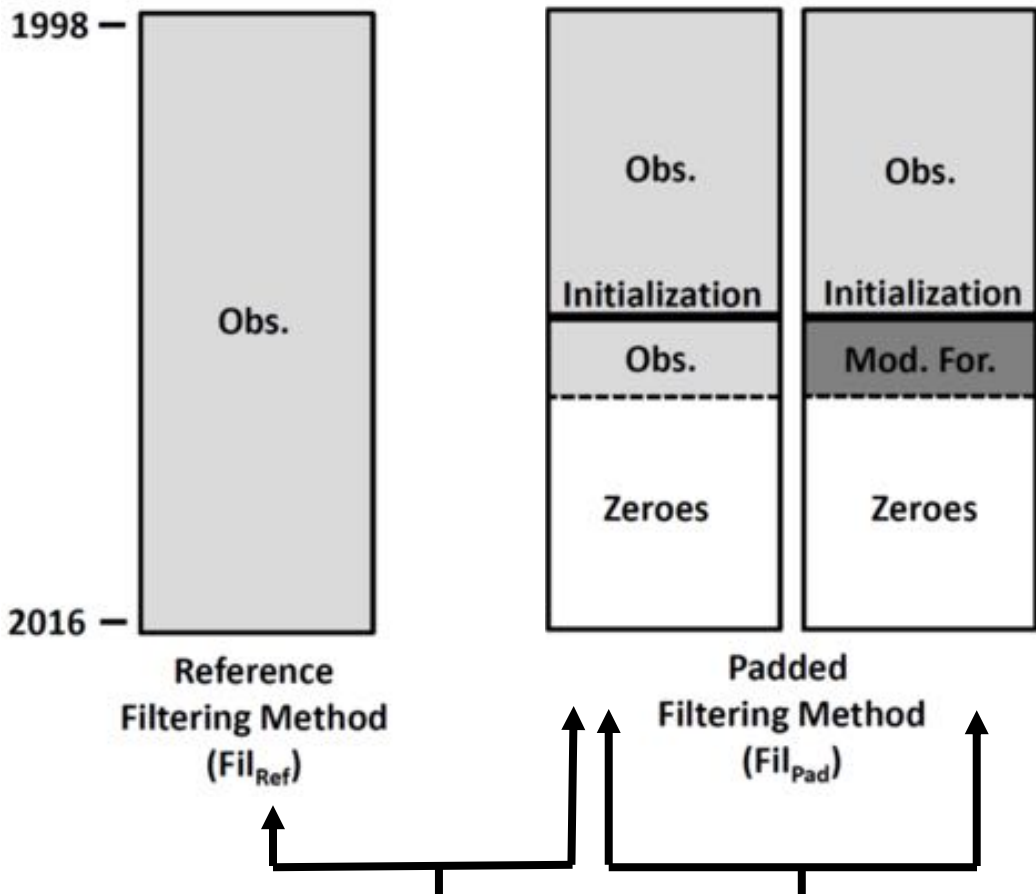
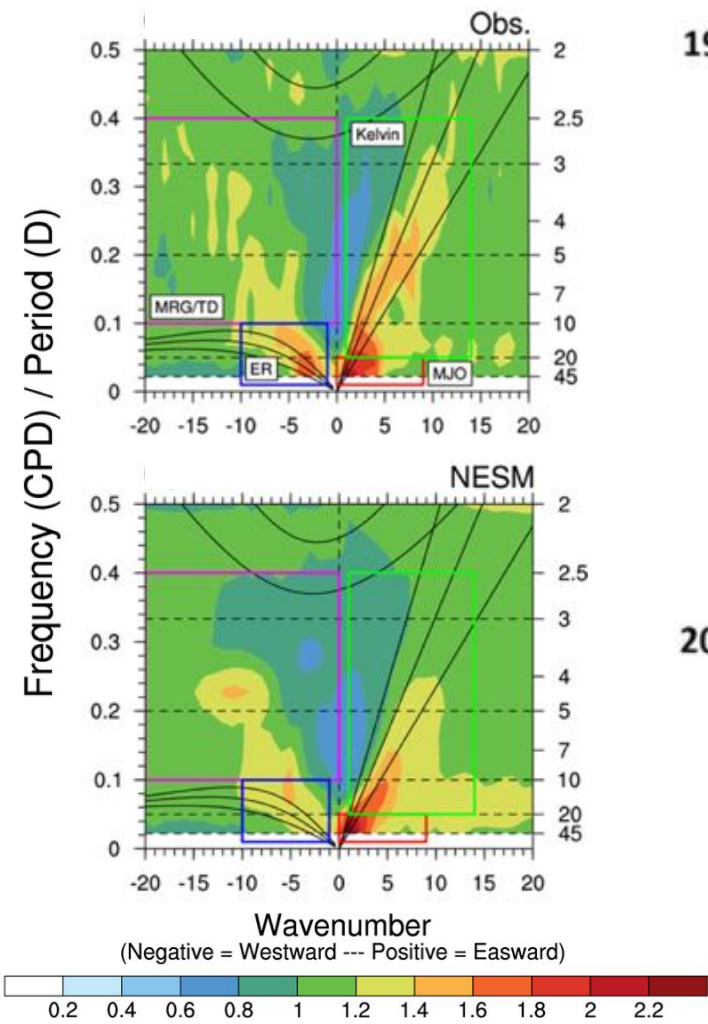
Navy Earth System Model (NESM)



