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Statistical Rainfall Forecasts in the Tropics Based on Spatio-Temporal Precipitation Properties and Tropical Wave Activity

Peter Vogel (1,2), Andreas Schlueter (1), Peter Knippertz (1), Andreas H. Fink (1), Tilmann Gneiting (2,3), and Manuel Klar (4)

(1) Institute of Meteorology and Climate Research, Karlsruhe Institute of Technology, Germany, (2) Institute for Stochastics, Karlsruhe Institute of Technology, Germany, (3) Heidelberg Institute for Theoretical Studies, Heidelberg, Germany, (4) Department of Mathematics, University of Trier, Germany

Precipitation forecasts for one up to several days are of high socioeconomic importance throughout the tropics, regarding both the occurrence as well as the amount of precipitation. However, forecasts based on numerical weather prediction models and even statistically postprocessed forecasts hardly outperform simple reference forecasts such as climatology or persistence in parts of the tropics, especially over West Africa, and thus are of no practical use in these regions.

In this contribution, we investigate the potential of statistical forecasts based on near-real time observations to predict the occurrence of precipitation, while the prediction of rainfall amount will be addressed in the future. Starting from relatively simple climatology-based forecasts as a reference, we improve predictions by including spatio-temporal information contained in precipitation observations and illustrate this approach over West Africa. The derivation of the spatio-temporal properties of the precipitation fields require a full spatial coverage of precipitation observations and therefore we rely on Tropical Rainfall Measuring Mission (TRMM) observations. Especially for the strongest phase of the West African monsoon from end of June to end of September, precipitation fields exhibit clear spatio-temporal information that is meteorologically interpretable and statistically meaningful, and leads to improved forecasts.

While these forecasts already outperform persistent and climatological predictions, forecasts can be improved further through adding information on the activity of tropical waves. We illustrate this approach for Kelvin and African easterly waves over West Africa and test it throughout the tropics. While this approach is meteorologically meaningful and interpretable, it also yields improved forecasts.

These new results show some promise to eventually develop a computationally inexpensive statistical model that could be used in operational procedures and will generate better precipitation forecasts for parts of the tropics than the current state of the art. This work is part of the Transregional Collaborative Research Center SFB/TRR 165 “Waves to Weather”.