1C.6 A MESOSCALE MODELING STUDY OF THE FORMATION OF AN AFRICAN DISTURBANCE PRECEDING TROPICAL CYCLOGENESIS

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1. INTRODUCTION

As previously noted by Hill and Lin (2003), the tropical disturbance that would become Hurricane Alberto (2000) originated over the Ethiopian Highlands (EH) 5 days prior to cyclogenesis over the eastern Atlantic Ocean. Because this disturbance was remarkably coherent as it traversed the Sahel of Africa and emerged over the ocean, as was shown with METEOSAT-7 satellite data, our interest lies in the formation of this disturbance in the vicinity of the EH. This study focuses on the mesoscale precursors to the development of this disturbance.

2. METHODOLOGY

The non-hydrostatic COAMPS™ model is used to simulate the development of the pre-"Alberto" disturbance, as well as to conduct sensitivity tests that highlight key features in the mesoscale environment contributing to the development of the initial mesoscale convective complex (MCC) and the associated mesovortex (MV) of this disturbance. Specifically, the effects of terrain, sensible heating, and latent heating on the convective and kinematic development of this disturbance are examined.

Simulations are conducted on three gridded domains of 45-, 15-, and 5-km resolution (Fig. 1). NOGAPS 12-hourly analyses were used to initialize the simulations. The Kain-Fritsch cumulus parameterization scheme is used with the 45- and 15-km domains, and the Rutledge-Hobbs microphysics scheme is employed. Further details of the COAMPS model are given by Chen *et al.* (2003).

3. SUMMARY

The no-terrain (NT) experiment indicates that a cyclonic shear zone along the left streamwise periphery of the African Easterly Jet (AEJ) is a possible major source of mid-tropospheric, cyclonic vorticity to the immediate west of the EH. To at least some degree, orographic forcing contributes to each stage of convective development. With the no-sensible-heat-flux (NSH) and no-latent-heat-flux (NLH) experiments, the heat source of the EH surface and the surrounding moisture sources of the Red Sea, Indian Ocean, and the Congolese rain forests are shown to be crucial to the initiation of scattered afternoon convection and the eventual maturity of convection into an MCC.

Additional sensitivity experiments excluding the effects of the deep planetary boundary layer (NPBL) and the presence of the Turkana Channel (NTCH) will be performed as we investigate more precisely the formation mechanisms for the pre-"Alberto" disturbance.

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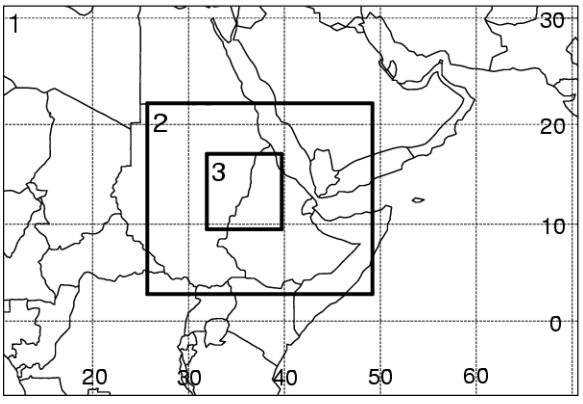

Figure 1. Grid domains prescribed for the COAMPS model based on the Mercator map projection.

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