Lidar measurements performed on 22 days of the years 2011–2014 were analyzed by using the constrained iterative inversion (CII) procedure and a graphical framework (GF) at a coastal site of southeastern Italy with the main goal of typing aerosols. More specifically, backscatter lidar measurements at 355, 532, and 1064 nm combined with aerosol optical thicknesses (AOTs) from sun photometer measurements collocated in space and time were used to retrieve the vertical profiles of intensive and extensive aerosol parameters.

Then, the vertical profiles of the Ångström coefficients for different wavelength pairs (\(\overline{A}(\lambda_1, \lambda_2, z)\)), the color ratio (CR(z)), the fine mode fraction (g(z)) at 532 nm, and the fine modal radius \((R_d(z))\), which represent aerosol characteristic properties independent from the aerosol load, were used for typing the aerosol over the Central Mediterranean. The ability of the Ångström coefficients to identify the main aerosol types affecting the Central Mediterranean with the support of the backward trajectory analysis was first demonstrated.

The used ground-based LIDAR system, identified as UNILE (University of Lecce) lidar, operates at the Mathematics and Physics Department of the Salento University (Lecce, 40.33°N; 18.11°E, 30 m above the sea level) within EARLINET, since May 2000. It is nowadays composed by a 30 Hz Nd:YAG laser operating at its fundamental wavelength, 1064 nm, and the second and third harmonics at 532 and 355 nm, respectively.

**Study Case : Results from the CII-GF Procedure for the LIDAR Measurements of July 8, 2013**

### Clustering of lidar measurements by \(\overline{A}(352, 1064, z)\) values and identification of different aerosol clusters

**Main properties of DP, MP, and CP aerosols**

### Four-day HYSPLIT back trajectories and GFs for the lidar measurements associated with cluster C1, C2, and C3, respectively.

- **Main RESULTS:**
  - Three main aerosol types, which were designed as continental-polluted (CP), marine-polluted (MP), and desert-polluted (DP), were identified and both the variability range and the vertical profile structure of the tested aerosol intensive parameters varied with the aerosol type.
  - The variability range and the altitude dependence of the aerosol extinction coefficients at 355, 532, and 1064 nm, respectively, also varied with the identified aerosol types, even if they are extensive aerosol parameters.

- **Mean vertical profiles of the \(\overline{A}(z)\) values associated with the DP aerosol were on average smaller than 0.4 within 2–4 km agl: the height range where dust particles are commonly located over the Central Mediterranean, during Saharan dust outbreaks. The \(\overline{A}\) values of MP and CP aerosols on average increased with the altitude for the increase with \(z\) of the small size particle contribution.**

- **The vertical profiles of the fine mode radius varied weakly with \(z\). In particular, the \(R_d(z)\) values associated with the MP and CP aerosol decreased slowly with \(z\) and on an average were smaller than the ones associated with the DP aerosol.**

- **The vertical profiles of the fine mode fraction were on average weakly dependent on altitude, but strongly dependent on the aerosol type.**

- **The color ratio vertical profiles were also weakly dependent on altitude. However, they showed large difference for the DP aerosol, while their values were rather similar for the MP and CP aerosol, in satisfactory accordance with previous studies.**