Global precipitation hindcast quality assessment of the Subseasonal to Seasonal (S2S) prediction project models

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1. Introduction and aim

- **Background:** Fill the "predictability gap" between weather and climate predictions → Subseasonal to Seasonal (S2S) prediction project: 11climate models (Vitart et al. 2017).
- **Motivation:** A comparative global precipitation hindcast quality assessment, exploring the common virtues and deficiencies in the subseasonal prediction range of all S2S models, is still undocumented.
- **Aim**: Perform an assessment of subseasonal global precipitation hindcast of all 11 S2S models and evaluate possible connections with the atmospheric circulation hindcast quality (Andrade et al. 2018).

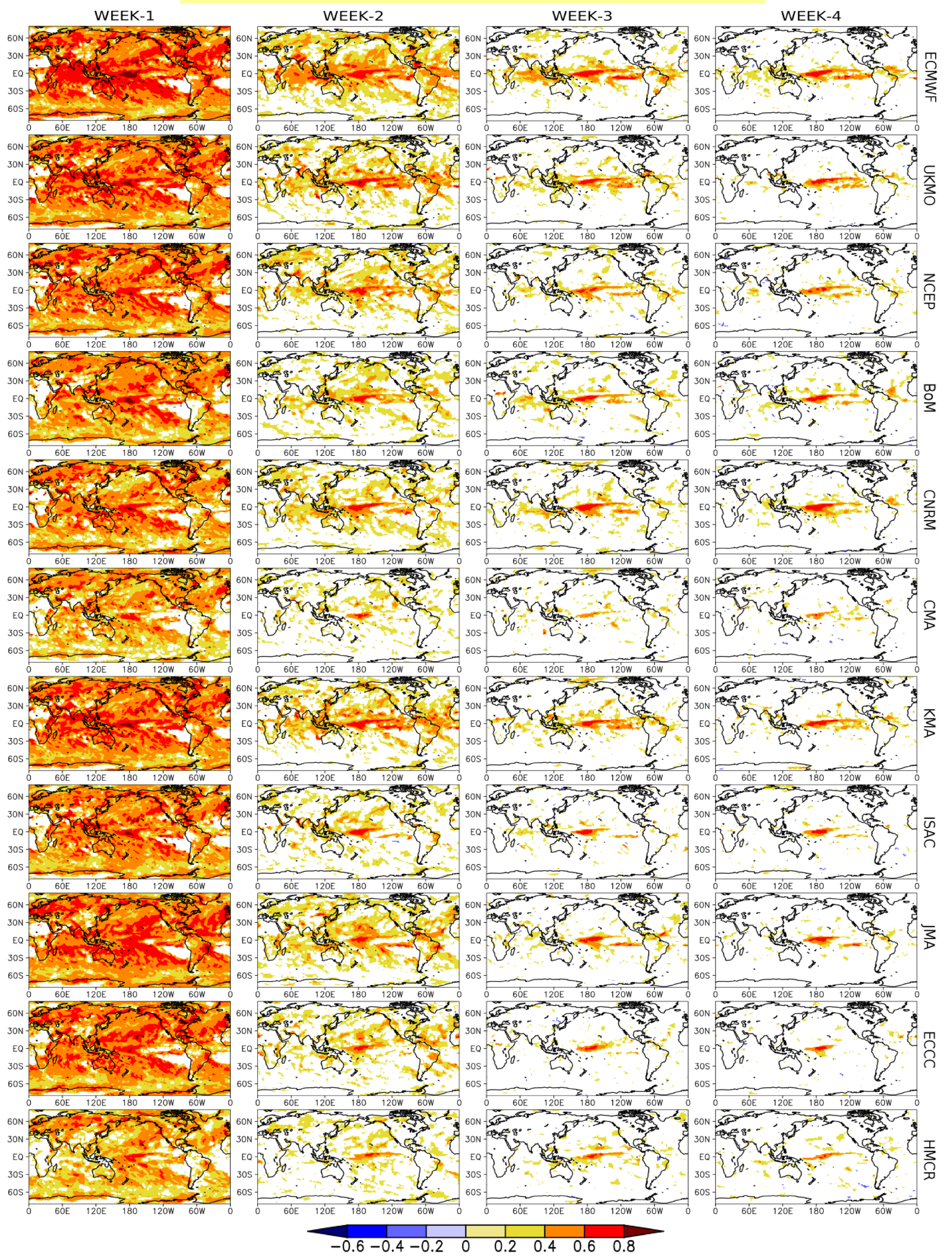
2. Data and methods

- **Data:** hindcasts from 11 S2S models; observed precipitation from GPCP version 1.2; 200 hPa wind components provided by the ERA-Interim reanalysis (used for obtaining zonally asymmetric stream function - ZAPSI); OISST.v2 and OLR dataset sourced by NOAA.
- **Methods:**

