Saharan Air Layer (SAL) over Tenerife: Summertime statistic analysis from lidar measurements

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The vertical distribution of dust is a key parameter on aerosol-ozone-UV interactions (i.e., Bonasoni et al., 2004) for atmospheric radiative forcing assessment and climate-related studies (IPCC, 2007). Despite of a great attention has been paid in last years to the aerosols in a climate-related studies (IPCC, 2007), the vertical distribution of dust is also required in other frameworks as for aerosol forecast modeling (i.e., Pérez et al., 2006) and satellite data validation (i.e., Pappalardo et al., 2010).

Canary Islands offer the most promising site as located downwind of the Saharan outbreaks sources for dust monitoring. The arrival of dust plumes to that area is a common feature, more frequently observed in summertime and extended up to high altitudes, resulting from strong convective activity over the Sahara desert under favorable meteorological conditions. The vertical characterization of individual dust events is significant for the determination of the so-called Saharan Air Layer (SAL), identified as a mass of warm, dusty and dry air which forms over the Sahara desert, in order to evaluate the climate impact of such phenomena, even at local scales.

In general, the synergy between lidar and sunphotometry observations is also widely used for dust research (i.e., Müller et al., 2003; Mona et al., 2006; Papayannis et al., 2008; Córdoba-Jabonero et al., 2011). Since 2005 height-resolved measurements are routinely performed at the AEMET/Santa Cruz de Tenerife subtropical station (SCO, 28.5°N 16.2°W, 52 m a.s.l.) by using a Micro Pulse Lidar v. 3 (MPL-3) within the NASA/MPLNET (Micro Pulse Lidar NETwork) site. SCO is also an AERONET (Aerosol Robotic NETwork) site.

In this work we present the statistical results of the SAL characterization in summertime over SCO from routine lidar measurements. This study focuses on vertical features (single/multi-layered structure, top height, among others) of the dusty episodes, in addition to other optical properties (Free-Tropospheric dust contribution to the total AOD, Lidar Ratio frequency, etc.). Air masses backtrajectory analysis completes this study. For instance, the SAL is examined for a strong dust intrusion occurring on 21 July 2009 over SCO (see Figure 1). Extinction coefficients are retrieved considering a pure dust scenario (Córdoba-Jabonero et al., 2010) and a Lidar Ratio of 55 sr is found. In this case, daily SAL top is ranging between 5.3 and 5.7 km, and a FT dust contribution of 88.3% is calculated.

This summertime statistic analysis represents a relevant advance on SAL characterization in aerosol stations fairly close to dust emissions. Moreover, these results can be directly applied to the evaluation of the ozone vertical depletion observed under Saharan dust events (Andrey et al., 2010) and the changes experienced by minor halogen species involved in ozone chemistry.

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Figure 1. Dust extinction coefficients on 21 July 2009, for instance, over SCO site.