Forecast	Time Range, Frequency	Atmosphere NAVGEM	Ocean HYCOM	Ice CICE	Waves WW3
Deterministic short term	0-16 days, Daily	T681L80 (19 km) 80 levels	1/25° (4.5 km) 41+ layers ¹	1/25° (4.5 km)	1/8° (14 km)
Probabilistic long term	0-45 days 2x Weekly 20 members	T359L60 (37 km) 60 levels	1/12° (9 km) 41 layers	1/12° (9 km)	1/4° (28 km)

Initial operational capability in 2019.

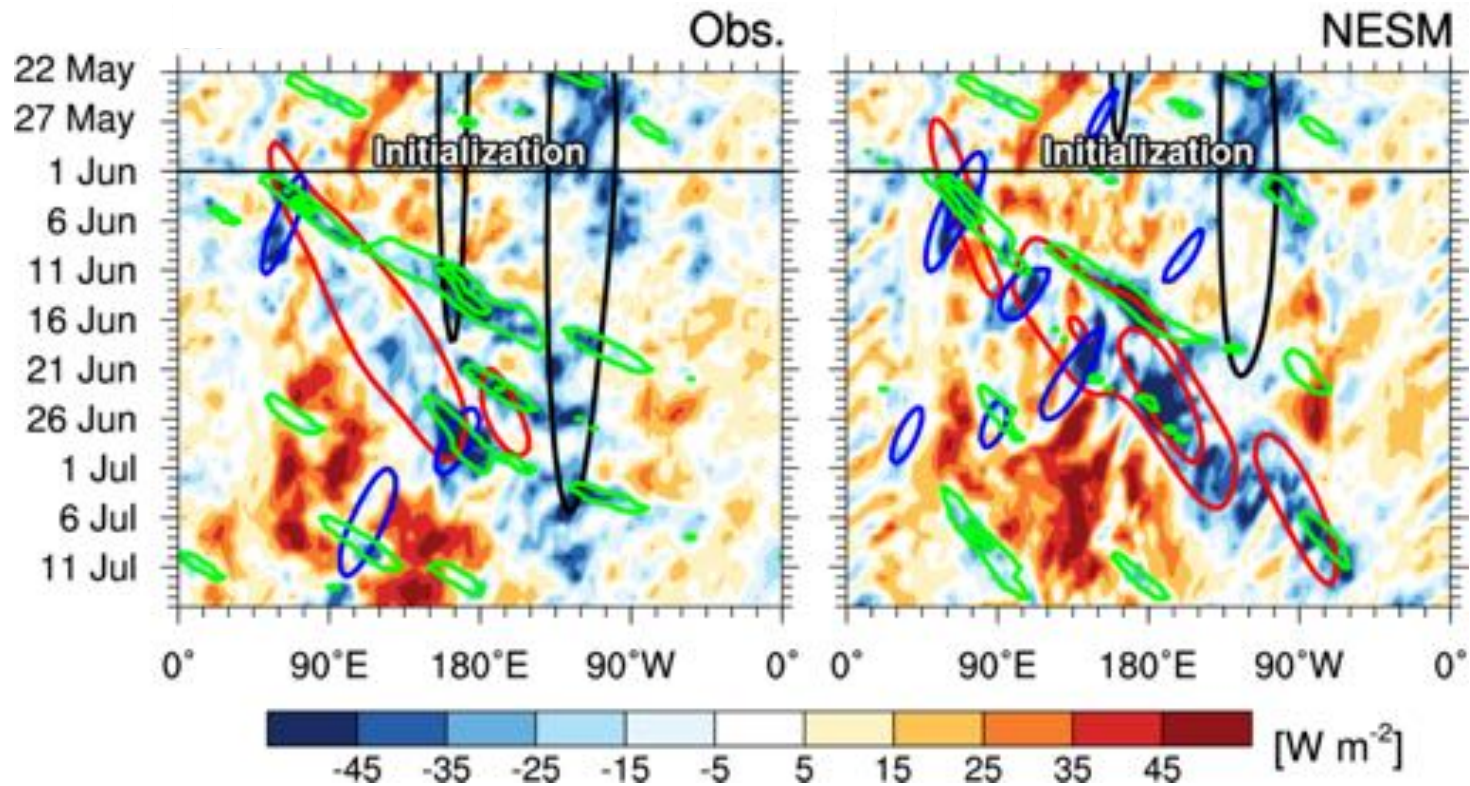
Wavenumber-Frequency Filtering Method



Where is filtering reliable?

How do the model and observations compare?