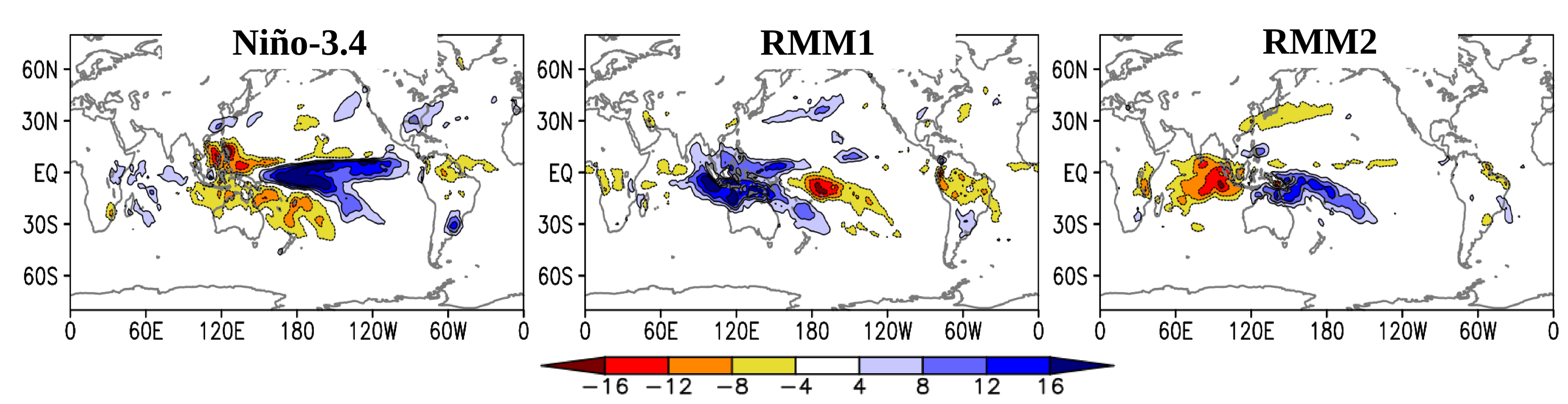
1. Deterministic metrics using different ensemble sizes (correlation, bias, variance ratio).
2. Period of analysis: Four weekly periods → days 1-7 (week-1), 8-14 (week-2), 15-21 (week-3), and 22-28 (week-4). Two extended seasons: November-March and May-September during 1999-2009.
3. Anomalies computed in a cross-validated way leaving one year out.
4. Sources of subseasonal predictability: Impact of ENSO and MJO on subseasonal precipitation prediction → linear regression analysis using ENSO and MJO indices (Niño-3.4 and RMM).

