

Assessment of conditional forecast skill for Brazilian precipitation

Amulya Chevuturi | Liang Guo | Matthew Young | Nick Klingaman
Steve Woolnough | Chris Holloway | Emily Black | Pier Luigi Vidale

a.chevuturi@reading.ac.uk

**Workshop on Predictability, dynamics and applications research using the
TIGGE and S2S ensembles (2-5 April 2019)**

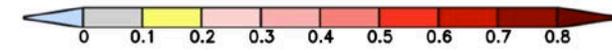
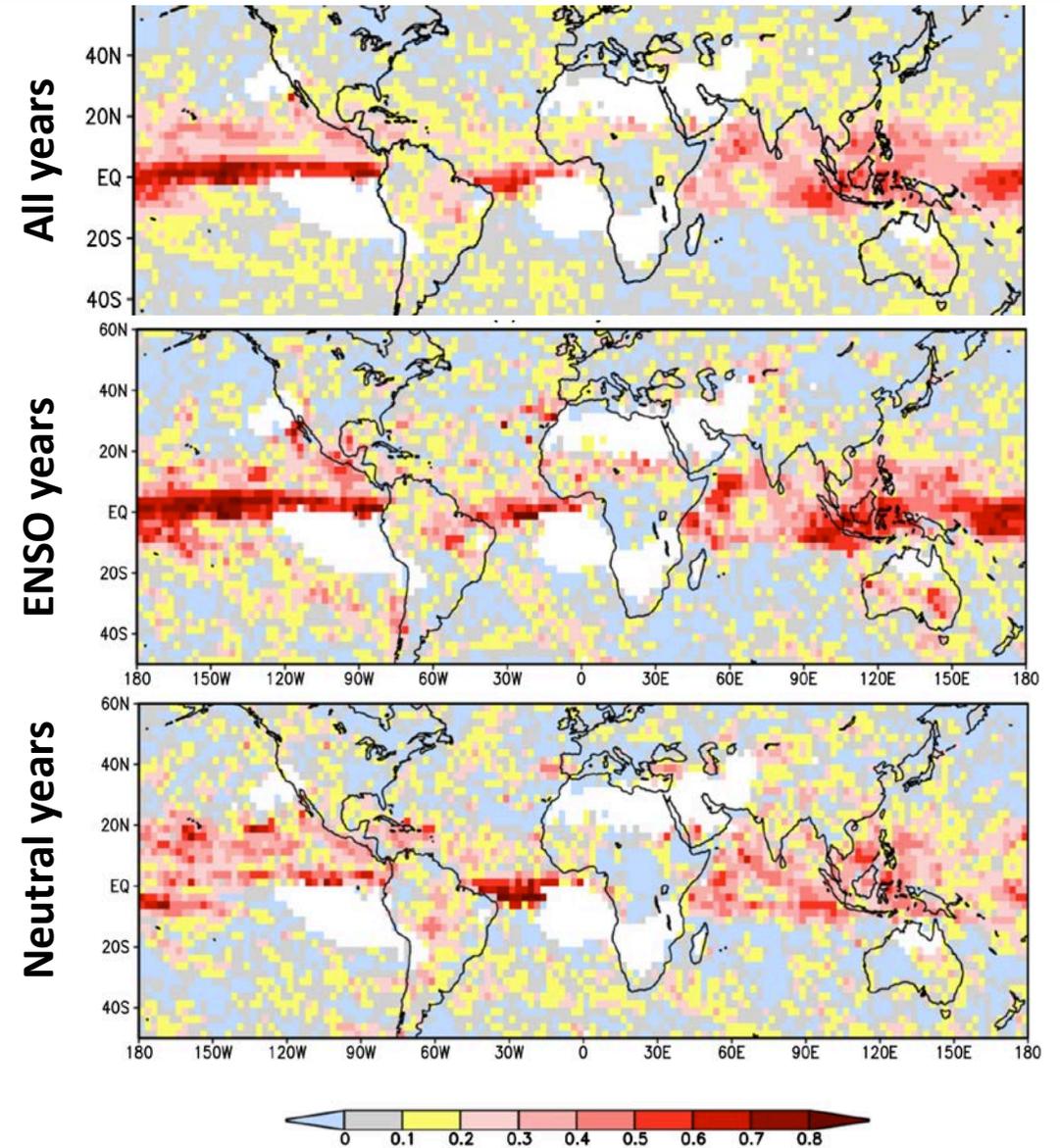
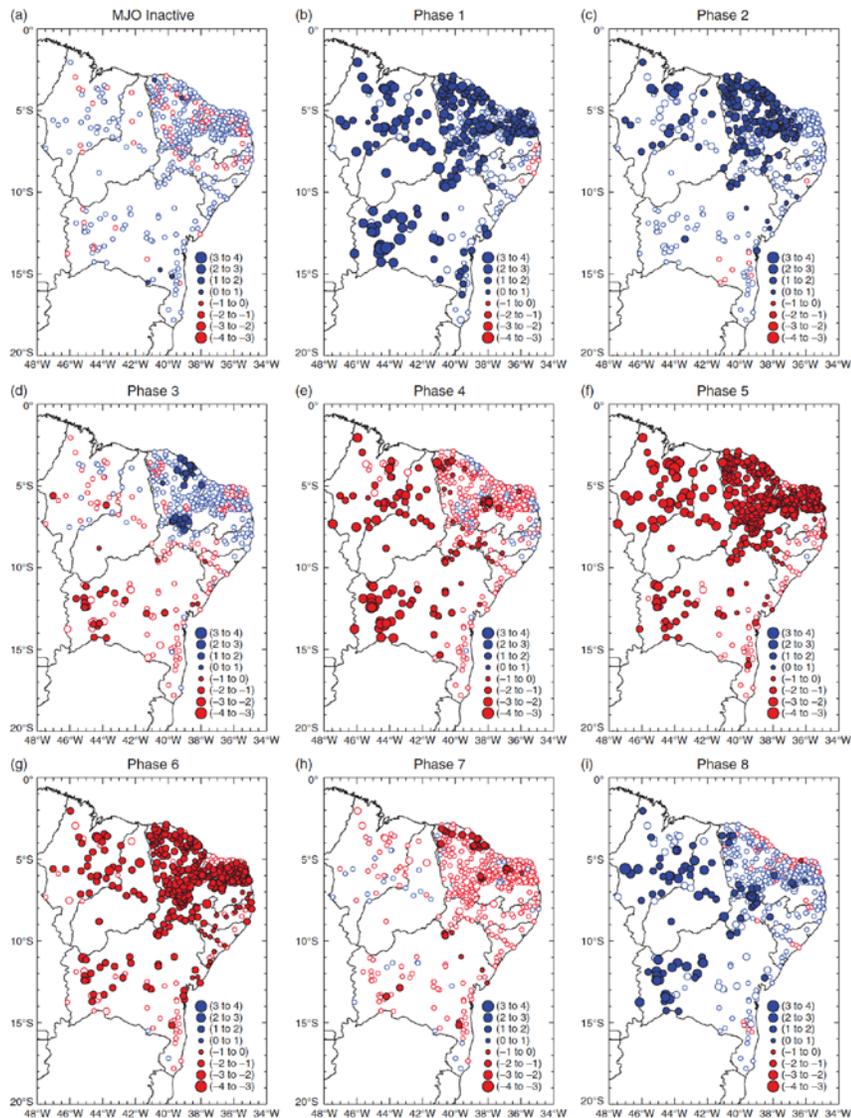
Objectives