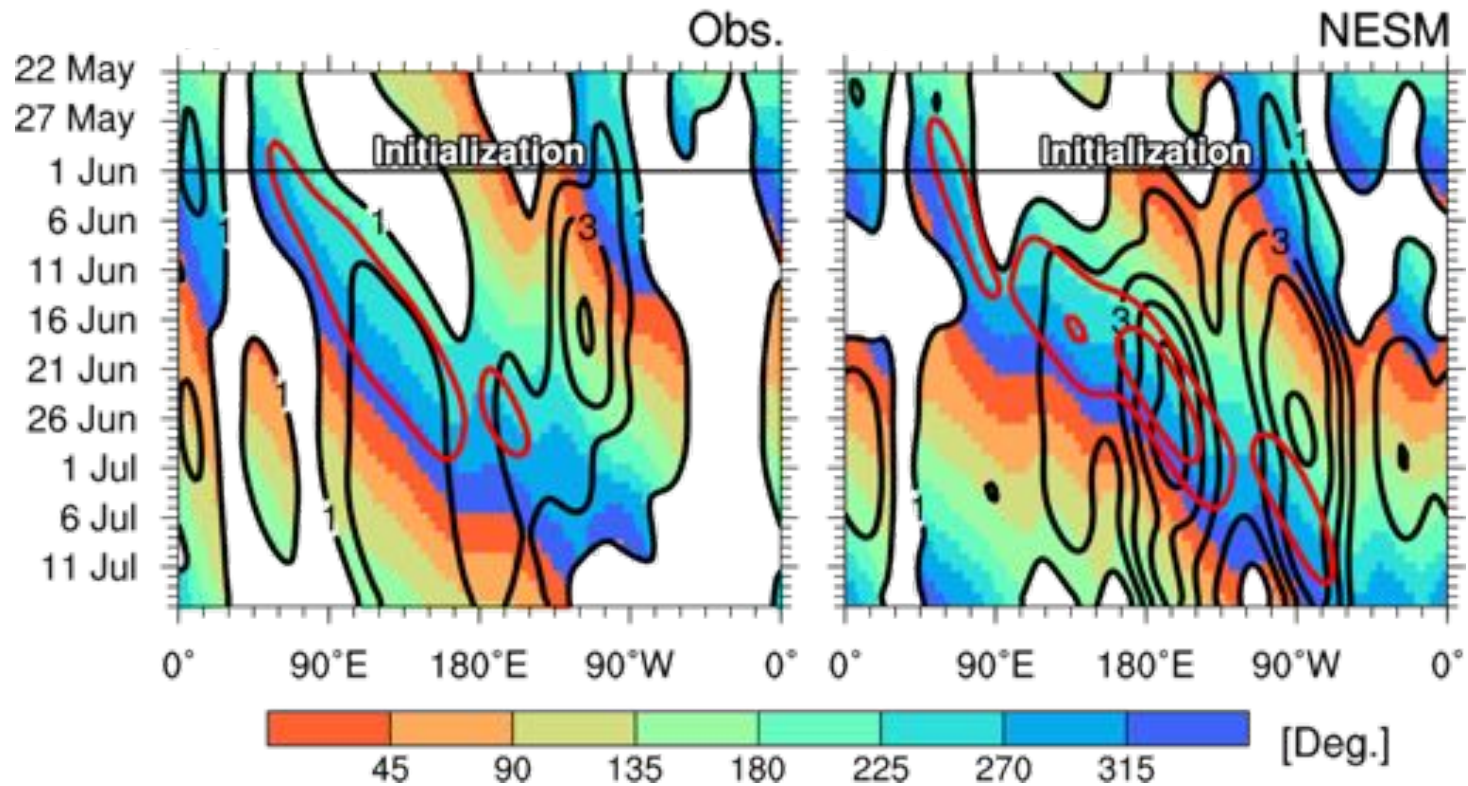
Example



OLR anomalies (10°S-10°N) from observations and NESM.

>100 d, **MJO**, **Kelvin**, and **ER** anomalies are contoured every 15 W m⁻² and unfiltered OLR anomalies are shaded.