3. Linear association assessment

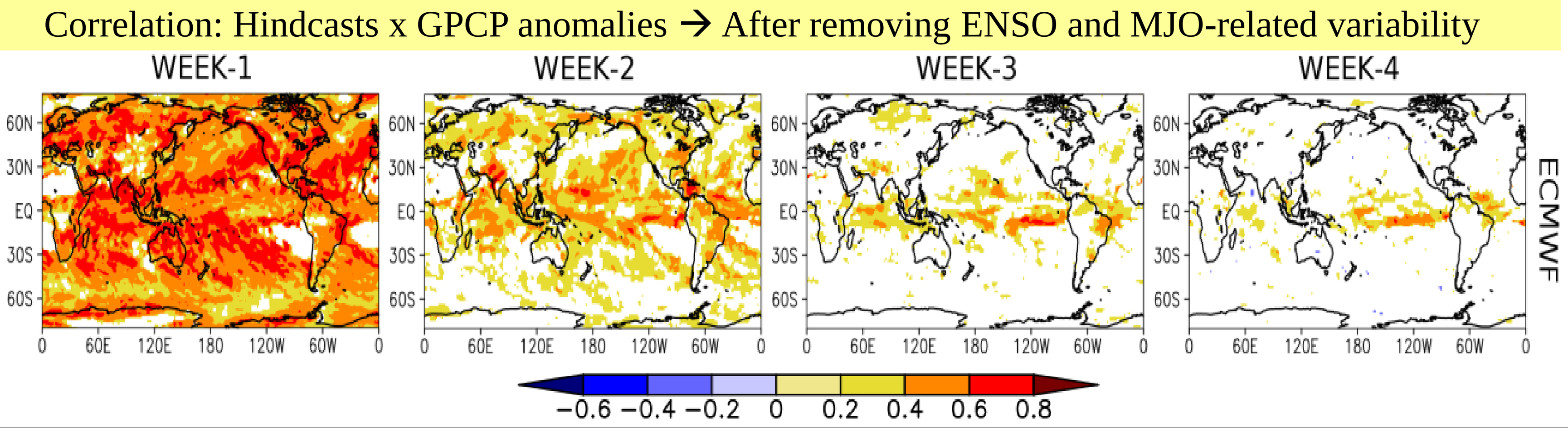
Correlation: Hindcasts x GPCP anomalies (November-March)



Regression: GPCP anomalies x Indices (ENSO and MJO) (November-March)

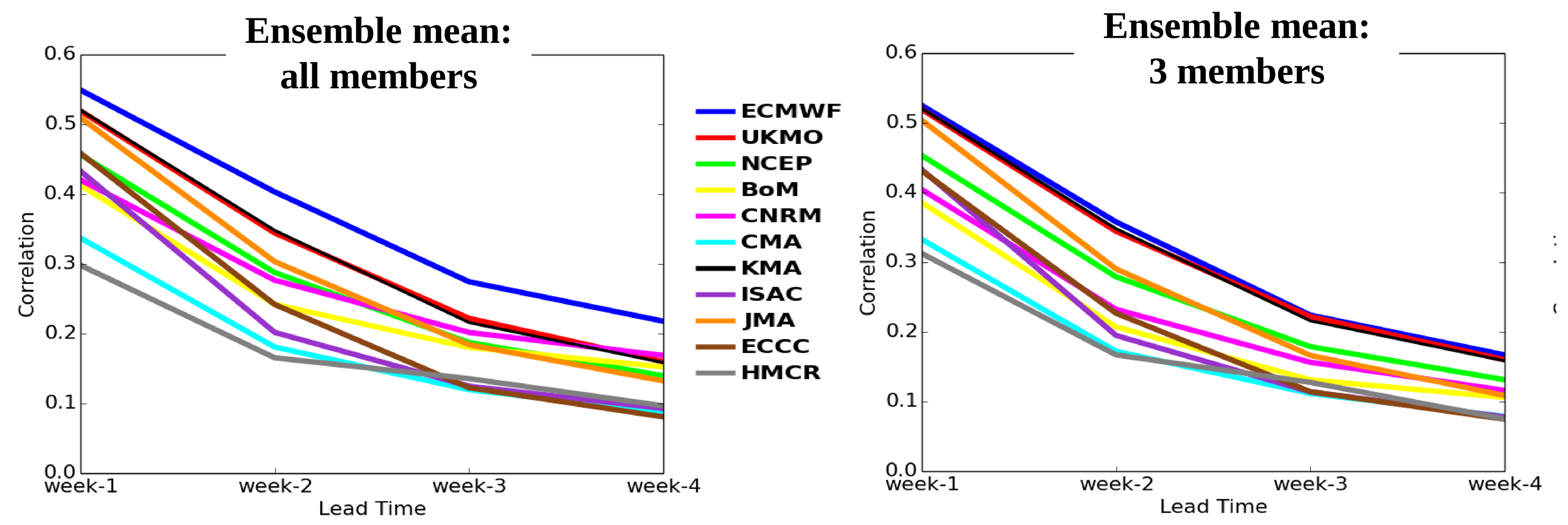


Correlation: Hindcasts x GPCP anomalies → After removing ENSO and MJO-related variability



