Usefulness of ECMWF system-4 ensemble seasonal climate forecasts for East Africa

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1. Background

Seasonal climate variability impacts agricultural activities and livelihoods at local to regional scales. In the East African region, an area highly vulnerable to climate anomalies, seasonal forecasts may contribute to the development of better coping mechanisms.

Dynamic ensemble seasonal climate forecasts have become better, but skill is not uniform. We need to know this skill before application in impacts modelling.

2. Objective

To assess skill of such a seasonal EPS system for E-Africa for the relevant cropping seasons of the region i.e. March-May (MAM), June-August (JJA) and October-November (OND), and at lead time *before the start of season* that would enable adaptation measures.

3. Methodology

Forecast data: ECMWF System-4 ensemble prediction system (EPS) hindcasts for 1981-2010, both raw and bias corrected (empirical quantile mapping).

Reference data: WATCH Forcing Data ERA Interim (WFD-EI).

Variables used in hydro and crop models: precipitation (*tp*), near surface air temperature (*tas*) and surface downward shortwave radiation (*rsds*).

Verification measures: mean ensemble bias (Bias); Ranked probability skill score (RPSS); Relative operating curve skill score (ROCSS).

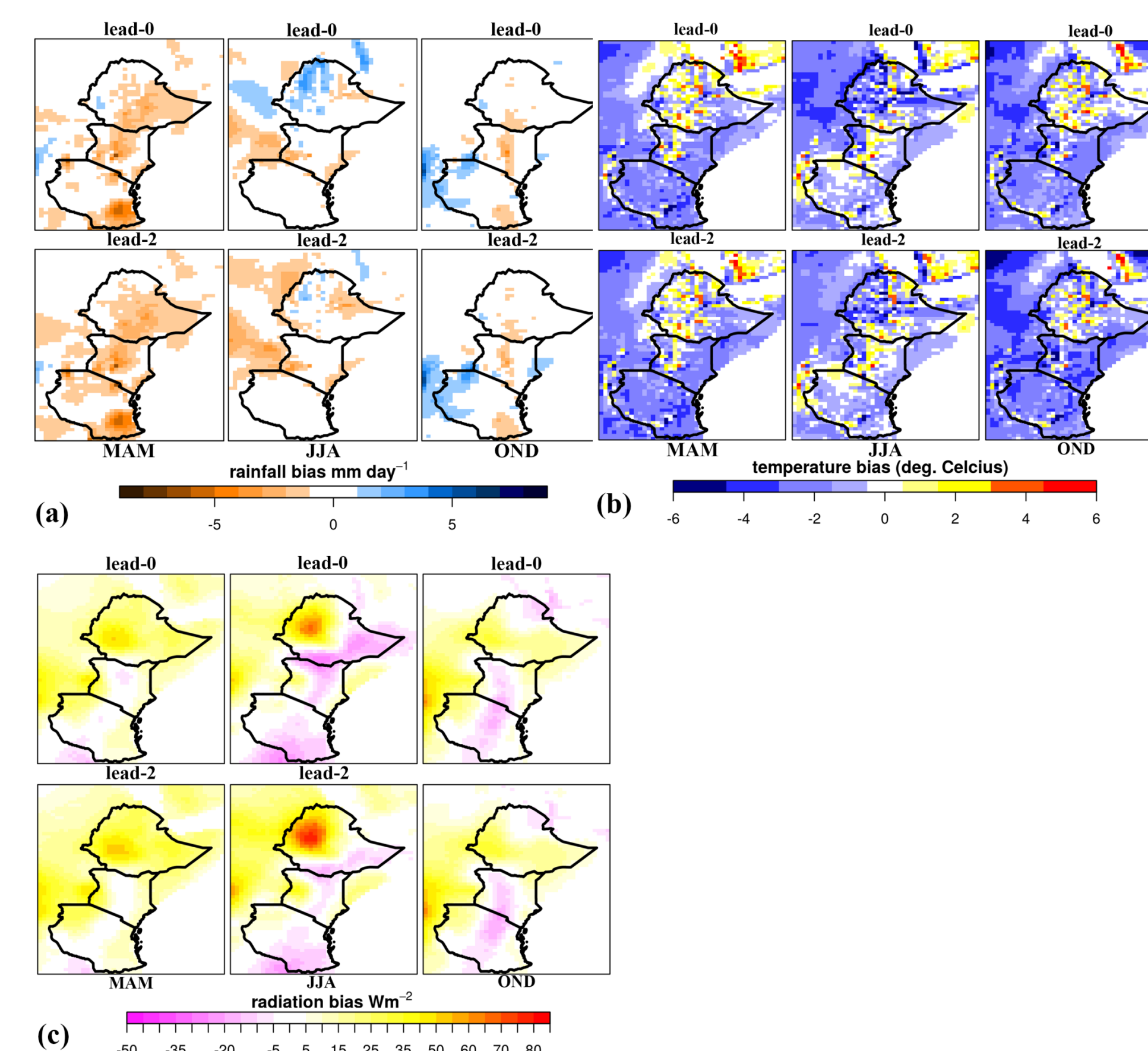Grid-based (0.5º) and for homogeneous rainfall areas.