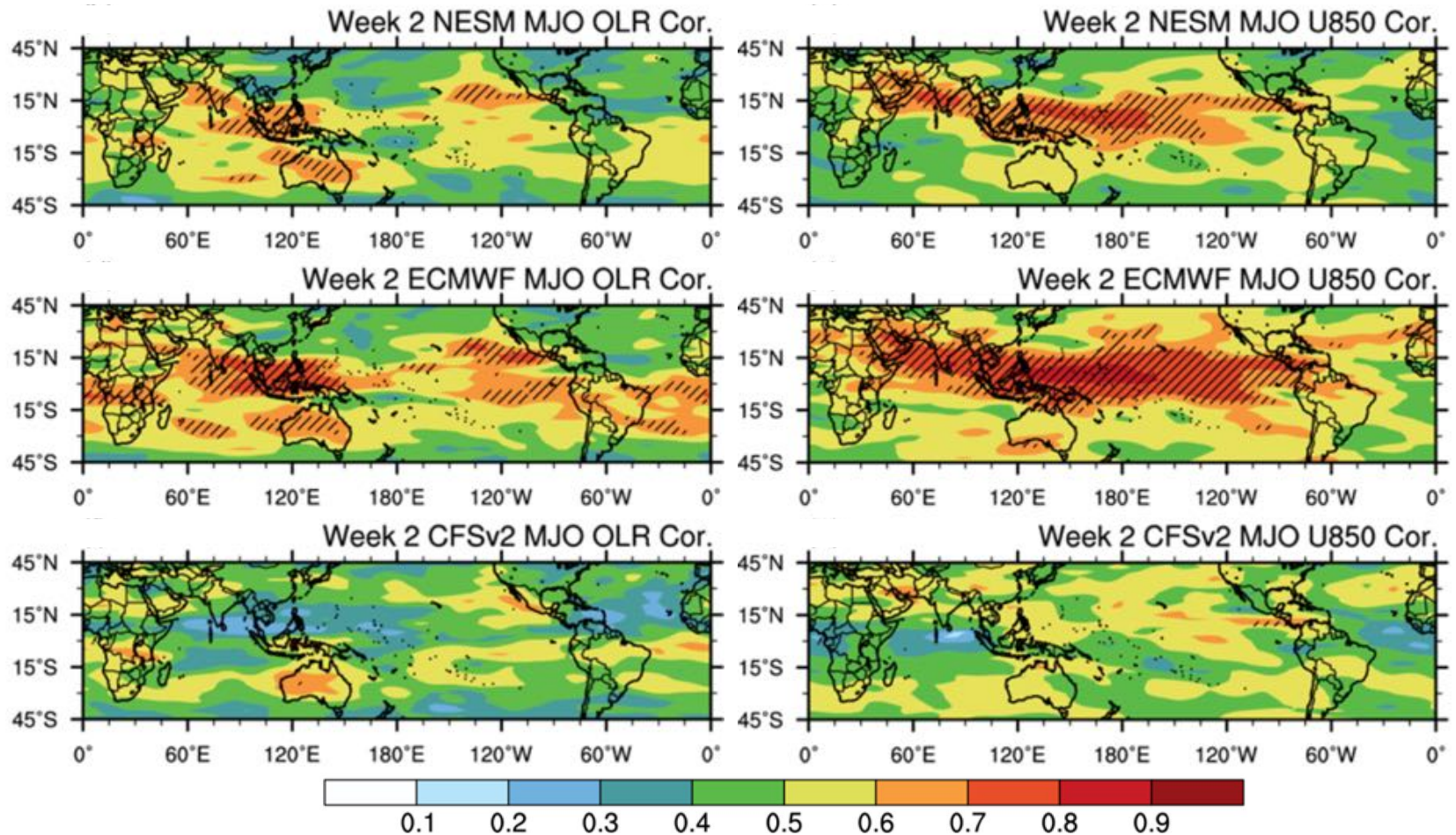
Example



Phase (degrees, shaded) and amplitude (σ , black contours) of MJO-filtered OLR anomalies from observations