Diagnosing and **U**nderstanding **B**razilian **S**ubseasonal **T**ropical and **E**xtratropical **P**rocesses (**DUBSTEP**)

Aim: Assessing **prediction skill for sub-seasonal rainfall** variability in Brazil, including **conditional skill** based on large-scale atmospheric circulations.

- S2S prediction skill for Brazilian precipitation
- Conditional forecast skill for Brazilian precipitation; teleconnections from large-scale climate variability

Motivation



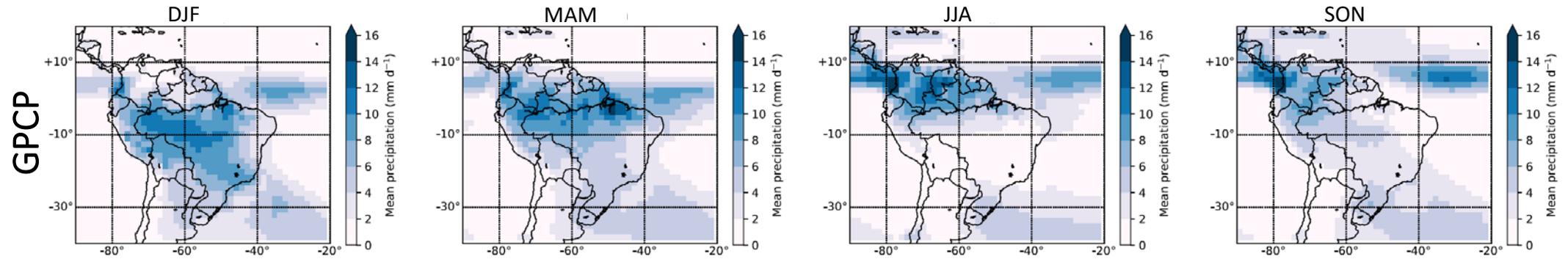
Li and Robertson (2015)

S2S Data

Model	Native Resolution	Years available	Initialisation frequency	Ensemble members	Reference
UKMO (GloSea5-GC2)	0.8° x 0.5°	1993–2015	1 st , 9 th , 17 th , 25 th of each month	7	MacLachlan et al., (2015)
NCEP (CFSv2)	~100 km	1999–2010	Daily	4	Saha et al., (2014)
ECMWF (IFS)	0.7°	1998–2017	Twice per week	11	Vitart et al., (2004)

