National Center for Atmosferic Science-NCAS

University of Reading

# Performance of the Brazilian Atmospheric Model for Sub-Seasonal Predictions

Bruno dos Santos Guimarães[12], Caio A. S. Coelho[1], Steven Woolnough[2]
1-Centre for Weather Forecast and Climate Studies (CPTEC); 2- University of Reading
bruno.guimaraes@inpe.br

## 1. Introduction

Forecasting at time scale between two weeks and two months is called sub-seasonal prediction. This type of prognosis is a major challenger because the main sources of predictability (initial and boundary conditions) have no significant influence on this time scale. The Madden-Julian Oscillation (MJO) has been recognized as the major source of sub-seasonal predictability and General Circulation Models (GCM) still have shown limitations in simulating this oscillation.

There is an increase in interest, both in research and operation, in the sub-seasonal forecast in the last years. Because of this, it is important that Brazilian Center for Weather Forecast and Climate Studies (CPTEC in Portuguese), which plays a leading role in South America with respect to weather and seasonal forecasts, follows this trend and starts work on the implementation of operational sub-seasonal prediction.

The aim of this work is evaluate the sub-seasonal prediction ability of the Brazilian Atmospheric Model (BAM), the general circulation model developed by CPTEC.

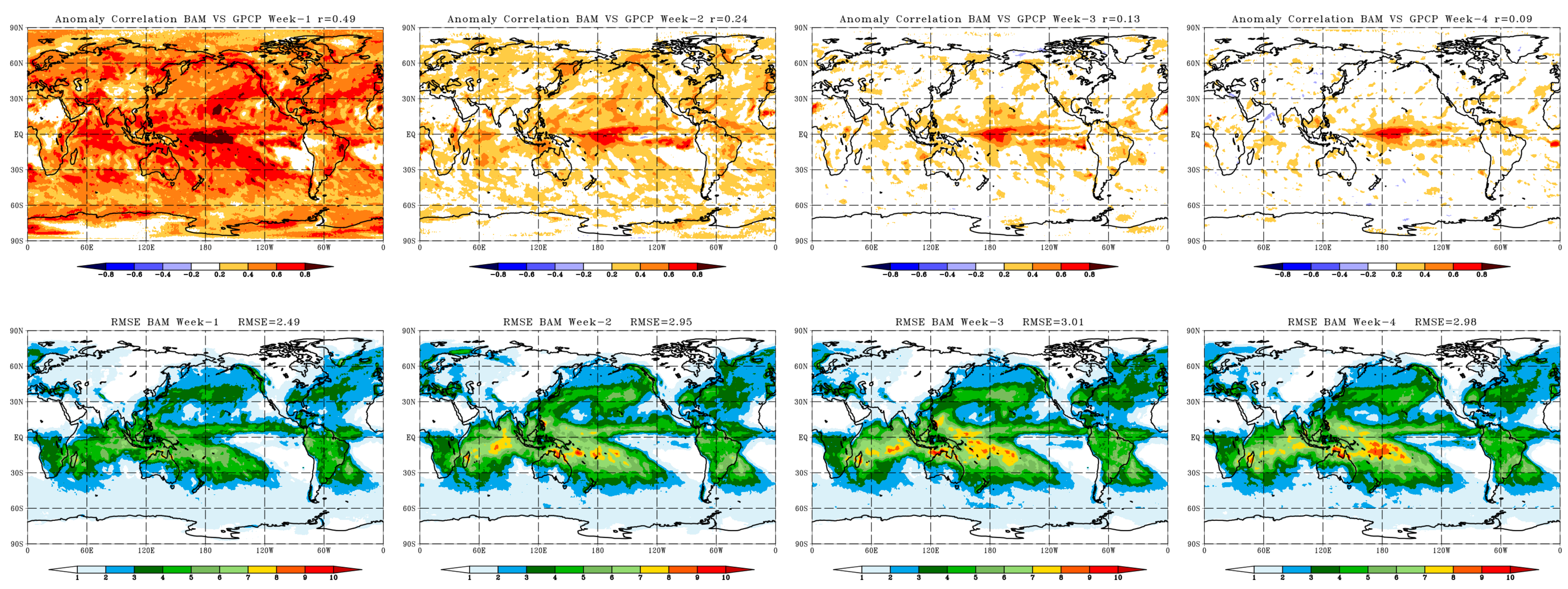
## 2. Data and Methods

**Data:** BAM hindcasts; observed precipitation form GPCP version 1.2; 2 Meters Temperature (T2M), 200 hPa and 850 meridional wind provided by ERA-Interim reanalysis; OLR dataset sourced by NOAA.

