EGU21-12380
https://doi.org/10.5194/egusphere-egu21-12380
EGU General Assembly 2021

The observation of different aerosols types in the Mount Etna environment and their relative and mutual impacts on local radiative balance

Pasquale Sellitto[1], Giuseppe Salerno[2], Simona Scollo[2], Alcide Giorgio di Sarra[3], Antonella Boselli[4], Giuseppe Leto[5], Ricardo Zanmar Sanchez[5], Alessia Sannino[6], Tommaso Caltabiano[2], Salvatore Giammanco[2], Francesco Monteleone[3], Giandomenico Pace[3], Chiara Giorio[7], Suzanne Crumeyrolle[8], and Bernard Legras[9]

[1]Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA-IPSL), Université Paris-Est Créteil (UPEC), Créteil, France (pasquale.sellitto@lisa.ipsl.fr)
[2]Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo, Catania, Italy
[3]ENEA SSPT-PROTER-OEM, Rome, Italy
[4]Consiglio Nazionale delle Ricerche, Istituto di Metodologie per l'Analisi Ambientale, CNR-IMAA, Tito Scalo, Italy
[5]Istituto Nazionale di Astrofisica—Osservatorio Astrofisico di Catania, Catania, Italy
[6]Dipartimento di Fisica—Università degli studi di Napoli "Federico II", Naples, Italy
[7]Yusuf Hamied Department of Chemistry, University of Cambridge, Cambridge, UK
[8]Laboratoire d'Optique Atmosphérique (LOA), Université de Lille, Lille, France
[9]Laboratoire de Météorologie Dynamique (LMD), Ecole Normale Supérieure, Paris, France

The EPL-RADIO (Etna Plume Lab - Radioactive Aerosols and other source parameters for better atmospheric Dispersion and Impact estimatiOns) and EPL-REFLECT (near-source estimations of Radiative EFfects of voLcanic aErosols for Climate and air quality sTudies) projects, funded by the EC Horizon2020 ENVRIplus and EUROVOLC Transnational Access to European Observatories programmes, aim to advance the understanding of Mount Etna as a persistent source of atmospheric aerosols and its impact on the radiative budget at proximal to regional spatial scales. Research was tackled by carrying out three campaigns in the summers of 2016, 2017 and 2019 to observe the volcanic plume produced by passive degassing, proximally and distally from the summit craters, using a wide array of remote sensing and in situ instruments. Diverse data are collected to explore the link of inner degassing mechanisms to the characterisation of near-source aerosol physicochemical properties and subsequent impacts on the atmosphere, environment and regional climate system.

The results of the three campaigns have shown that the volcanic plume emitted by Mount Etna often mixes with aerosols of different origins generating a complex layered pattern. Frequent mineral dust transport events were observed by both LiDAR observations located at Serra La Nave (~7 km south-west from summit craters) and at a medium-term radiometric station, equipped with a Multi-Filter Rotating Shadowband Radiometer (MFRSR), and other instruments located at Milo (~10 km eastwards from the craters). LiDAR observations also allowed to study the coexistence of

volcanic aerosols and biomass burning particles from local to more distal smoke plumes transports (like for the well-documented large fires from continental southern Italy in July 2017). In situ filter and optical particles counter measurements confirmed the presence of dust at Milo. The interaction/mixing among volcanic, wildfire, and dust aerosols occurs in an overall dynamical regime which appears to be dominated by sea breeze, which is strengthened by the presence of the dark volcanic lava flanks. Photolysis process also possibly play a role in determining the daily evolution of the aerosol plume.

The sources of these different aerosol types are studied in detail using Lagrangian trajectories and meteorological data. Off-line radiative transfer calculations, using EPL-RADIO/REFLECT observations as input data, are used to estimate the relative radiative impact of the different aerosol types with respect to the background passive-degassing aerosols coming from Mount Etna.