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Lidar and radiometric measurements at Granada (Spain)

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Monitoring the vertical aerosol distribution is a basic requirement for the climate research due its influence on atmospheric radiative transfer. LIDAR is the only instrument that can efficiently and continuously measure the vertical distribution of the aerosols into the atmosphere with a high vertical resolution.

This work presents some preliminary results of the LIDAR system operated at the Andalusian Center for Enviromental Studies (CEAMA). This LIDAR system located in South-eastern Spain has been set up in an urban environment of Granada, a non-industrialised medium size city (37.18ºN, 3.58ºW and 680 m a.m.s.l.). The LIDAR system is based on a Nd:YAG laser source with a repetition rate up to 10 Hz and equipped with second and third harmonic generator. The radiation is transmitted into the atmosphere at 1064, 532 y 355 nm. The radiation backscattered is collected in four elastic channels (1064, 532 polarized, 532 non-polarized and 355 nm) and two inelastic channels so-called Raman channels (387 and 408 nm). The system has been employed to measure vertical profiles of different atmospherics properties under daytime and nighttime conditions.

In this work the LIDAR data are presented and analysed in synergy with aerosol optical depth measurements obtained by a CIMEL radiometer. This instrument provides solar extinction and diffuse sky radiance measurements. Solar transmission measurements are performed at 340, 380, 440, 670, 870, 940 and 1020. Sky measurements are performed at 440 nm, 670 nm, 870 nm, and 1020 nm by means of almucantar and principal plane observations. The measured aerosol optical depth was derived from the total optical depth using the appropriate calibration constant and subtracting the

Rayleigh optical depth and O_3 and NO_2 absorption optical depths. The sky radiances and aerosol optical depth measurements were inverted to carry out columnar optical properties of the aerosol like aerosol phase functions, asymmetry parameters and single scattering albedo applying spherical and non-spherical algorithms.

A synergetic approach has been used, not only to validate the LIDAR data, but also to derive a typical value of the so-called extinction-to-backscatter ratio (LIDAR ratio). To derive the appropriate "correct" values of the vertical profile of aerosol backscatter coefficient in the lower troposphere we used an iterative inversion approach (by "tuning" the LR values) based on the inter-comparison of the AOT values derived by LIDAR and CIMEL data, assuming the absence of stratospheric aerosols and that the PBL is homogeneously mixed between ground and the height where the LIDAR overlap factor is close to 1. On the other hand, the LR obtained from the aerosol optical properties derived from the CIMEL inversion were also computed.