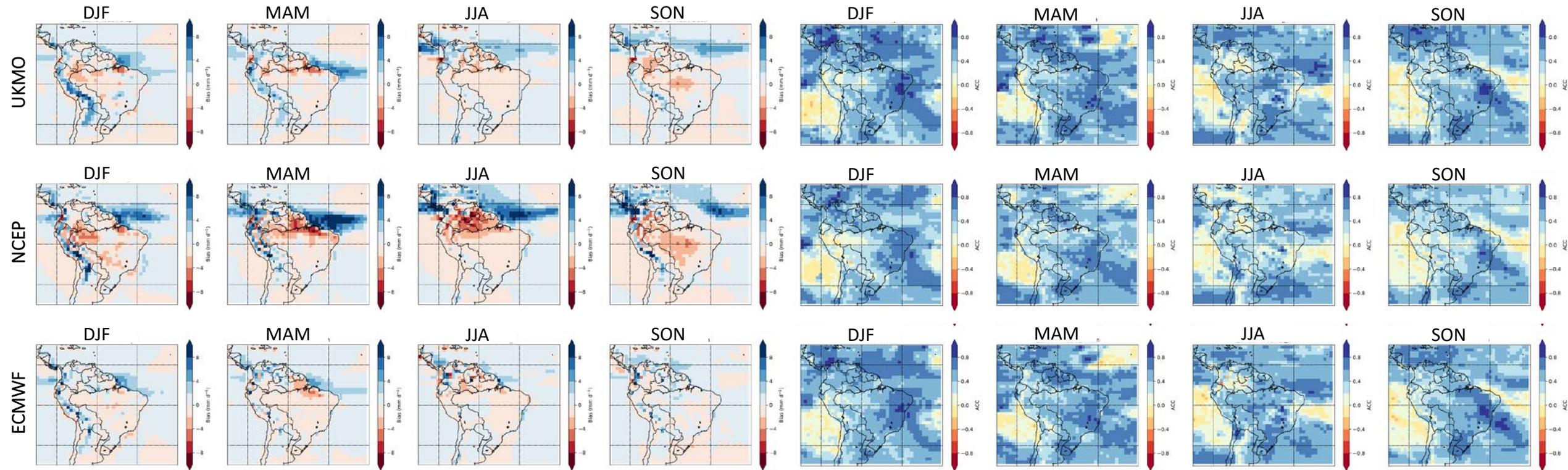
- Evaluation of S2S skill for weekly averaged precipitation in all 4 seasons (DJF, MAM, JJA, SON)
 - Lead times of 1-5 weeks
 - Weekly averaging increases skill by reducing noise from daily rainfall variability.
- Observations: GPCP (satellite + gauge)
- Analysis Horizontal Resolution: 1.5° × 1.5°
- Challenge: Comparing models with different initialisation dates and ensemble sizes
 - Lagged ensembles for NCEP (last 7 days) and ECMWF (last 3 forecasts)
- Common time period of analysis: 1999-2010
- Evaluation of effects of the ENSO and MJO on the precipitation over Brazil in S2S for DJF
 - Oceanic Nino Index (ONI) is used for ENSO
 - Wheeler–Hendon real-time multivariate (RMM) index for MJO

