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Skill of Global Raw and Postprocessed Ensemble Predictions in the Tropics

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Throughout the tropics, forecasts of precipitation have a multitude of users from the short range to the seasonal timescales. Despite this, relatively little is known about the quality of current numerical weather prediction (NWP) ensemble forecasts for precipitation at accumulation periods of one to a few days. Therefore in this comprehensive evaluation study, we systematically analyze for the first time NWP ensemble forecast skill for amount and occurrence of precipitation as well as the occurrence of extreme precipitation events for ten Köppen-Geiger climates in the tropics. We assess ensemble forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) and the Meteorological Service of Canada (MSC) for accumulation periods of 1–5 days against satellite-based gridded observations during the period 2009–2017. In order to evaluate the full potential of ensemble forecasts, we apply the state-of-the-art statistical postprocessing technique Ensemble Model Output Statistics (EMOS) and compare raw and postprocessed forecasts against a probabilistic forecast derived from past observations (referred to as "extended probabilistic climatology" or short EPC).

Unprocessed forecasts from both ensemble systems are generally uncalibrated, overconfident and unreliable. Despite this, they are (slightly) skillful for several Köppen-Geiger climates such as arid Australia or arid southern Africa. For tropical and northern arid Africa and in alpine climates, they have at best neutral skill. Statistical postprocessing improves forecast skill, and postprocessed forecasts for amount and occurrence of precipitation are skillful in most climates. In tropical and northern arid Africa and alpine climates, however, even postprocessed forecasts do not outperform EPC. For the occurrence of extreme events, we find similar results, in that ECMWF and MSC forecasts are skillful in most regions, but have at best neutral skill in tropical and northern arid Africa and alpine climates. We suspect three main problems, namely convective parameterization, model resolution, and observational errors as major causes for the poor performance of raw and postprocessed NWP ensemble predictions in the latter regions.

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