Determination of aerosol size and microphysical properties based on multi-wavelength raman lidar measurements in the framework of HyMeX-SOP1

Benedetto De Rosa¹, Paolo Di Girolamo¹, and Donato Summa²

¹Unibas, Dipartimento di Ingegneria, Potenza, Italy (bundit@hotmail.it)
²CNR IMAA-Istituto di Metodologie per l’Analisi Ambientale

Tropospheric aerosols are a fundamental component of the Earth’s radiation budget. In order to properly estimate their direct and indirect effect, accurate measurements of aerosol size and microphysical properties are required. A limited number of techniques are presently available and capable to provide these measurements.

Multi-wavelength Raman lidars have strong potential. However, their effectiveness and reliability of need to be assessed and verified against independent measurements.

This abstract reports measurements that were carried out by the Raman lidar system BASIL in the frame of the Hydrological Cycle in the Mediterranean Experiment – Special Observation Period 1 (HyMeX-SOP1). The considered dataset represents a good opportunity to verify the quality of retrievals in terms of size and microphysical properties obtained from multi-wavelength Raman lidars.

A specific case study was selected revealing the presence of variable aerosol properties at different altitudes. Specifically, Raman lidar measurements on 02 October 2012 show the presence of two distinct aerosol layers, a lower one extending up to ~3 km and an upper one extending from 3.5 km to 4.7 km. Aerosol and size microphysical properties are determined from multi-wavelength measurements of particle backscattering and extinction profiles based on the application of a retrieval scheme which employs Tikhonov’s inversion with regularization. Inversion results suggest a size distribution with the presence, in both the lower and upper aerosol layer, of two particle modes (a fine mode, with a radius of ~0.2 mm, and a coarse mode, with radii in the range 2-4 mm), volume concentration values of 2-4 mm³cm⁻³ and effective radii in the range 0.2-0.6 mm.

This effort benefited from the dedicated flights of the French research aircraft ATR42, equipped with a variety of in situ sensors for measuring aerosol/cloud size and microphysical properties. Aerosol size and microphysical properties retrieved from multi-wavelength Raman lidar measurements were compared with simultaneous and co-located in-situ measurements.