S2S Rainfall Forecast Skill

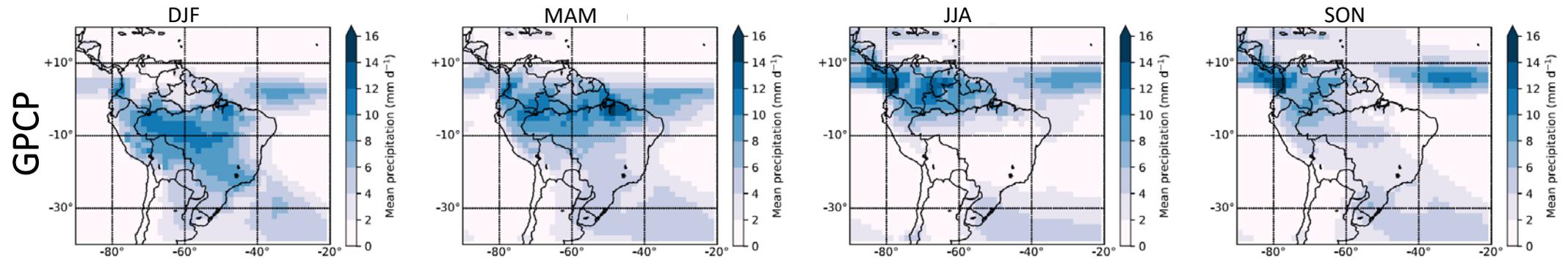


Bias Week 1

Anomaly correlation coefficient (ACC) Week 1

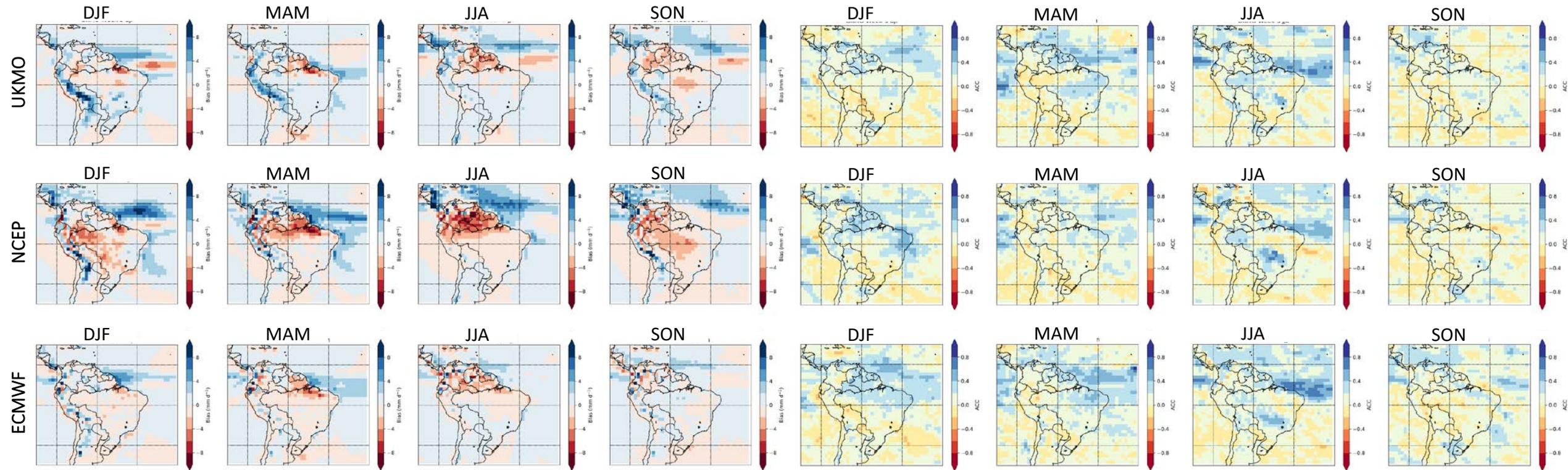


S2S Rainfall Forecast Skill



Bias Week 5

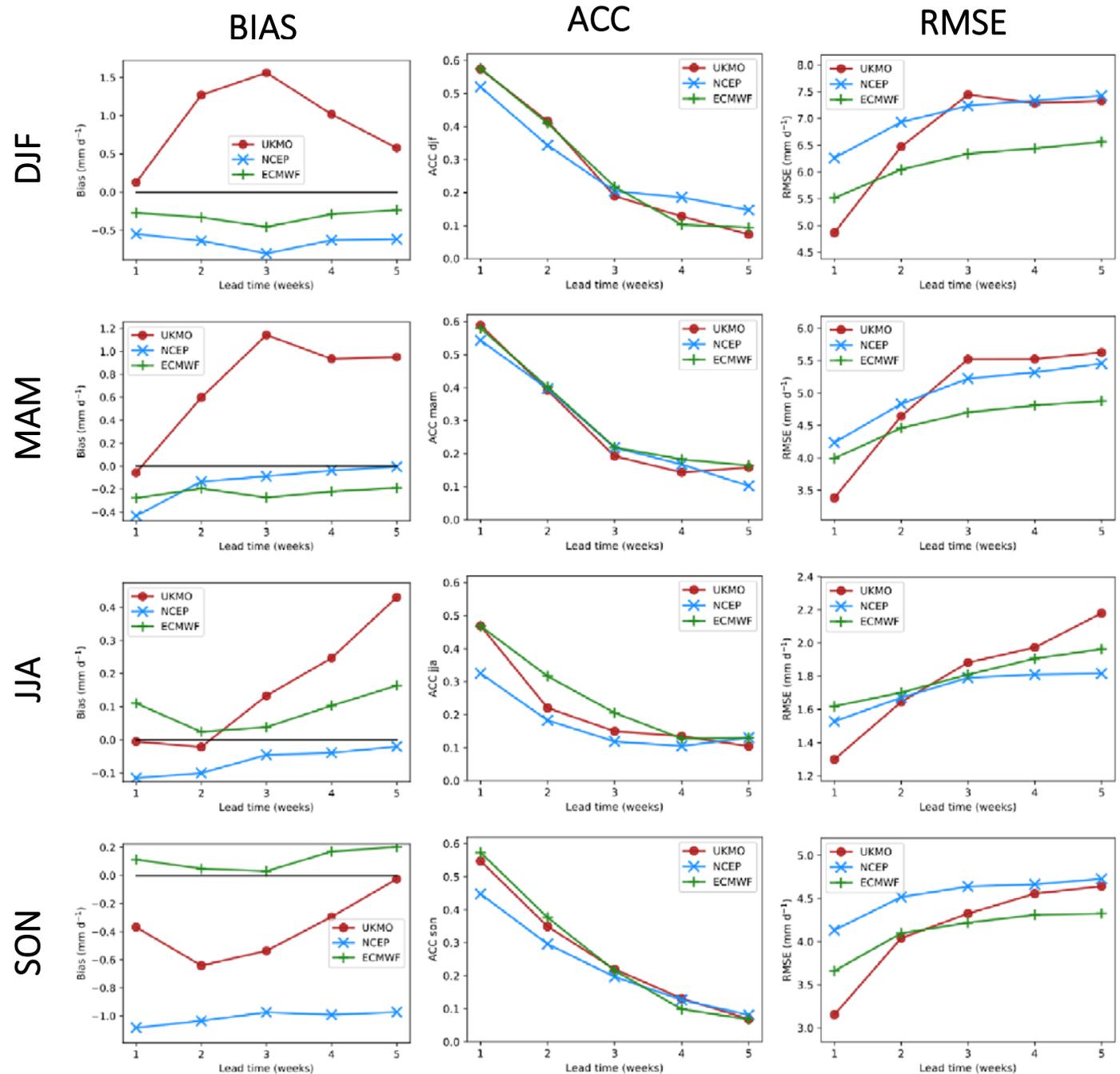
Anomaly correlation coefficient (ACC) Week 5



