Session: C28 Poster: W47B

Towards understanding climate variability over tropical Africa: A study of some lower tropospheric processess

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Precipitation in tropical Africa is largely due to Mesoscale Convective Systems (MCS). In tropical North Africa (the Sahel), synoptic features and the dynamics of MCS turn them into travelling storms and so they affect a large area over a relatively short time whereas in the Kalahari transect of tropical Africa, they tend to be more isolated. Vertical motions within MCS could be as significant as horizontal motions. These updraughts and downdraughts impact heavily on local rainfall, wind, lightning and other forms of severe weather. However, their instantaneous limited lateral extent and timescale do not often make them evident on synoptic charts. These also keep them at sub-grid levels in most climate models; hence, the need for parameterization in numerical weather prediction models (NWP). An aggregate of these NWP simulations over an extended period gives an indication of climate variability over tropical Africa. This indication can be improved upon through better understanding of the dynamics, moisture flux, heat flux, momentum transfer etc. within these tropical storms. This study looks at one of these parameters namely, the dynamics of tropospheric wavelike perturbations over tropical Africa with the aim of isolating disturbances that most likely trigger MCS. Local, synoptic and global systems that enhance the development of these waves are discussed with the aim of postulating on precursors for climate variability over tropical Africa. An example of a precursor is the depth of the lower tropospheric air mass over tropical Africa. Simulations point to the fact that this depth must be of the order of 700 hPa before MCS can develop. Speculations are made on local, synoptic and global systems that enhance the achievement of this depth. The frequency and duration of this depth over a particular location is shown to have implications for extreme events like floods.