Study area
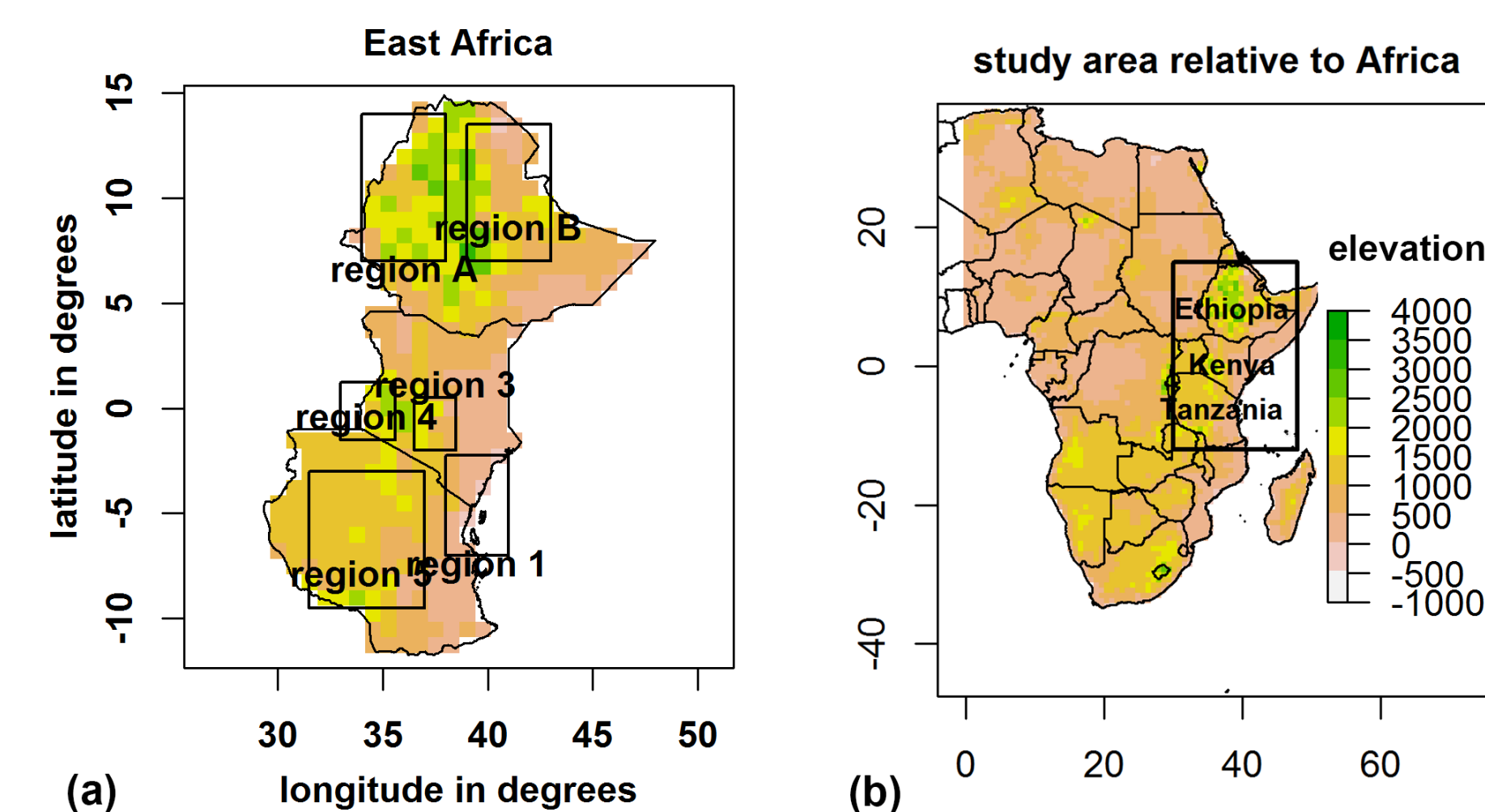
Study area relative to Africa (b) and homogeneous rainfall regions (a).