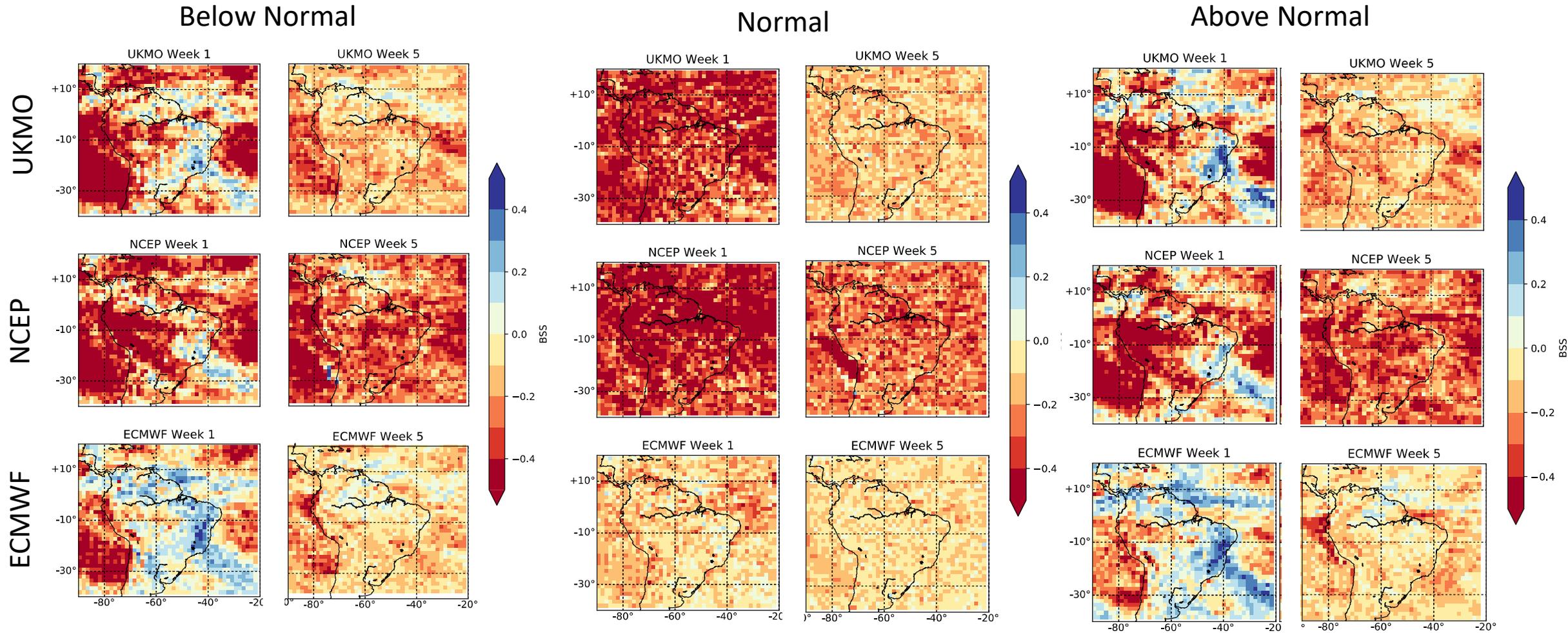
Forecast Skill

over Brazil (40°S-20°N, 90-20°W)

- In Bias, **ECMWF** has **dry bias** during wet seasons but **wet bias** during the dry seasons.
- In terms of RMSE, **UKMO's skill deteriorates quicker** than the other two systems.
- All models show **lowest ACCs in JJA**, which suggests issues in predicting rainfall during the dry season.
- Skill is generally **highest in ECMWF** and UKMO and **lowest in NCEP**
- Models **lose useful skill (ACC > 0.5) after Week 2.**

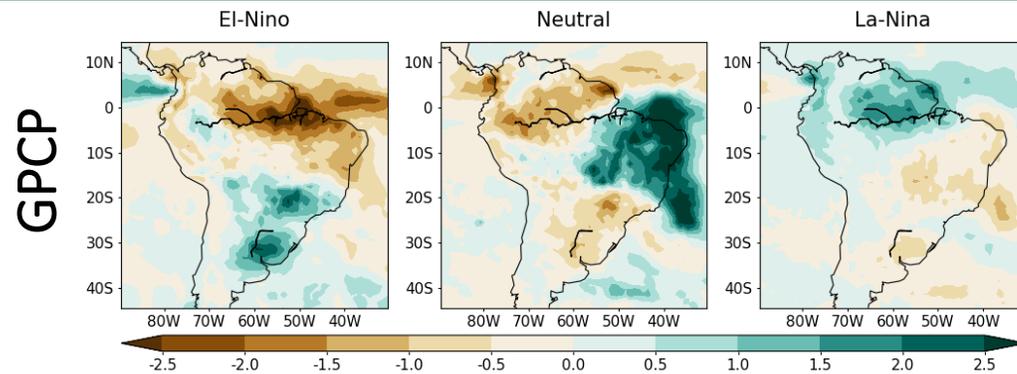


Brier Skill Score (BSS)

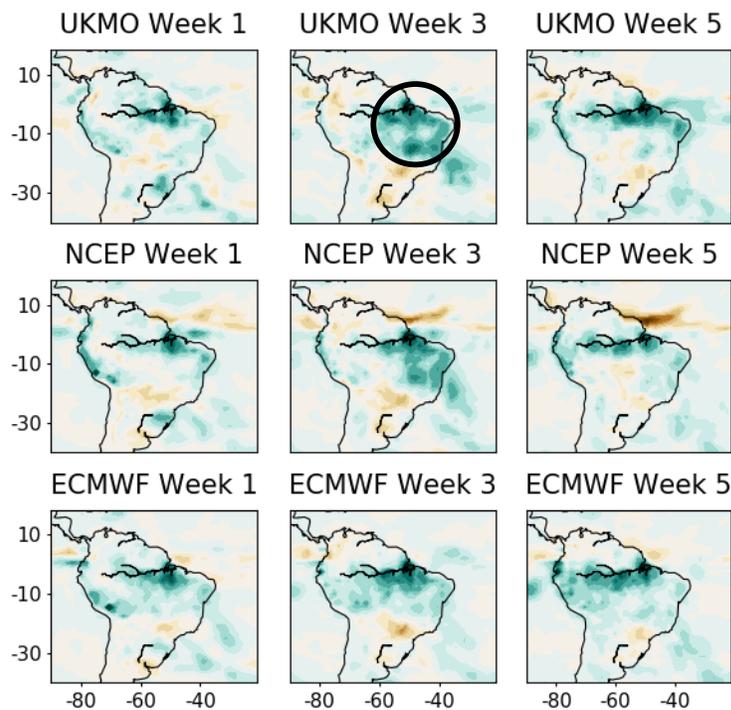


- **Higher forecast skill** for **above and below normal precipitation** categories in week 1 than normal precipitation category.