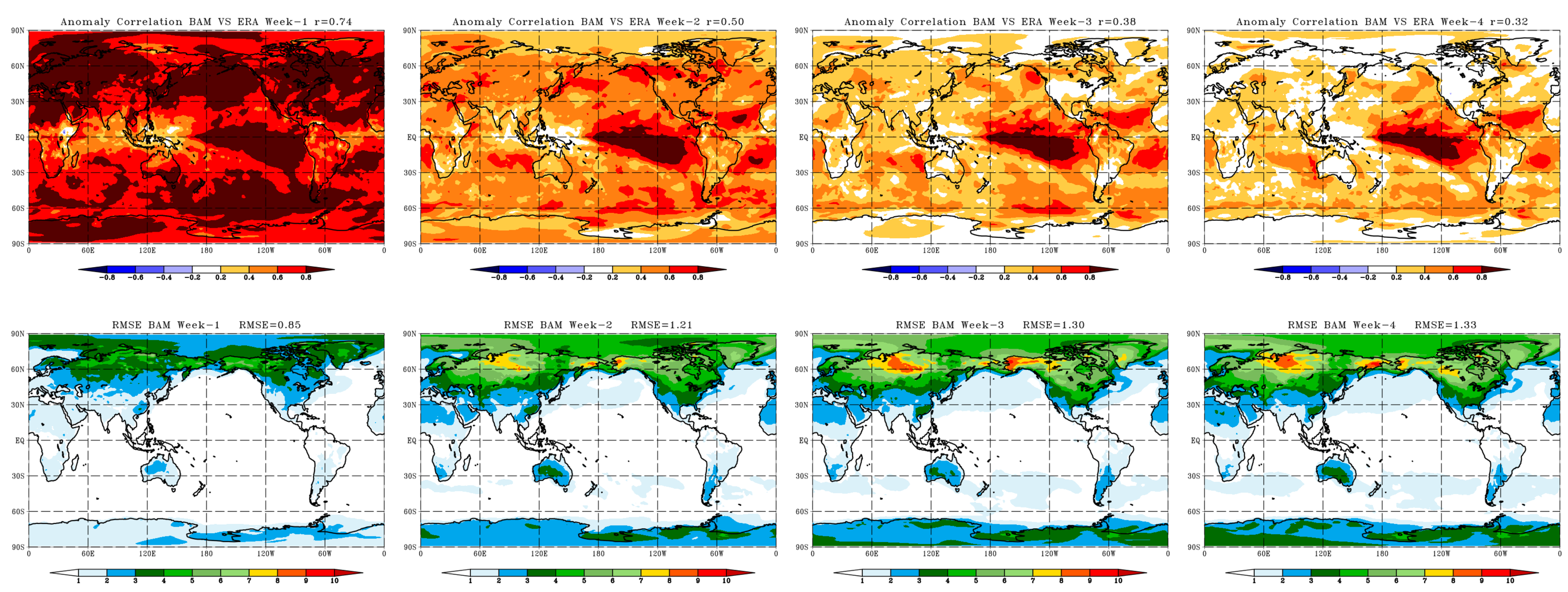
**BAM Hindcasts:** Hindcasts were generated for the extended austral summer period (November-March) for the period from 2000 to 2011 (12 years). Two start dates for each month. An ensemble with 1 control and 10 perturbed members. Empirical Orthogonal Function Method to perturb initial conditions.

**Probabilistic and Deterministic Evaluation Metrics:** Anomaly correlation; Root-mean-Square Error (RMSE); Area Under the Relative Operating Characteristic (AROC) and reliability diagram; bivariate correlation; bivariate RMSE.; spread of members.

