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A newly identified mechanism for dust emissions over the Sahel associated with the West African Monsoon inter-tropical discontinuity region.

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Near dawn airborne lidar and dropsonde observations acquired on 7 July 2006, during the African Monsoon Multidisciplinary Analysis (AMMA) Special Observing Period 2a1, were used to investigate dust mobilisation, lifting and transport in the inter-tropical discontinuity (ITD) region over western Niger. Atmospheric reflectivity data from the LEANDRE 2 lidar system enabled us to analyse the structure of dust plumes in the context of wind and thermodynamic information provided by the WIND lidar system and dropsondes.

The synoptic situation as well as the dust load over West Africa this day are illustrated using respectively the European Centre for Medium-range Weather Forcasts (ECMWF) analyses and the Meteosat Second Generation (MSG) Spinning Enhanced Visible and Infra-Red Imager (SEVERI) images produced from a combination of three infrared channels, namely channel 10 (12μm), channel 9 (10.8 μm) and channel 7 (8.7μm).

Dust mobilisation was mainly observed in two locations: (a) Within the monsoon flow as the result of the passage of a density current issued from a mesoscale convective

system over southwest Niger. (b) At the leading edge of the monsoon flow where the near-surface winds and turbulence were strong, because the monsoon flow was behaving as an intrusive density current.

The circulation in the head of the monsoon density current lifted the mobilized dust towards the wake, along an isentropic surface. Away from the leading edge, some of the mobilized dust was observed to mix across the monsoon-harmattan interface, due to the existence of mechanical shear above the monsoon layer, and to become available for long-range transport by the harmattan.

Because dust sources are widespread over the Sahel and presumably active on many days when the ITD is located in this region during summer, dust emissions associated with the described mechanism may influence the radiation budget over West Africa.