

Planetary Boundary Layer and Saharan Air Layer top height determination using Ceilometer and Micro Pulse Lidar. Intercomparison for two case studies.

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Top heights of the Planetary Boundary Layer (PBL) and the Saharan Air Layer (SAL) during two Saharan dust events were compared by using both a Vaisala ceilometer CL51 (CL51; 910 nm) and a Micro Pulse Lidar (MPL; 523 nm) in Tenerife, Canary Islands.

Ceilometers were originally conceived for both cloud and PBL height detection, but not specifically to measure the dust layer. However, a previous study showed that the CL51 is capable of detecting mineral dust within the SAL (Hernández *et al.*, 2011). That study was carried out in the Canary Islands in winter when Saharan dust intrusions occur within the Marine Boundary Layer, MBL, (Viana *et al.*, 2002; Alonso-Pérez, 2008), with both the CL51 and the MPL located at the Santa Cruz Observatory (SCO; 28.5° N, 16.2° W, 52 m a.s.l.) a background urban station located in the metropolitan area of Santa Cruz de Tenerife that belongs to Izaña Atmospheric Research Centre.

Two case studies are presented in this work.

From 14 October to 24 November 2011, the CL51 was installed at Izaña Observatory (IZO; 28.3° N, 16.5° W, 2373 m a.s.l.), which is representative of the free troposphere, and the MPL was located at SCO, within the MBL. In this period, an exceptional episode of Saharan dust intrusion at high altitude occurring from 15 to 17 October, 2011 was studied.

During the second period of the inter-comparison, both instruments have been located at SCO within the MBL. Our second case study is the Saharan dust episode occurred in December 5-11, 2011.

The PBL and SAL heights were determined using the gradient method. The PBL and SAL correspond respectively, to the first and subsequent measurable minima of the derivative of the CL51 and MPL backscatter signals. Also, we have developed a methodology for determining the SAL heights using relative humidity (RH) and temperature vertical profiles from radiosoundings.

Our results have been analysed using ancillary information: 1) analysis of airmass origin reaching the site, performed using both HYSPLIT 4 and ECMWF backtrajectories; 2) simulations of vertical profiles of dust concentrations using the BSC-DREAM8b dust model; 3) vertical profiles of temperature, RH and wind direction from radiosonde and ozonsonde stations, at

Güímar and Jardín Botánico respectively, both in Tenerife 4) aerosol optical depth from Izaña and Santa Cruz de Tenerife AERONET stations; 5) Moderate Resolution Imaging Spectroradiometer (MODIS) and Meteorological Second Generation (MSG) satellite imagery 6) ECMWF and the non-hydrostatic mesoscale meteorological MM5 models and 7) heights of PBL and aerosol layers and extinction coefficient measured at SCO provided by the Micro Pulse Lidar Network (MPLNET).

We have found a good agreement between the Vaisala CL51 ceilometer and the MPL in the determination of the PBL and SAL heights, noting that in winter season is more challenging for the MPL to detect dust layers because they travel at lower altitudes. The SAL heights determined by RH and temperature vertical profiles are also in good agreement with the results obtained by CL51 and MPL.

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