4. Results

(i) Biases

a) Precipitation (*tp*) wet bias in OND, dry bias in MAM, a mix of both in JJA
b) Bias in *tas* similar in the three seasons, constant with lead time, correlates with elevation
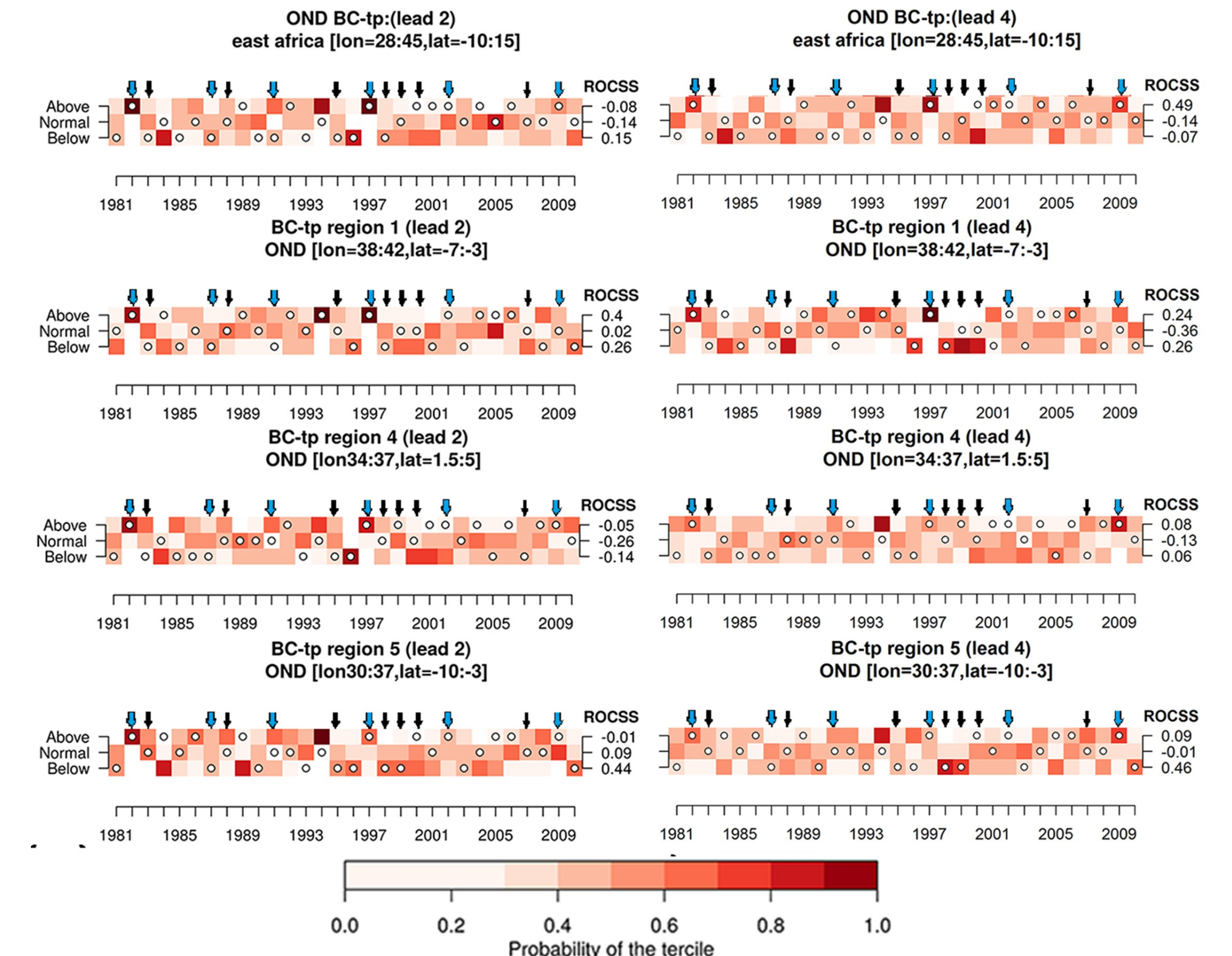c) Bias in *rsds* correlate with cloud/rain patterns

