



HAL
open science

Small-scale volcanic aerosols variability, processes and direct radiative impact at Mount Etna during the EPL-RADIO/REFLECT campaigns

Pasquale Sellitto, Giuseppe Salerno, Alessandro La Spina, Tommaso Caltabiano, Simona Scollo, Antonella Boselli, Giuseppe Leto, Ricardo Zanmar Sanchez, Alessia Sannino, Suzanne Crumeyrolle, et al.

► To cite this version:

Pasquale Sellitto, Giuseppe Salerno, Alessandro La Spina, Tommaso Caltabiano, Simona Scollo, et al.. Small-scale volcanic aerosols variability, processes and direct radiative impact at Mount Etna during the EPL-RADIO/REFLECT campaigns. EGU General Assembly 2020, May 2020, Vienne, Austria. <10.5194/egusphere-egu2020-8337>. <insu-02891851>

HAL Id: insu-02891851

<https://insu.hal.science/insu-02891851v1>

Submitted on 7 Feb 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License

EGU2020-8337

<https://doi.org/10.5194/egusphere-egu2020-8337>

EGU General Assembly 2020

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Small-scale volcanic aerosols variability, processes and direct radiative impact at Mount Etna during the EPL-RADIO/REFLECT campaigns

Pasquale Sellitto¹, Giuseppe Salerno², Alessandro La Spina², Tommaso Caltabiano², Simona Scollo², Antonella Boselli³, Giuseppe Leto⁴, Ricardo Zanmar Sanchez⁴, Alessia Sannino⁵, Suzanne Crumeyrolle⁶, Benjamin Hanoune⁷, Chiara Giorio⁸, Salvatore Giammanco², Tjarda Roberts⁹, Alcide di Sarra¹⁰, Bernard Legras¹¹, and Pierre Briole¹²

¹Laboratoire Interuniversitaire des Systèmes Atmosphériques, Université Paris-Est Créteil, France (pasquale.sellitto@lisa.u-pec.fr)

²Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo, Catania, Italy

³Consiglio Nazionale delle Ricerche, Istituto di Metodologie per l'Analisi Ambientale, Tito Scalo (Potenza), Italy

⁴Istituto Nazionale di Astrofisica, INAF Osservatorio Astrofisico di Catania, Catania, Italy

⁵Dipartimento di Fisica, Università degli Studi di Napoli Federico II, Naples, Italy

⁶Université de Lille, UMR CNRS 8518 - LOA - Laboratoire d'Optique Atmosphérique, Lille, France

⁷Université de Lille, UMR CNRS 8522 - PC2A - Physico-Chimie des Processus de Combustion et de l'Atmosphère, Lille, France

⁸Dipartimento di Scienze Chimiche, Università degli Studi di Padova, Padua, Italy

⁹Laboratoire de Physique et Chimie de l'Environnement et de l'Espace - LPCEE, UMR 7328, CNRS-Université d'Orléans, Orléans, France

¹⁰ENEA, Laboratory for Observations and Analyses of the Earth and Climate (SSPT-PROTER-OAC), Rome, Italy

¹¹Laboratoire de Météorologie Dynamique - LMD, UMR CNRS 8539, École Normale Supérieure, Institut Pierre Simon Laplace, Paris, France

¹²Laboratoire de Géologie, École Normale Supérieure, Paris, France

The aerosol properties of Mount Etna's passive degassing plume and its short-term processes and radiative impact were studied in detail during the EPL-RADIO/REFLECT campaigns (summer 2016, 17 and 19), using a synergistic combination of remote-sensing and in situ observations, and radiative transfer modelling. Summit observations show extremely high particulate matter concentrations, with no evidence of secondary sulphate aerosols (SA) formation. Marked indications of secondary SA formation, i.e. by the conversion of volcanic SO₂ emissions, are found at larger spatial scales (<20 km downwind craters). Using portable photometers, the first mapping of small-scale spatial variability of the average size and burden of volcanic aerosols is obtained, as well as different longitudinal, perpendicular and vertical sections. A substantial variability of the plume properties is found at these spatial scales, revealing that processes (e.g. new particle formation and coarse aerosols sedimentation) are at play, which are not represented with current regional scale modelling and satellite observations. Vertical structures of typical passive degassing plumes are also obtained using observations from a fixed LiDAR station constrained with quasi-simultaneous photometric observations. These observations are used as input to radiative

transfer calculations, to obtain the shortwave top of the atmosphere (TOA) and surface radiative effects of the plume. Moreover, the radiative impact of Mount Etna's emissions is studied using a medium-term time series (a few months during summer 2019) of coupled aerosol optical properties and surface radiative flux at a fixed station on Etna's eastern flank. These are the first available estimations in the literature of the radiative impact of a passive degassing volcanic plume and are here critically discussed. Cases of co-existent volcanic aerosol layers and aerosols from other sources (Saharan dust transport events, wildfire from South Italy and marine aerosols) are also presented and discussed.