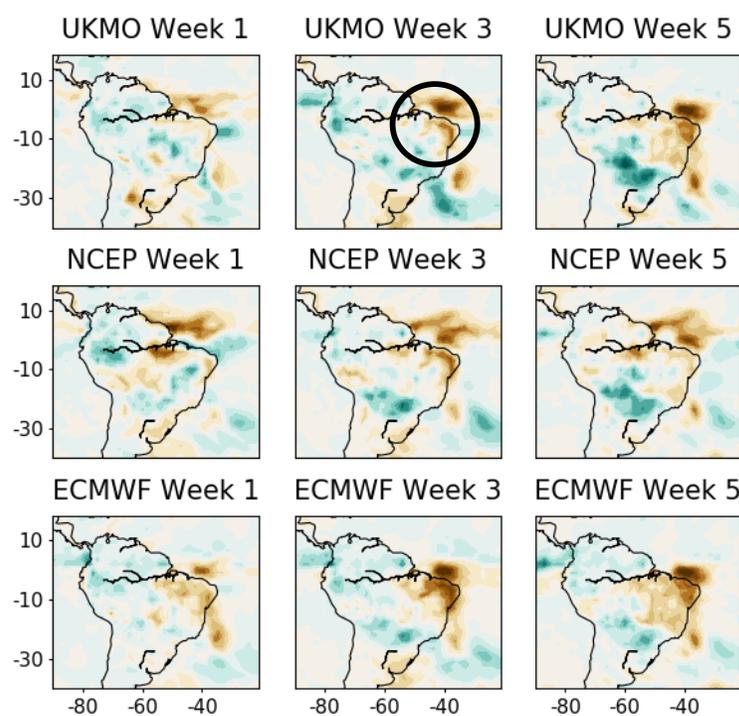
DJF Precipitation Anomaly Bias - ENSO



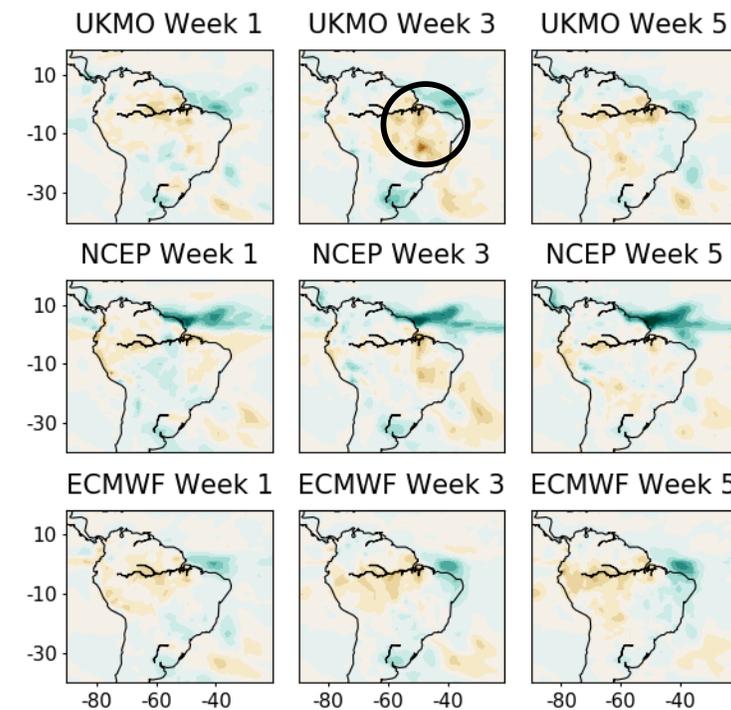
El-Nino



Neutral



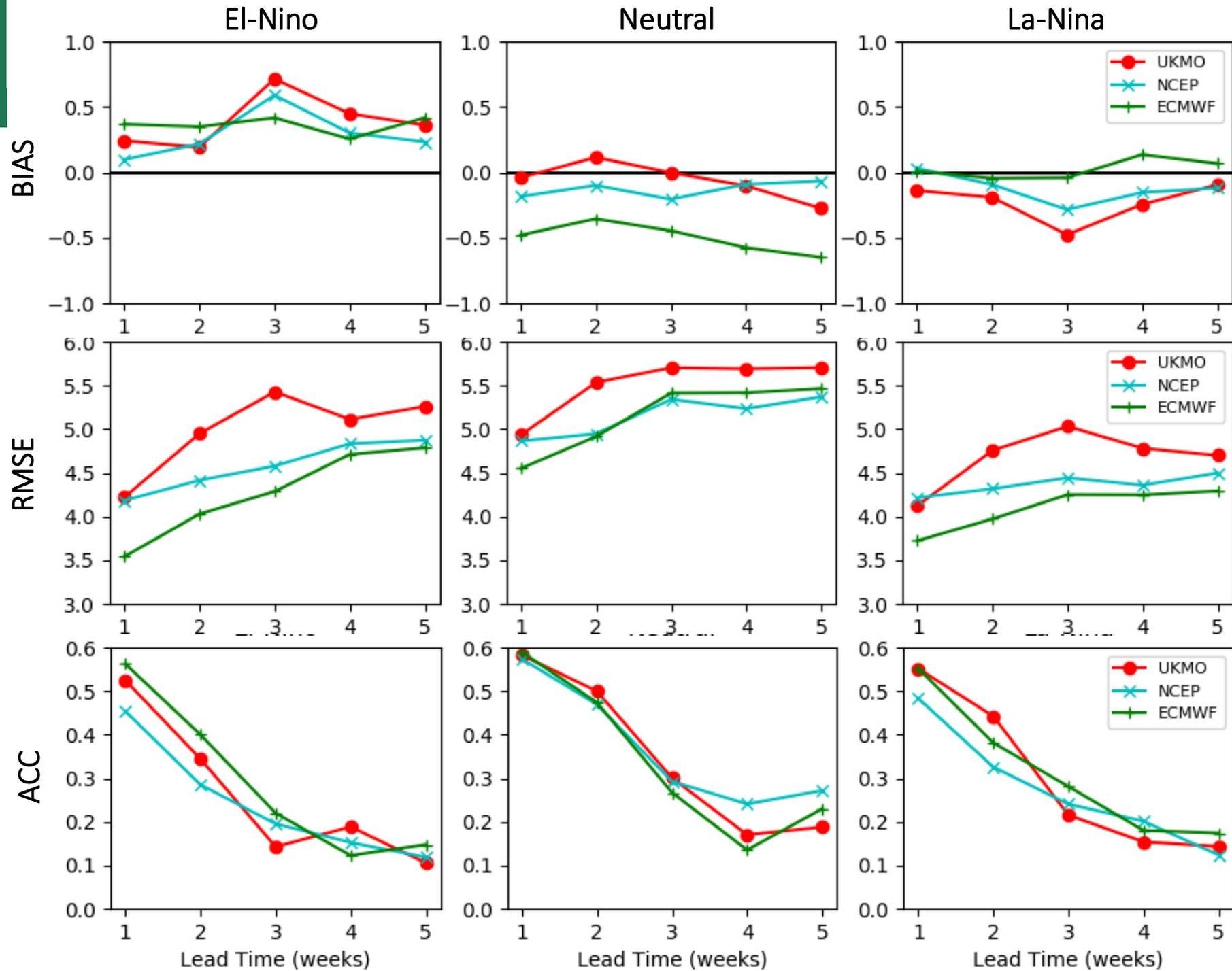
La-Nina



Forecast Skill

over Brazil (40°S-20°N, 90-20°W)