and an NESM forecast.

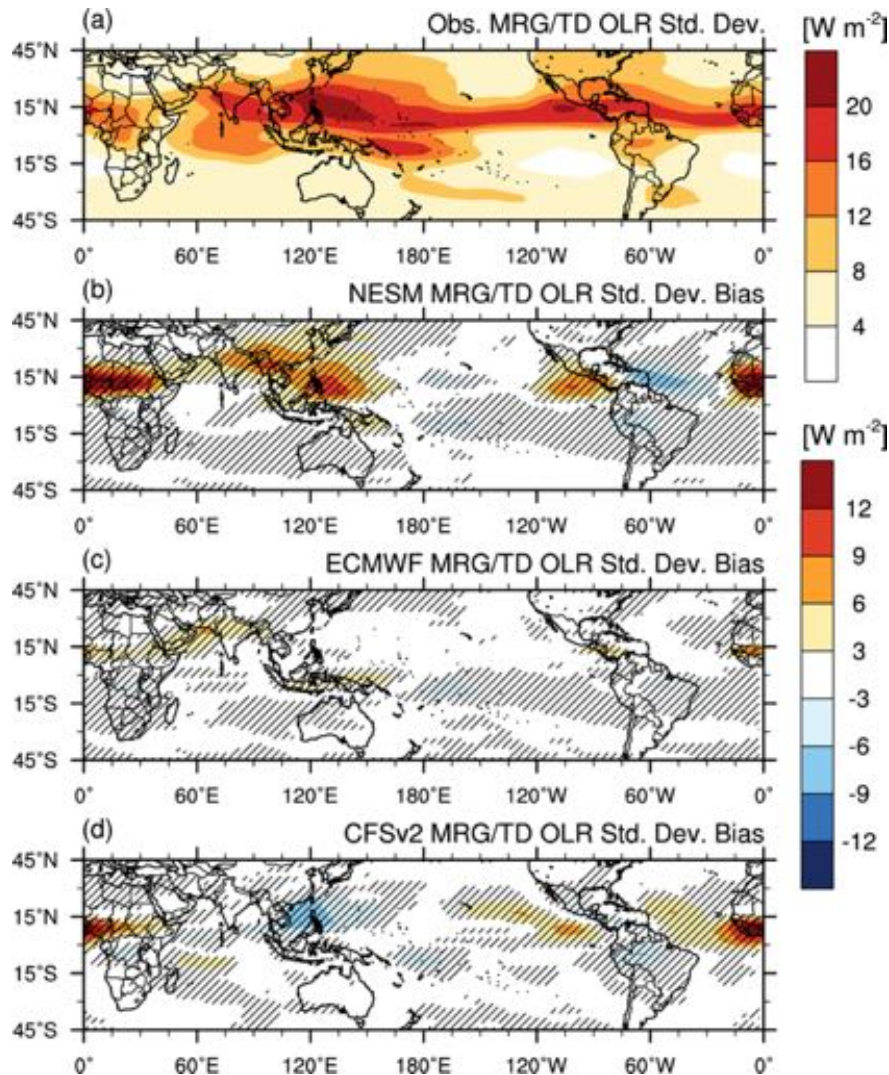
The phases are decaying (0°), suppressed (90°), developing (180°), and enhanced (270°).