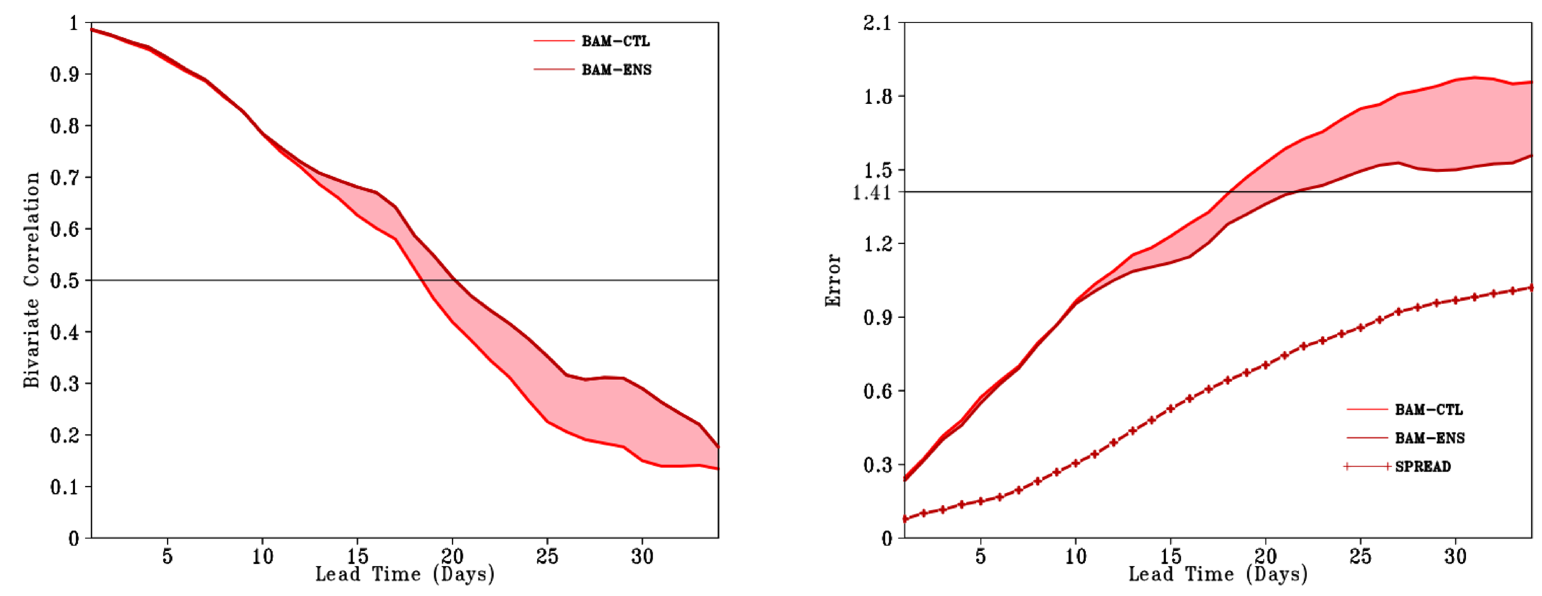
## 3. Anomaly correlation and RMSE – Precipitation



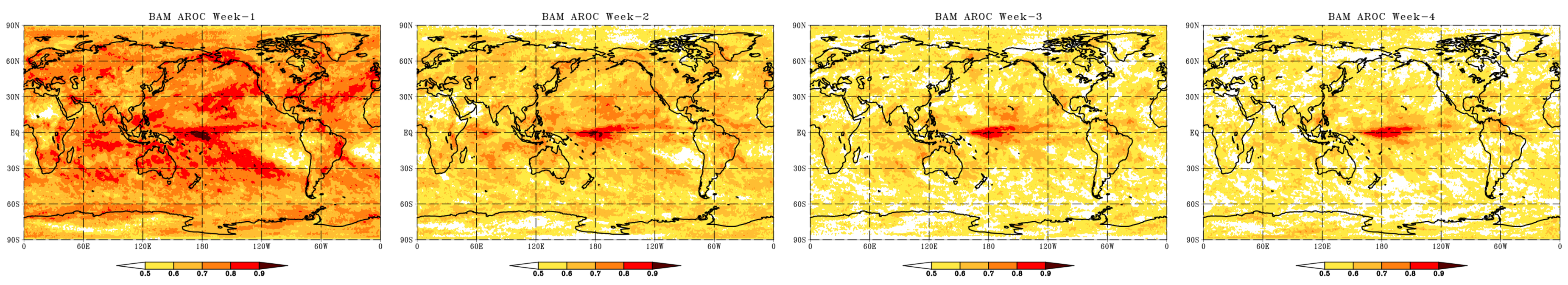
## 4. Anomaly correlation and RMSE – T2M



