

Exploring synoptic-scale drivers of interannual rainfall variability over Africa

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Variability in local climate is a result of an interplay of multi-scale drivers –processes and feedbacks - intertwined within dependency or conditioning chain across spatial scales: from global to synoptic to meso- to local. Resolving these drivers and dependencies can be framed through the following questions: where does a deterministic signal at a particular time scale arise, how does it propagate through space and scales, and how can we maximize our ability to capture it? Here, we report on an exploratory study focusing on the synoptic-scale forcing underlying rainfall variability at the interannual time scale over Africa. In that, we systematically map, over the continent, variables and spatial scales which provide the strongest explanatory power of interannual rainfall variability. In addition, we contrast the explanatory power of mean state of synoptic fields with that of their variance, and of frequency of individual (daily) states. The analyses utilize multiple regression and CCA performed on mean de-orthogonalized fields of q,t,u,v,z at various pressure levels, with daily states of synoptic variables classified using self-organizing maps (SOM). The results are interpreted from the process perspective in terms of their agreement with the current understanding of the role of process chains affecting rainfall over various regions of the continent, and in terms of their implications to statistical downscaling of climate projections and seasonal forecasts.

Keywords: rainfall variability, statistical climatology, Africa, self organizing maps