P39 A numerical study of precipitation processes in the southeast region of Saudi Arabia during summer 2009

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During the summer of 2009, an extensive field campaign was carried out in southwest Saudi Arabia, a region of complex terrain with contrasting dry continental flow from the high altitude desert escarpment and maritime flow from the Red Sea. Both dynamic fields and microphysical measurements were collected along with observations from the Abha radar, located on the plateau in southwestern Saudi Arabia that serves as the center of the study area. These intensive airborne measurements are crucial not only for cloud microphysics scheme initialization and validation but also for precipitation mechanism diagnoses. This study, using the Weather Research and Forecasting (WRF) model with various microphysics schemes, diagnoses the physical processes leading to precipitation and examines the cloud properties under complex thermodynamics conditions. Two ideal cases have been simulated by WRF model version 3.4.1 using the Thompson microphysics scheme. The control simulations are driven by Abha rawinsoundings on 11 August 2009 at 0000 UTC and 1200 UTC. The model-simulated soundings show good agreements with the observed soundings, capturing the moist cloud layer near 450 hPa. The control simulations also reproduced the observed hydrometeors including cloud water mixing ratio and rain droplet number concentration. Compared with the observed cloud microphysical properties measured from cloud-penetration by aircraft, the control simulations also captured the time and location of the convective cloud life cycle along the escarpment around 1200 UTC. The good performances of the control simulations encourage us to continue conducting further sensitivity experiments to test the dynamical effects of the dry mid-air intrusion and the microphysical role of aerosol/nuclei distribution in precipitation formation and maintenance.