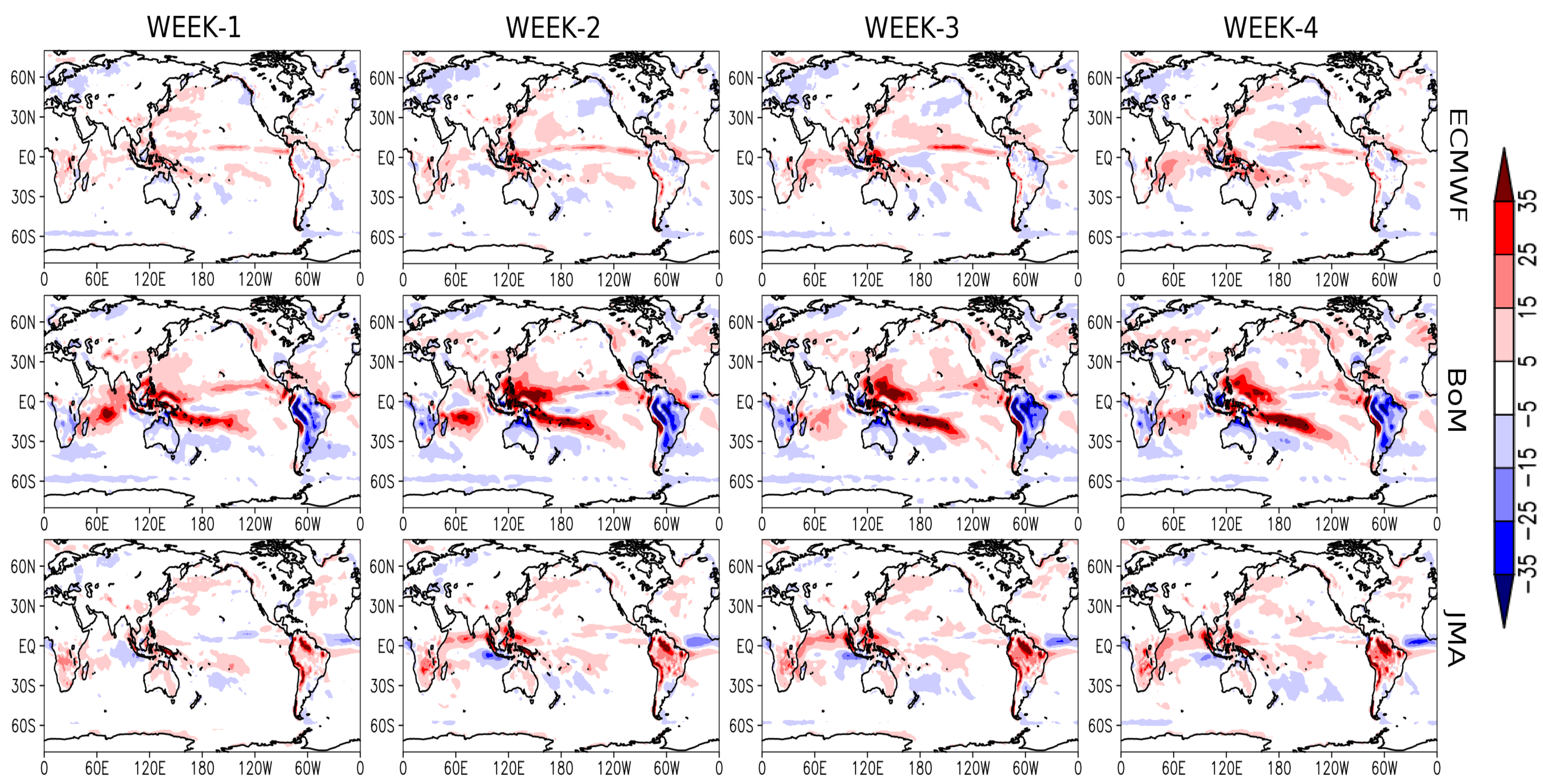
4. Model's ranking

Zonal average of correlation: Hindcasts x GPCP anomalies (November-March) 20S-20N



