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Three-dimensional distribution of Mount Etna's emissions during the EPL-REFLECT campaign in July 2019

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Mount Etna (Italy) is the most high-impact volcanoes on Mediterranean scale mainly due to its eruptive activity and continuous passive degassing, and the inherent large amount of effluents released into the atmosphere. Mount Etna's emission mainly originate from the summit craters at an altitude of about 3300 m, feeding frequently volcanic gases and aerosols into the free troposphere. Consequently, their effects on the atmosphere and regional climate system span over relatively long spatiotemporal scales.

In order to better understand the role that Mount Etna's emissions play on the atmospheric composition and radiative balance in the Mediterranean area, multidisciplinary and multi-scale studies have been carried out since a few years within the different phases of the EtnaPlumeLab (EPL) research cluster. A part of the EPL effort is based on dedicated field campaigns, that aim at the characterization of volcanic sources emissions and nears-source plume dispersion and evolution.

In this work, we investigate the three-dimensional (3D) distribution of the volcanic aerosols from Mount Etna observed during the most recent EPL field campaign, named EPL-REFLECT (near-source estimations of Radiative EFfects of voLcanic aErosols for Climate and air quality sTudies) carried out within the Transnational Access component of the EUROVOLC project. This field campaign completes the previous EPL-RADIO (Radioactive Aerosols and other source parameters for better atmospheric Dispersion and Impact estimatiOns) campaign. Here we discuss the observations of a multiparametric LiDAR system AMPLE. The LiDAR is equipped with a fast scanning, double depolarization (at 532 and 355 nm) and high repetition laser source (1kHz), which is an essential point to derive time series of 3D-resolved aerosol properties near Etna. During the 8-12th of July 2019 period, day/night LiDAR measurements were performed by AMPLE from the astronomical observatory of the INAF-Catania in the location of Serra la Nave at 1725 m a.s.l., pointing towards the summit of Mount Etna. In particular, on the July 11th, the scan was performed with time-steps of 15 minutes at different angles from the top of the volcano to the zenith. These

acquisitions highlight the atmospheric evolution of two layers related to two distinct degassing episodes. A comparative analysis with wind speed information and the integration with complementary photometric ground measurements have further constrained this 3D characterization and the evolution of these layers, including those outside the LiDAR field of view.