Geophysical Research Abstracts, Vol. 9, 07661, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07661
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African easterly waves in a regional climate model

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A Regional Atmospheric Model (MAR) is used to study synoptic weather systems that propagate over West Africa during the monsoon season. A wavenumber-frequency spectrum analysis is performed on the meridional wind from both model output and reanalysis data (which are also used to drive the regional model at its boundaries). The spectra show a significant peak that corresponds to the signal of African Easterly Waves (AEWs): a period of 3-10 days and a wavelength of 2000-4000 km. AEW activity is then isolated through space-time filtering of the simulated meridional wind, vertical wind, Outgoing Longwave Radiation (OLR) and precipitation.

Two different simulations of 1986 and 1987 are compared focusing on origin and propagation of AEWs. For each year, one simulation extends to 14°E and the other to 21°E. The time-longitude diagrams (at 800 hPa) of the space-time filtered meridional wind show that most AEWs come from the reanalysis that drives the MAR at its Eastern border. AEWs seem to propagate quite well if they have sufficient amplitude when they enter the model domain.

The relationship between AEWs, convection and precipitation simulated by the MAR is then addressed. At 800 hPa, there is good correspondence between the vertical motion and the meridional wind. The upward motion is located in the northerlies and a Q-vector analysis shows the dynamic origin of the vertical motion at this level. However, at 280 hPa the vertical wind does not match up with the meridional wind and appears not to be dynamically forced. OLR anomalies does not propagate in phase with the meridional wind at 800hPa. Anomalies of precipitation seem to be localised in the trough.