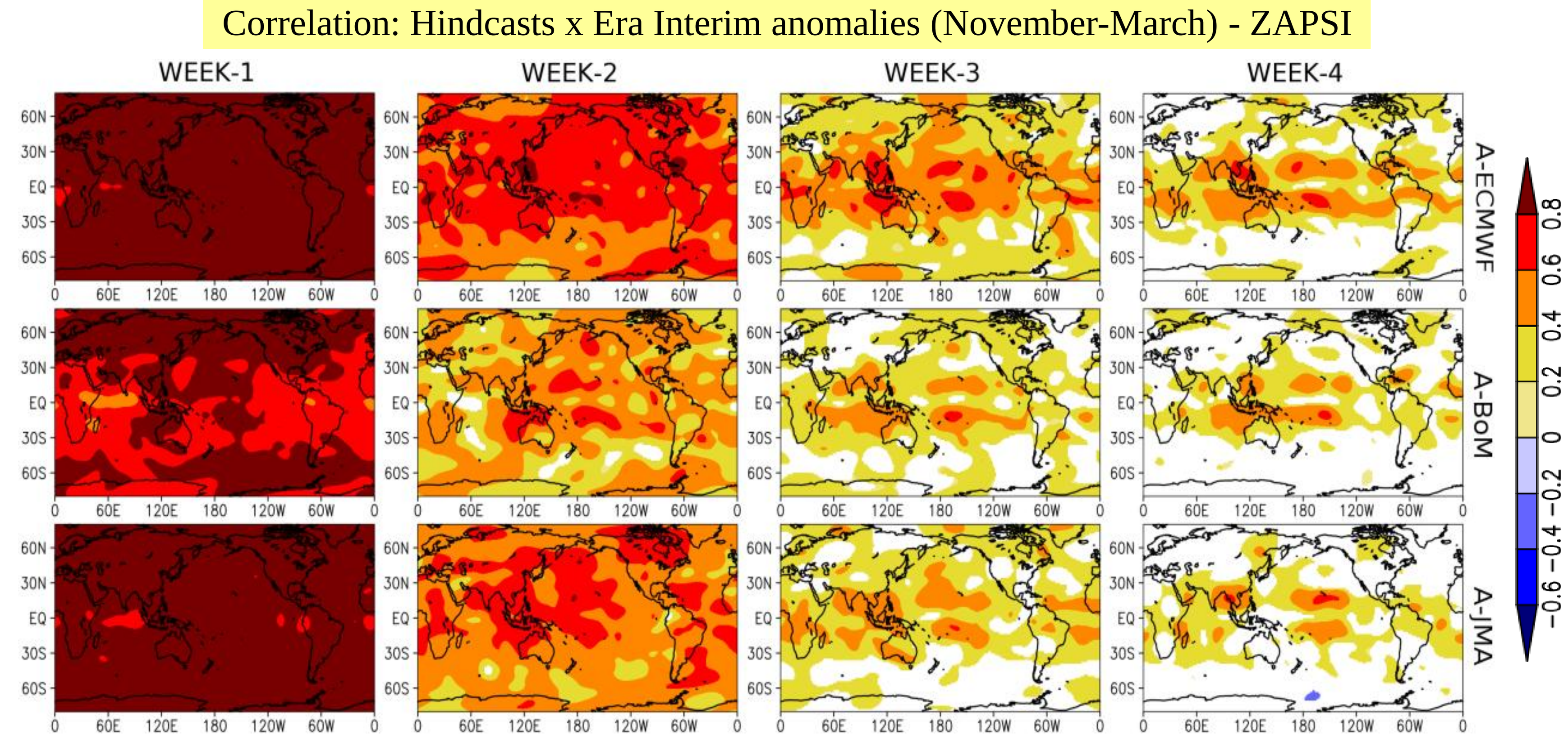
5. Systematic errors

Bias: Hindcasts x GPCP totals (November-March)

