

East African long rains at the sub-seasonal scale: connections with regional and large-scale climate

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The long rains occurring in March-April-May (MAM) in East Africa have been notoriously difficult to capture in climate models and the CMIP5 ensemble. This is highlighted by the fact that CMIP5 models show increasing MAM rainfall in East Africa while measurements show a drying at the end of the 20th century. Evaluating models with a process-based analysis is key to selecting which models to use for projections on a regional scale, but the MAM season poses an extra challenge in this regard since the processes governing the rainfall are hard to pinpoint in the historical period.

To understand these processes better, we analyze East African long rains at the sub-seasonal level. We examine Kenyan rainfall using the Chirps rainfall dataset and atmospheric circulation over East Africa using the ERA-Interim reanalysis dataset. We find that the rainfall trends in individual months vary, with the most substantial decline at the end of the 20th century occurring in April. We find that the peak in the MAM rainfall climatology happens sometime in April, and the exact timing of this peak shifts within the month. Wet composite years tend to have a peak closer to the beginning of the month and vice versa for dry composite years. By using the timing of this peak as an indicator of when atmospheric conditions change, we connect dynamic features to rainfall during the season. We also find useful metrics for the process-based analysis of the CMIP5 ensemble in East Africa that will aid in quantifying and contextualizing our confidence in future climate projections in this fragile and changing region.