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Potential predictability of Horn of Africa precipitation in ECHAM5

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The Horn of Africa is a region where agriculture, economy and human health are very sensitive to extremes in precipitation. Models for seasonal forecasts of precipitation in this region are mostly based on statistical relations of precipitation with large-scale atmospheric circulation, as well as with slowly-varying sea surface temperature (SST). Here we examine the potential for dynamical forecasting of rainfall on such time scales in the Horn of Africa with the atmosphere general circulation model ECHAM5. The model was run with a T106 horizontal resolution ($\sim 1.125^{\circ}$) and forced with reconstructed sea surface temperature data from 1870 to 2009.

Comparisons to observations from the Global Precipitation Climatology Project show that ECHAM5 simulates a realistic climatology of precipitation throughout the Horn of Africa. The results of an analysis of variance indicate that the season with the highest potential for seasonal predictability of rainfall in this region is Northern Hemisphere summer.

In agreement with observational studies, the model simulations show an El Niño (La Niña)-like SST pattern in the equatorial Pacific in summers of low (high) precipitation in the Horn of Africa. Accordingly, the large-scale atmospheric circulation anomalies show a weak (strong) Tropical Walker Circulation in summers of low (high) precipitation.

Sensitivity experiments support the connection between SST anomalies in the equatorial East Pacific and rainfall in the Horn of Africa in Northern hemisphere summer. Model simulations driven by an El Niño-like pattern result in dry conditions over the Northeastern part of the Horn of Africa and the South of the Arabian peninsula.