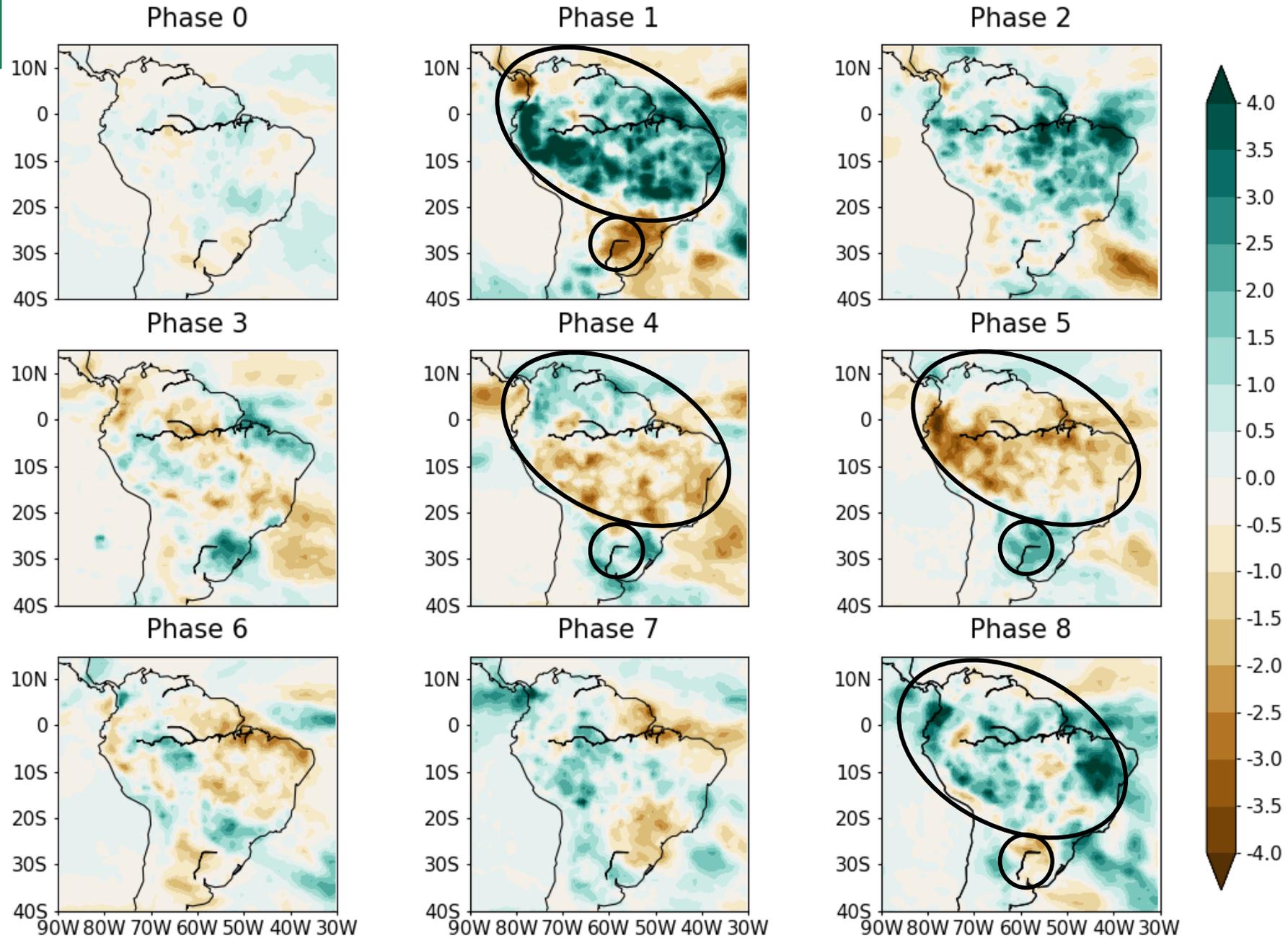
- Models underestimate:
 - dry anomalies during El-Niño
 - wet anomalies during La-Niña
- RMSE are **lowest in ECMWF** and the **highest in UKMO**.
- **Skill is lower during El-Niño** than in Neutral or La-Niña phases in all models.