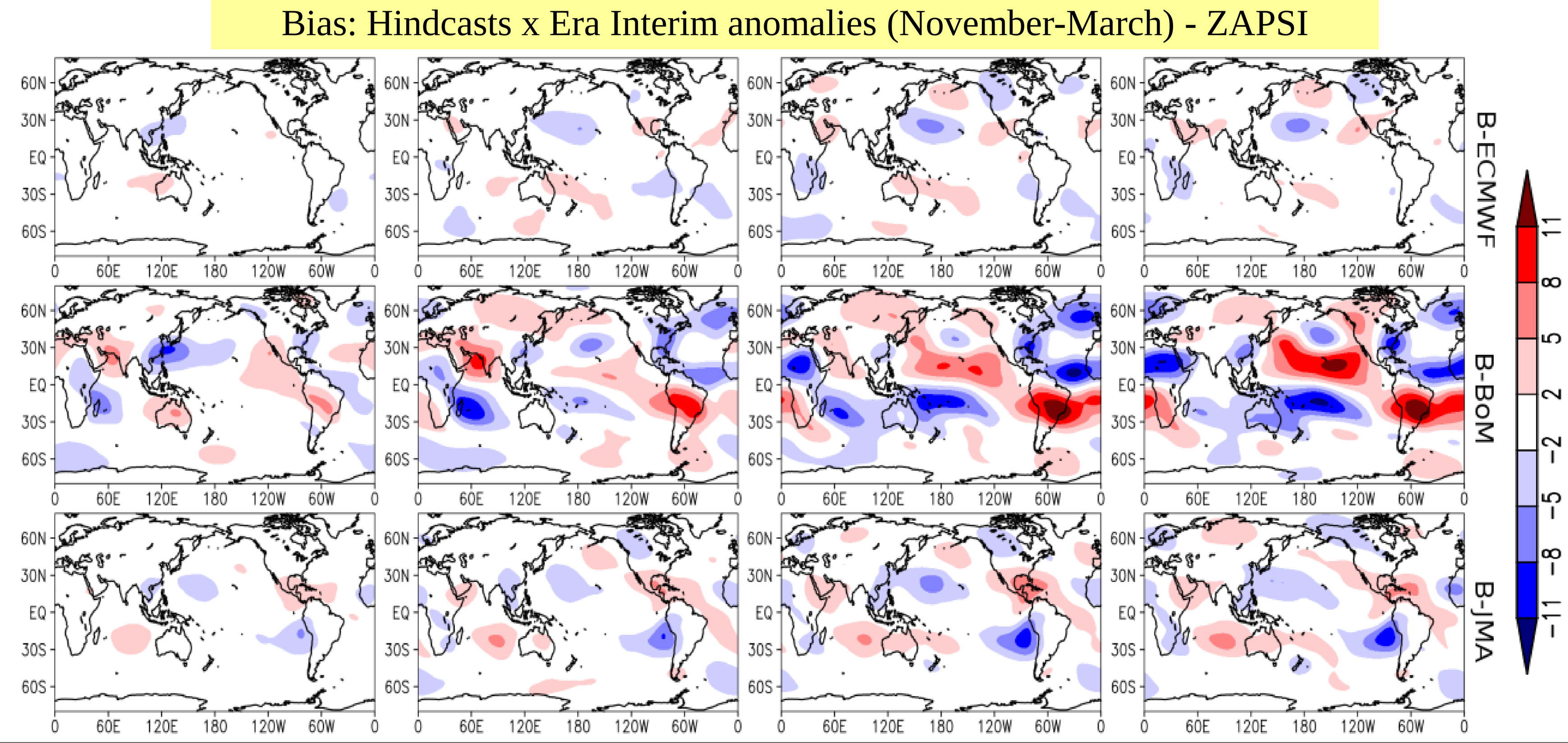


6. Connections with the atmospheric circulation

Correlation: Hindcasts x Era Interim anomalies (November-March) - ZAPSI



Bias: Hindcasts x Era Interim anomalies (November-March) - ZAPSI



7. Summary

- Weeks 1-2: Higher correlation. Meaningful scores over tropics → ENSO and MJO-related effects.
- Top scoring models: ECMWF, UKMO, and KMA. Models with larger ensemble sizes: lower correlation using fewer perturbed members.
- Large positive (negative) biases over the tropical oceans (continents and/or extratropics).
- Atmospheric circulation hindcast quality: improved for finer spatial resolution and coupled model.
- Low extratropical correlation in weeks 3-4: inherent unpredictability and deficiencies in simulating teleconnections.

References

Andrade F. M. de, Coelho C.A.S., Cavalcanti, I. F. A., (2018) Global precipitation hindcast quality assessment of the Subseasonal to Seasonal (S2S) prediction project models. **Climate Dynamics**. In review

Vitart F et al (2017) The Subseasonal to seasonal (S2S) prediction project database. **Bull Am Met Soc** 98:163-173

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