Saharan dust intrusion monitoring. Part 1: Detection, identification and vertical structure analysis

Carmen Córdoba-Jabonero (1); Mar Sorribas (1); Juan Luis Guerrero-Rascado (2)*; José Antonio Adame (1); Yballa Hernández (3); Hassam Lyamani (2); Victoria Cachorro (4); Manuel Gil (1); Lucas Alados-Arboledas (2); Emilio Cuevas (3); Benito de la Morena (1)

(1) Instituto Nacional de Técnica Aeroespacial (INTA), Atmospheric Research and Instrumentation Branch, Torrejón de Ardoz (Madrid), Spain; (2) Universidad de Granada (UGR), Andalusian Environmental Centre (CEAMA), Group of Atmospheric Physics, Granada, Spain; (3) Agencia Estatal de Meteorología (AEMET), Atmospheric Research Centre of Izaña, Sta. Cruz de Tenerife, Spain; (4) Universidad de Valladolid (UVA), Group of Atmospheric Optics, Valladolid, Spain; *Now at Évora Geophysics Centre (CGE), University of Évora, Évora, Portugal

ABSTRACT

A general work focused on the study of Saharan dust intrusions is presented as a case study of air masses advected from the Saharan region to the Canary Islands and the Iberian Peninsula (IP). This work is divided in two parts in order to examine two relevant and different aspects of this study. Each one is separately submitted. This first one (Part 1) describes the dust detection, identification and vertical structure analysis by using AERONET data, lidar measurements and backtrajectory modelling. In the Part 2 the evaluation of potential dust impact on surface once that Saharan dust intrusion arrives at the Southern IP will be presented.

The observations were performed over three Spanish geographically strategic stations within the dust-influenced area along a common dust plume pathway monitored from 11 to 19 of March 2008. A 4-day long dust event (13-16 March) over the Santa Cruz de Tenerife Observatory (SCO), and a linked short 1-day dust episode (14 March) in the Southern IP over the Atmospheric Sounding Station 'El Arenosillo' (ARN) and the Granada station (GRA) were detected.

Meteorological conditions favoured the dust plume transport over the area under study. Backtrajectory analysis clearly revealed the Saharan region as the source of the dust intrusion. Under the Saharan air masses influence, AERONET Aerosol Optical Depth at 500 nm (AOD^{500}) ranged from 0.3 to 0.6 and Ångström Exponent at 440/675 nm wavelength pair ($AE^{440/675}$) was lower than 0.5, indicating a high load and predominance of coarse particles during those dusty events. Lidar observations characterized the vertical structure of those dust plumes, identifying different aerosol contributions depending on altitude. In particular, the 3-km height dust layer transported from the Saharan region and observed over SCO site was later on detected at ARN and GRA stations. No significant differences were found in the lidar (extinction-to-backscatter) ratio (LR) for dust particles over all stations. LR ranged from 60 sr to 70 sr during the main dust episodes. However, AERONET retrieved LR values for dust particles are underestimated, unless a dust more realistic model is used instead in the AERONET inversion algorithm (Müller et al., 2010). These similar LR values found in all the stations suggest that dust properties were kept nearly unchanged in the course of its medium-range transport.

REFERENCES

Müller et al., J. Geophys. Res. 115, D11207, doi:10.1029/2009JD012523, 2010.