(ii) Probabilistic score: RPSS

- RPSS for *tp* good in limited areas, in some seasons, some lead times
- Skill *tas* good in many areas, all seasons, all lead times
- Skill *rsds* skill intermediate in these aspects.

dots: significant RPSS > 0 at 95% level.
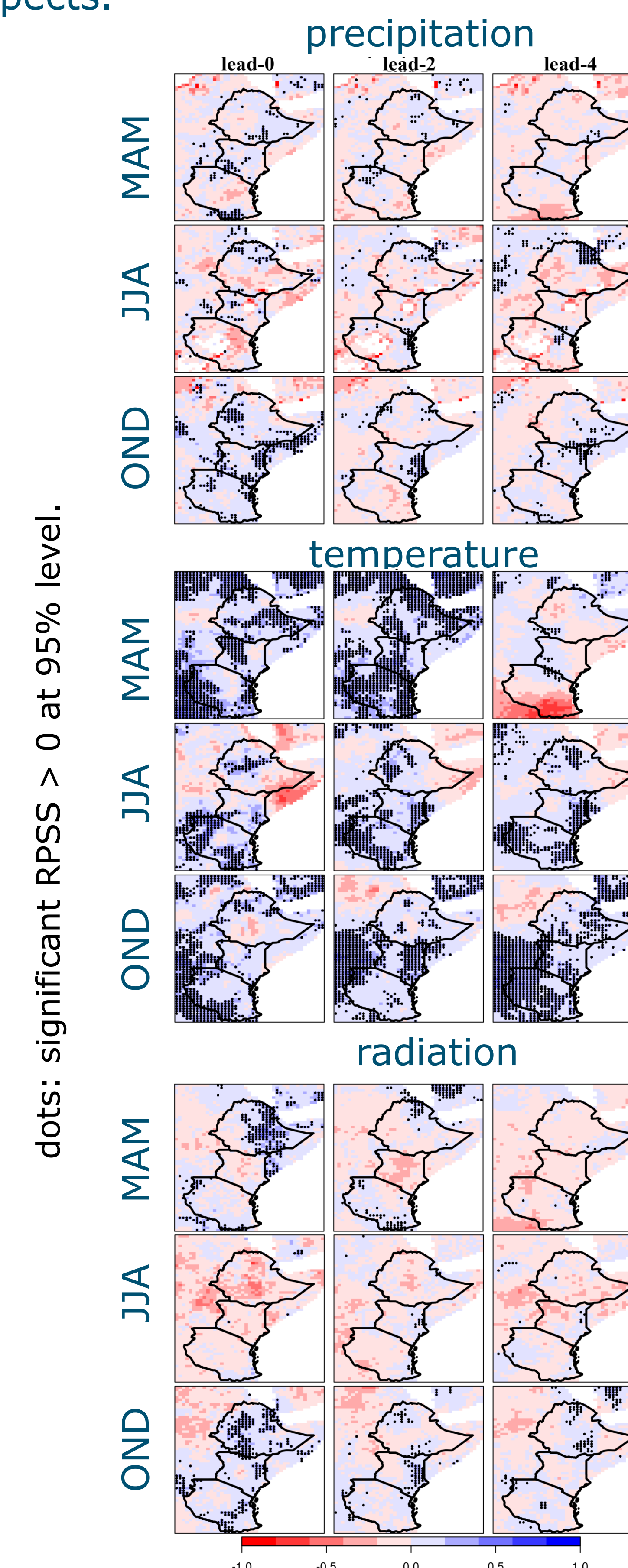
(iii) Probabilistic score: ROCSS

tercile of occurrence of observations (open circles), and ROCSS (text at right) over East African sub-regions in OND seasons for lead times 2 (left) and 4 (right) months before start of season.

Blue arrows show El Nino (wetter than normal) years, and black arrows show La Nina (dry) years .

5: Conclusions

ECMWF System-4 is skilful over all seasons, but the level depends on lead-time and region.

Bias correction does not affect probabilistic score, its important though for impact modelling (thermal time accumulation in crop modelling affects phenological development).

Regional skill assessment important since impacts are also noted at these scales.

ECMWF System-4 EPS is potentially useful in crop and other impact modelling over East Africa.