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Saharan dust lofting by Haramattan and monsoon flows convergence: Numerical Modelling and Lidar observations.

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The convergence line between monsoon and harmattan flows constitutes an interface which is called Intertropical Discontinuity (ITD). It represents the boundary between dry, hot air to the north and warm, humid air to the south, as these winds converge, dry and moist air are forced upward. It is an area of low pressure closely linked to other structures such as the Heat low, the African Easterly Jet, the Intertropical Convergence Zone and the African easterly waves.

The ITD tracking the sun's movement forms a wave-shaped pattern stretching east to west across the continent. Although, atmospheric conditions can speed or delay the progress of the line, so its location is not exactly the same from year to year, the latitudinal displacements of the ITD, were associated to pressure changes in the harmattan and the monsoon air masses on both sides of it. The ITD can give rise to very violent disturbances as squall lines, with storms and strong wind gusts, but also large dust lofting events.

In this presentation, the ITD structure and dynamics, and the mechanisms of the key

processes associated with the Saharan dust lofting, are analysed by means of numerical simulations using the MesoNH model, Lidar observations and dropsondes measurements. MesoNH is a regional model initialized by and nudged with ECMWF analyses, including a prognostic dust scheme allowing feedback studies between dynamics and radiation ***[Grini et al., 2006],*** and a dust emission box model, the Dust Entrainment And Deposition (DEAD) model ***[Zender et al., 2003]*** which is implemented as a component of the MesoNH. DEAD describes dust sources and sinks while dust advection and diffusion are quantified by the transport processes and methods used in the host model.

A series of simulations over ten days -between 2 and 12 of July 2006- was carried out, on a 2000 km^2 domain (20-km horizontal resolution) centered at 20˚N and 7˚E, 62 levels were used on the vertical resolution starting at 30 m above the ground.

Lidar observations and dropsondes measurements were carried out during the AMMA Special Observing Periods (SOPs) which took place in summer 2006, respectively by means of an airborne lidar –the differential absorption lidar LEANDRE 2 system and the AVAPS 4-channel dropsonde system onboard the SAFIRE Falcon 20- between 3 and 10 july 2006 over northern Niger.

Large dust uptakes were observed to be associated with the leading edge of the monsoon flow and to be transported southward above the monsoon flow during the 3 days of flight, with a dust concentration reaching 2000μg/m3, particularly, a dust uptake event was caused by the monsoon flow on July 7, 2006, while harmattan flow was at the origin of the dust uptakes events observed the 3 and 10 of July 2006.

Dust storms were illustrated with the aid of MesoNH horizontal and vertical fields which allowed us to follow the life cycle of these dust storms and their relations to the intertropical front, harmattan and monsoon dynamics and structure which were analyzed by dropsondes measurements.