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Seasonal predictions of summer precipitation over West Africa using coupled general circulation models: skill of the ENSEMBLES project multi-model forecasts

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As part of the EU-funded ENSEMBLES project, seasonal-to-annual predictions from five state-of-the-art European ocean-atmosphere coupled general circulation models were run over a 46-year hindcast period (1960-2005). This study assesses the multi-model skill in predicting seasonal precipitation for the June-July-August (JJA) season over West Africa, using the 2 to 4-month lead forecasts initialized in May. Forecasts are compared to the GPCC Full Data Reanalysis database (version 4). Ensemble multi-model forecasting addresses two sources of uncertainty : initial condition uncertainties and those due to model formulation and parameterizations. The use of ensembles allows for two types of forecast assessment, in deterministic form using the ensemble mean and probabilistic form using each member of the ensemble with a quantile-quantile calibration.

Deterministic scores (anomaly correlation) and probabilistic scores (ranked probability skill score, potential economic value using a cost-loss model) provide an overview of the predictability of rainfall over West Africa at a seasonal time scale and a comparison between the five single models and the multi-model ensemble. These scores confirm the added value of a multi-model approach: the spread-skill ratio, anomaly correlation coefficients and RPSS are improved with respect to single models (Batté and Déqué, 2011, in press). Links between these results and sea-surface temperature are discussed by comparing the covariance between global SSTs and precipitation anomalies over West Africa in the multi-model ensemble and in reference datasets. Skill scores are also studied after splitting the West African region into two smaller "Sahel" and "Gulf of Guinea" spatial domains to better assess multi-model performance over these sub-regions.