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How a dusty cold pool can change the diurnal evolution of the Saharan Atmospheric Boundary Layer

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The Saharan Atmospheric Boundary Layer (SABL) structure, dynamics, thermodynamics and composition over the Central Sahara, associated with several concomittant dust lifting processes observed/modelled on 21 June 2011, in the framework of the FENNEC 2011 Special Observing period, are analysed. The aerosol optical depth on that day was in excess of 3.

On the morning of June 21, dust lifting occurred at the passing of the African Easterly Waves over Mauritania with dust being raised by cold-pools issued from convective systems having developped the previous day. Behind this wave, the harmattan flow was channeled between the Hoggar and the Atlas and also generated dust. The dust production was amplified when this flow experienced further constriction between dusty density currents flowing down the Atlas slopes and an intense monsoon pulse from the west of the Hoggar also generating much dust. Two aircraft (the SAFIRE Falcon and the FAAM BAe 146)operated over Mauritania and Mali on that day enabled to document the complex interactions between the monsoon flow, the intertropical front, the density currents from the Atlas, in the SABL. AROME operational simulations werealso used to analyse how the different air masses have interacted to form the observed complex multi-layer dust structure in the SABL.

Afternoon Falcon 20 and BAe 146 flights sampled the growth of the SABL. A clear influence of the cold pool and the dusty layers above can be observed on the developpement of the boundary layer.

Finally, two AROME simulations (one with and one without prognostic dust) were used to investigate the influence of the complex dust layers on the dynamics/thermodynamics of the developping convective boundary layer over the Central Sahara.