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The impact of a gavity current to the north of the inter-tropical discontinuity region

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The impact of a convective system downdraught and associated gravity current on the monsoon and harmattan flow structure as well as on aerosol vertical distribution over the Sahel and the Sahara is investigated by means of dropsondes and an airborne lidar. Complementary ground-based and satellite observations, as well as ECMWF analyses are also used. The missions were conducted on 5 and 6 June 2006, in the framework of the African Monsoon Multidisciplinary Analysis (AMMA) Special Observing Period. The targeted area was the Saharan heat low region, and Mali in particular, over which the inter-tropical discontinuity (ITD) was strongly perturbated by the convective system from which emanated a northward propagating gravity current in the morning of 5 June. On 5 June, to the north, away from the influence of the gravity current, the atmosphere exhibited a two-layer structure, with a well mixed 3 km deep internal boundary layer (IBL) capped by a stable layer 2-2.5 km deep layer refered to as the Saharan aerosol layer (SAL). The aerosol loading in the IBL (as determined by lidar) was observed to be much less than in the SAL aloft. Plumes of dust generated by strong low level winds west of the Hoggar as observed in Spinning Enhanced Visible and Infra-Red Imager (SEVIRI) images, and possibly injected in the upper SAL through orographic lifting, contributed to the dust loading of the elevated SAL over much of the domain observed by the lidar. In the northernmost part of the domain investigated, the depth of the SAL top was decreased as the result of subsidence enhanced by the presence of an elevated jet associated with the monsoon trough and/or related to the

return circulation of plain-mountain wind system involving the Atlas range. Associated with the gravity current passing over dust sources, a large aerosol plume was observed by means of lidar measurements and SEVIRI imagery. The plume was seen to reach heights of approximately 3 km above ground level a few tens of kilometres behind the leading edge. Lidar measurements suggest that a fraction of the dust lofted by the gravity current is mixed into the SAL, and in some instances injected above the SAL. On 6 June, the influence of the gravity current (cooling and moistening of the IBL, as well as increased aerosol load in this layer) was observed using dropsondes and airborne lidar measurements more than 300 km further north than on 5 June.