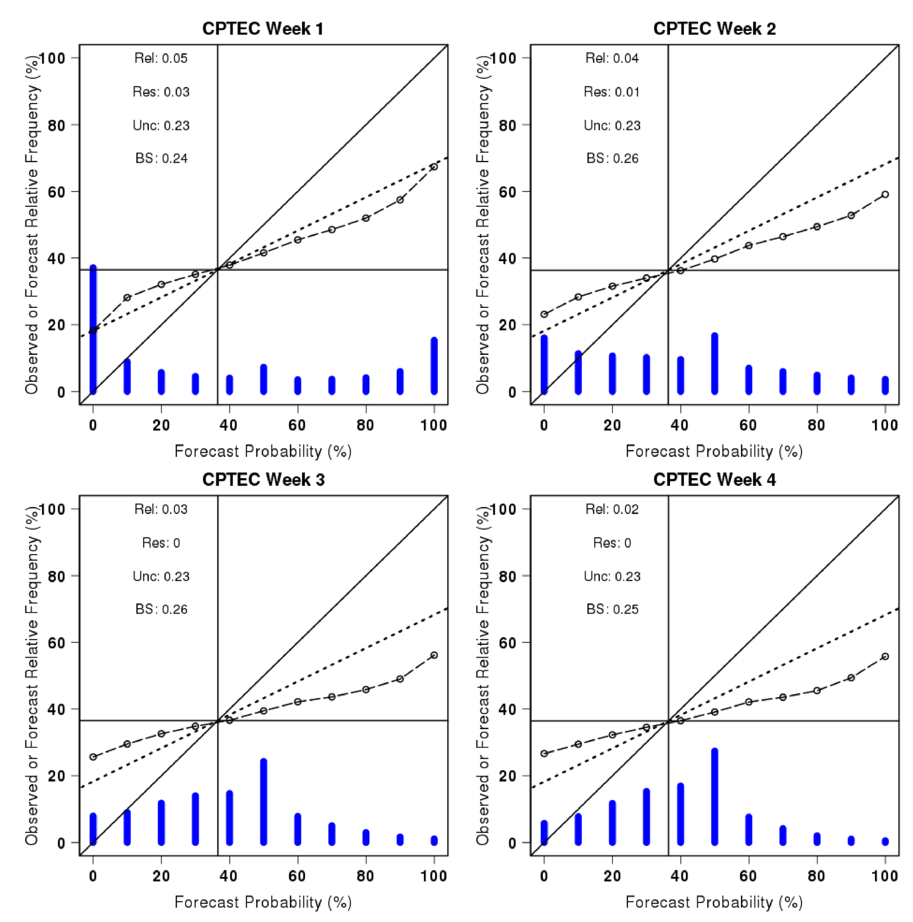
## 5. Evaluation of MJO




## 6. AROC – Precipitation



## 7. Reliability Diagram – Precipitation




## 8. Summary

The deterministic assessment shows higher correlation scores during the first week with rapid score decreases in the following weeks, maintaining meaningful signal over Equatorial Pacific Ocean.

BAM shows better 2m temperature hindcast quality when comparing with precipitation anomalies.

With respect to the MJO, the BAM ensemble mean predictions improve within two forecast days when comparing with control member. Skilful MJO predictions are verified up to 20 days.

The probabilistic assessment shows that BAM can successfully distinguish wet events from dry up to 4 weeks in advance over tropical and extratropical regions. However, BAM hindcasts need for applying a procedure for calibrating, because it is observed that probabilities do not match the observed frequencies.

Finally, these results show that BAM has similar prediction ability to other models that are part of the subseasonal-to-seasonal prediction project.