Correlation of Obs./Mod. MJO-Filtered Fields



Correlation of observed and WK2 forecasts of MJO-filtered OLR (left) and U850 (right).
Based on JJA 1999-2015 forecasts.

Biases in MRG/TD Activity



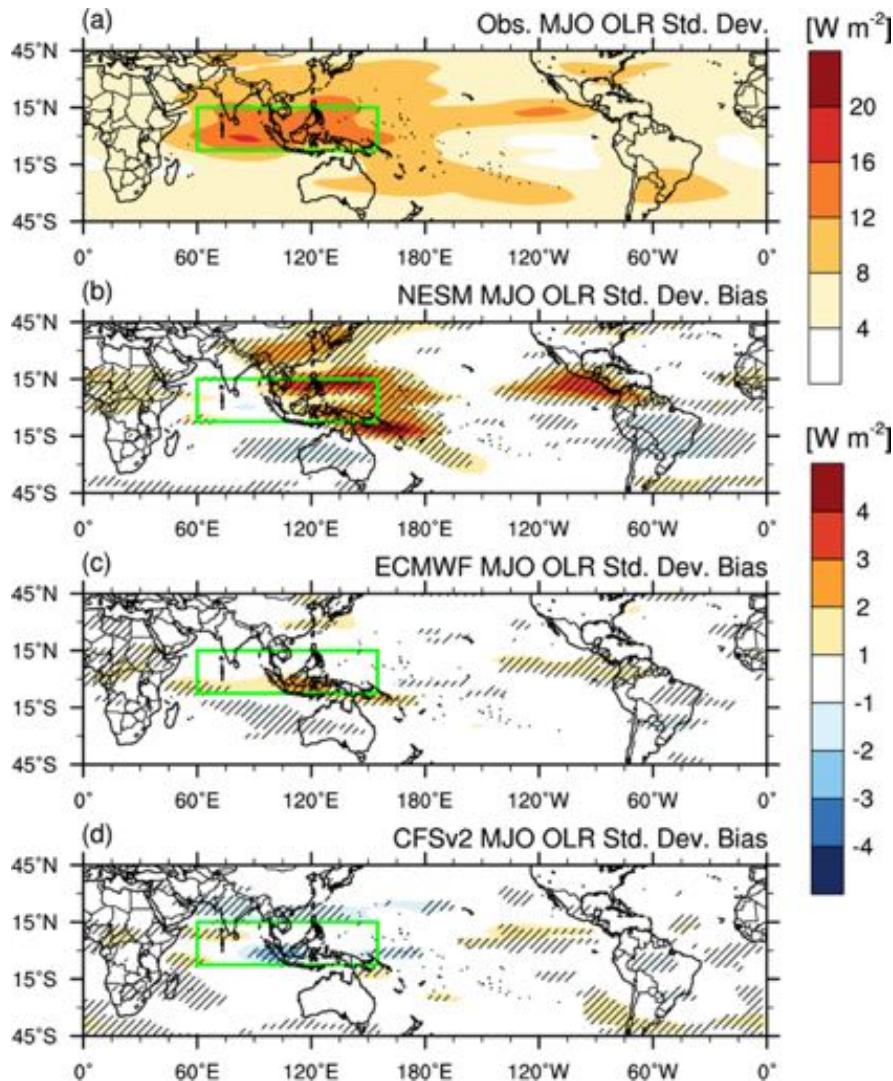
MRG/TD-filtered OLR

(a) MRG/TD-filtered OLR standard deviation during week 2-3 (W m^{-2} , shaded).

Standard deviation biases from (b) NESM, (c) ECMWF, and (d) CFSv2.

Based on JJA 1999-2015 forecasts.

