

Interannual Variability and Ensemble Prediction of Upper Blue Nile Basin Kiremt Season Precipitation

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Abstract. Ethiopian agriculture and Nile River flows are heavily dependent upon precipitation in the upper Blue Nile basin as a means of irrigation and streamflow contribution, respectively. This study focuses on the development of forecasting methods for prediction of Kiremt season (June – September) precipitation for the portion of the basin lying within Ethiopia. Amidst the temporal and spatial variability of precipitation within Ethiopia, the basin is deemed homogeneous in nature by means of a principal component analysis. Predictors of the seasonal precipitation comprise global, regional, and local features, including sea-level pressures, sea-surface temperatures, geopotential height, air temperature, and the Palmer Drought Severity Index, reflecting the El Niño Southern Oscillation phenomenon as the leading mode of variability within the system. Statistical modeling framework for the generation of forecast ensembles focuses on two approaches, including a traditional linear regression (parametric) and a local polynomial regression (non-parametric), driven by the climatic predictors from a one-season (March – May) lead time. Cross-validated forecast ensembles from both modeling approaches are assessed by means of a rank probability skill score, and prove to be an improvement over forecast by climatology, as currently utilized by the Ethiopian National Meteorological Services Agency. This unique forecasting methodology may therefore serve as an attractive alternative for future water resources planning and management within the basin.

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