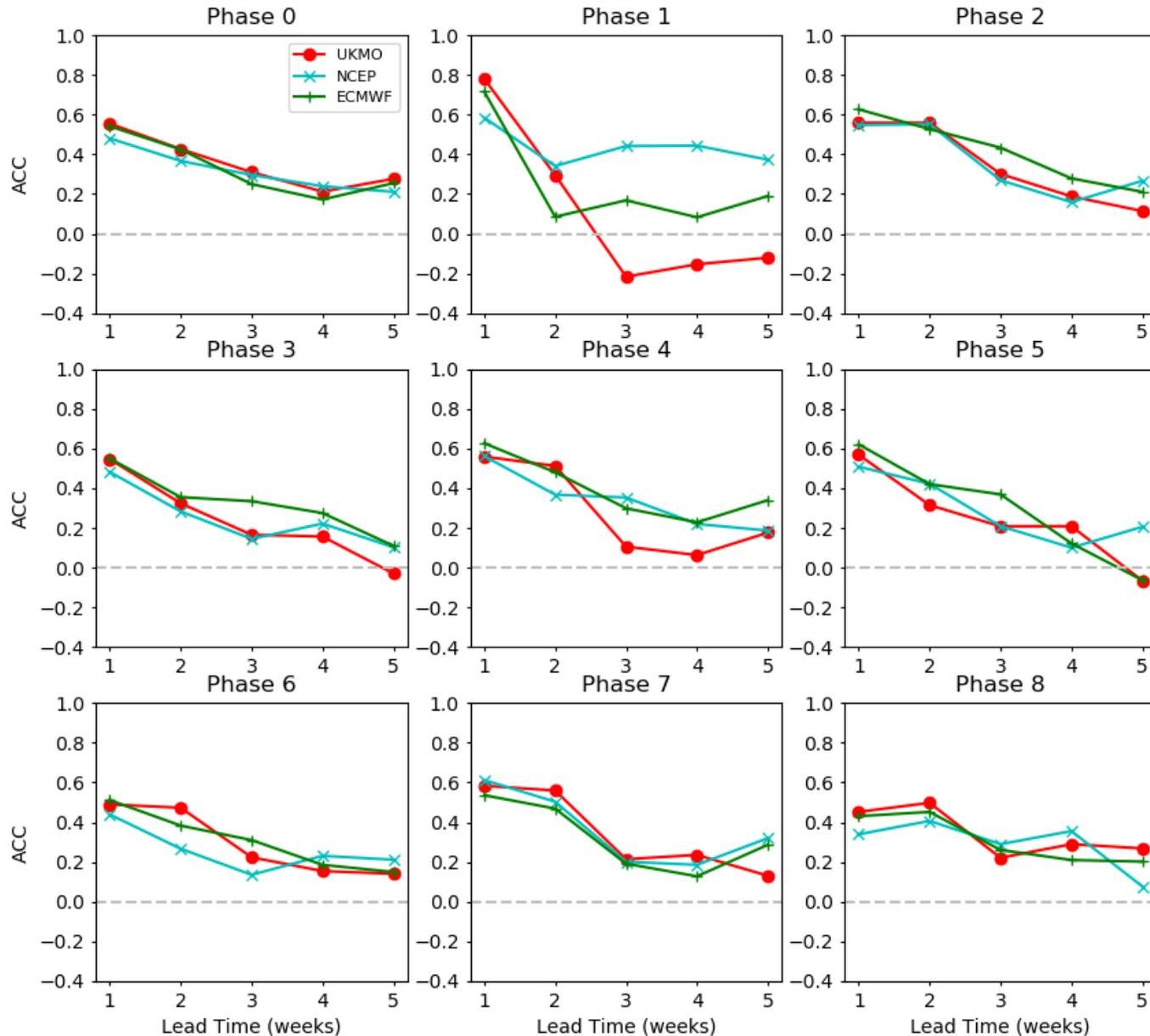
MJO

- MJO in **Phases 8, 1 and 2** leads to precipitation anomalies that are:
 - wet over SACZ
 - dry over SESA
- The precipitation anomalies are **reversed** during **Phases 3, 4 and 5**.
- Precipitation **suppressed** in **Phase 0** (inactive MJO).

GPCP Precipitation Anomalies (DJF)



Forecast Skill over Brazil (40°S-20°N, 90-20°W)



- Forecast skill decreases with lead time in all MJO phases.
- Forecast skill highest in **Week 1** for the observed MJO in **Phase 1**.
- Forecast skill decreases with lead time, and models usually have no skill beyond **Week 2**.

Conclusions

Models exhibit large precipitation biases

- Errors might be associated with tropical convection, orography and regional SSTs

Models show lowest skill in JJA season

- Indicating issues in predicting rainfall during the dry season

Models underestimate the strength of the MJO and ENSO teleconnections

- S2S rainfall predictions are better during Neutral ENSO conditions

Precipitation errors are well established within the first week of the forecasts

- Skill declines with lead time and models mostly lose useful skill after Week 2

Future work includes

- Forecast skill analysis for Brazilian operational model
- Analysing model skill using CHIRPS dataset over different sub-regions
- MJO teleconnections analysed using model MJO indices