Biases in MJO Activity



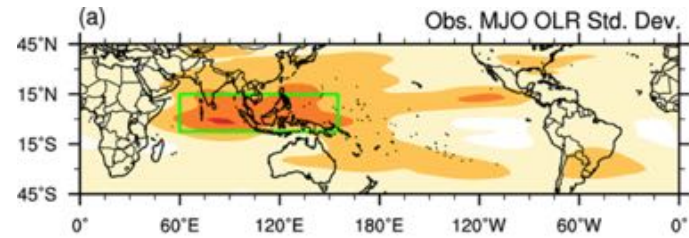
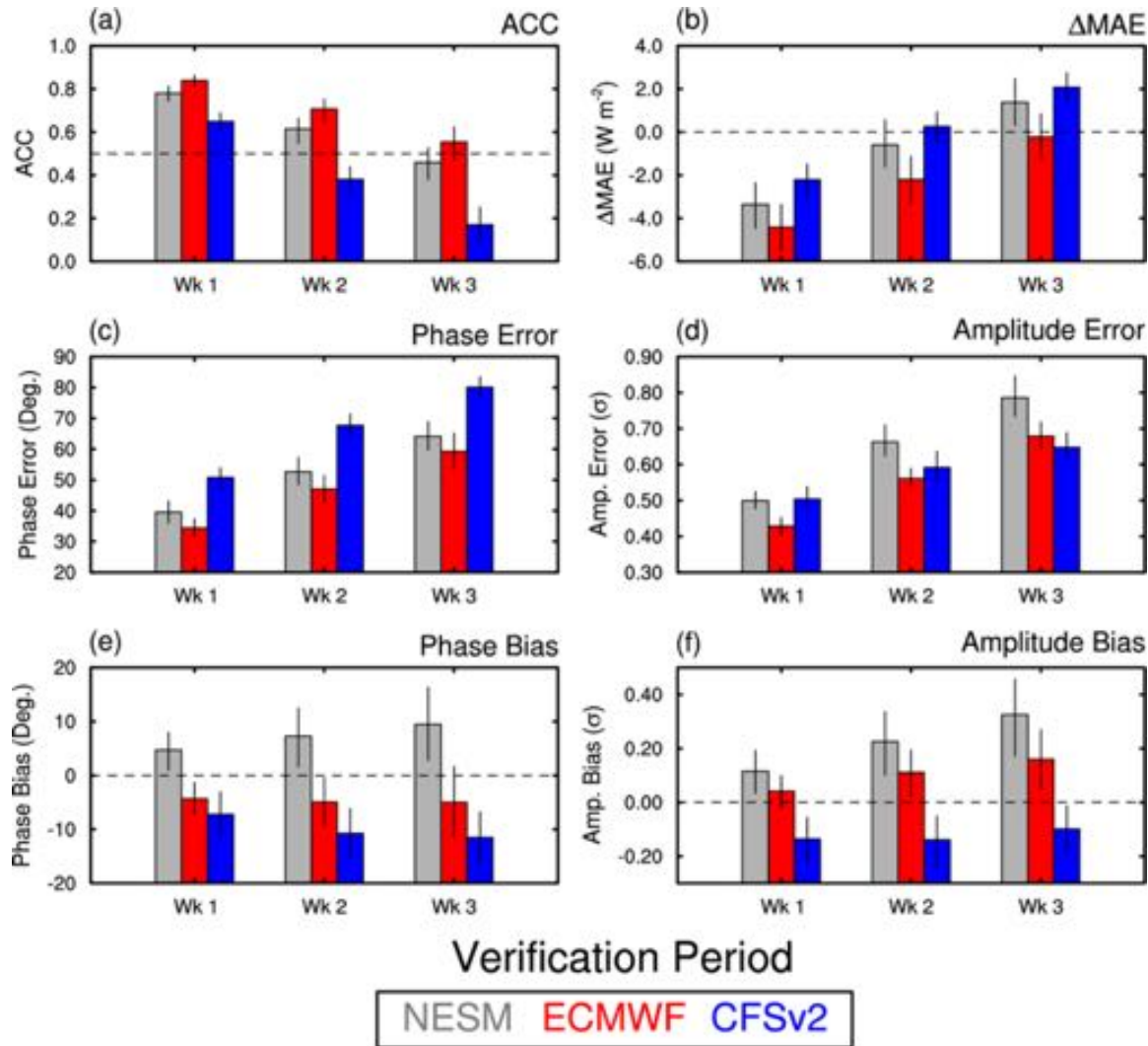
MJO-filtered OLR

(a) MJO-filtered OLR standard deviation during week 2-3 (W m⁻², shaded).

