The prediction of convective precipitation is a challenge, especially in tropical Africa where observation networks are inadequate for resolving mesoscale circulations. A high-resolution simulation is used to examine the evolution of organized deep convection within several hundred km of the Ethiopian Highlands and Darfur Mountains. This region has received little attention in the literature despite satellite studies showing it to be the origin of coherent episodes of organized convection that produce most of the rainfall in the Sahel, aid in easterly wave generation, modulate the diurnal cycle of rainfall, and, occasionally, contribute to tropical cyclogenesis.

The simulation generates zonally propagating episodes of precipitating convection with similar properties to satellite-derived rain events. Individual events and composite environments are analyzed to identify conditions conducive to long-lived episodes, which have significant regional impact. Moderate-to-strong lower-tropospheric wind shear is one distinguishing feature of long-lived episodes, while short-lived events are associated with weak low-level shear. In general, high values of convective available potential temperature are present in the boundary layer downstream of initial convection that matures into long-lived events. Convection is short-lived in the wake of intense mesoscale convective systems whose downdrafts stabilize the boundary layer. Long-lived episodes have little or no negative buoyancy in the boundary layer downstream of initial convection while short-lived episodes are associated with greater amounts of negative buoyancy. The longevity and organization of convection is also affected by the mid-tropospheric relative humidity. The frequency of long-lived episodes increases as the relative humidity increases during the second week of the simulation.