Standard deviation biases from (b) NESM, (c) ECMWF, and (d) CFSv2.

Based on JJA 1999-2015 forecasts.

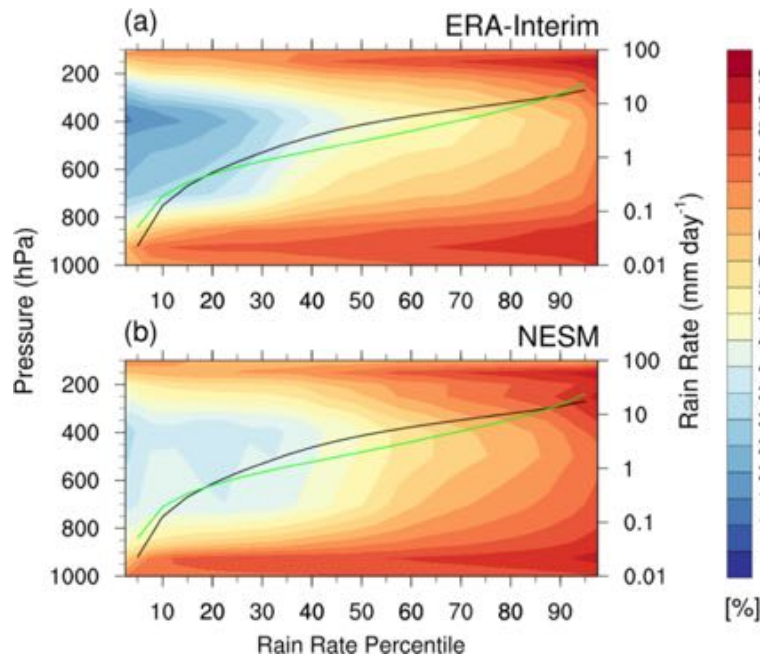
MJO-Filtered OLR Forecast Skill



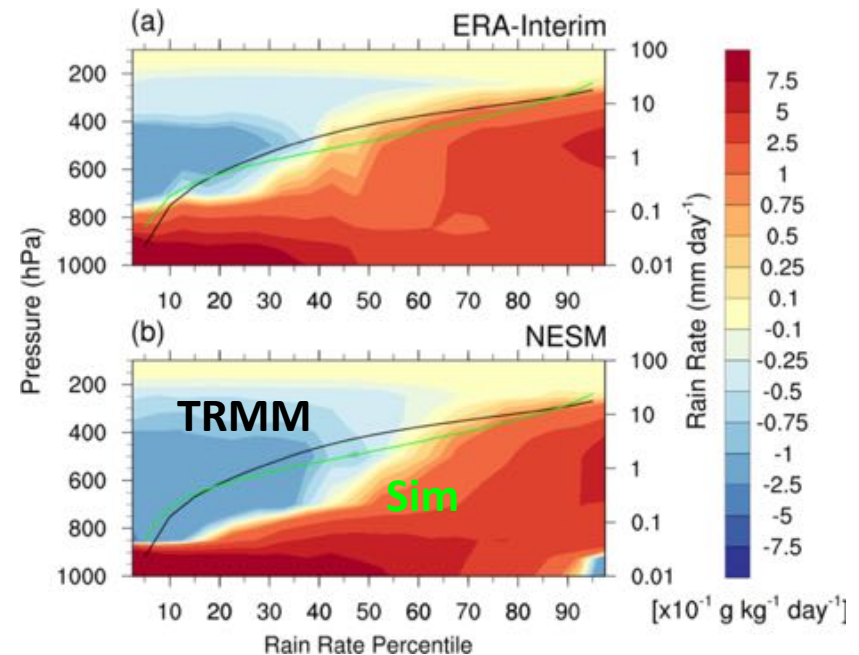
Skill in forecasting MJO-filtered OLR over the Indian Ocean and Maritime Continent according to different metrics.

Fast-Process Diagnostics

“Fast-process diagnostics” shed light on the ability of cumulus parametrizations to represent moisture-convection interactions.



Relative Humidity



$Q_2 + \text{Vertical } q_v \text{ Adv.}$

Fields binned by rain rate percentile over 15°S-15°N, 60-180°E from one 60 d simulation.