

The EPL-RADIO project co-funded by ENVRplus



In 2011, a Memorandum of Understanding was signed between the Geosciences Department of the École Normale Supérieure and the Etna Observatory (Italian National Institute of Geophysics and Volcanology), to facilitate exchanges in the fields of research and education.

In the last few years, various experiments were set up at Mt. Etna to analyse the properties of volcanic gasses and aerosols and their impact on the atmospheric chemistry and climate processes. These activities were conducted under the umbrella of a multidisciplinary research cluster called EtnaPlumeLab (EPL).

As a part of this cluster, ENVRplus partially funds the EPL-RADIO (EtnaPlumeLab-Radioactive Aerosols and other source parameters for better atmospheric Dispersion and Impact estimatiOns) project. This project aims at improving the characterisation of Mt. Etna as a source of atmospheric aerosols, targeting emission

Pasquale Sellitto is Assistant Professor at Geosciences Department of École Normale Supérieure (where he is Responsible of the third year B.Sc. programme) and Associate Research Scientist at Laboratoire de Météorologie Dynamique, Paris. His research activities are in the field of remote sensing and modeling of the atmospheric composition and atmospheric radiative transfer, with application to air quality and climate.

processes from inner degassing mechanisms to aerosol near-source characterisation. This project brings together a variety of innovative information, exploiting expertise from both atmospheric sciences and volcanology specialists. This information is derived from the observation of:

- a) radioactive disequilibria of radon daughters,
- b) coupled direct/remote size-resolved aerosols distribution and
- c) primary/secondary near-source sulfate aerosols partitioning.

The results relative to point a) will provide information on inner degassing dynamics. Those

regarding b) and c) will allow a detailed size-resolved physicochemical characterisation of the emitted aerosols to constrain the regional climatic impacts of Mt. Etna in the Mediterranean area. With regards to the latter, it should be mentioned that it has been recently demonstrated that Mt. Etna's emissions have the potential to significantly modulate the radiative transfer in the Mediterranean area, thus producing regional climate forcing, which greatly depends on the chemical and micro-physical characterisation of the emitted and produced (in-plume) aerosols.

Photo 1: Difficult access to the Etna's summit crater area with INGV 4x4. In the picture (from left to right): Pierre-Jean Gauthier, Senior Researcher at the Blaise Pascal University, Clermont-Ferrand; Luca Terray, student of the Geosciences Department of the ENS; Giuseppe Salerno, Senior Researcher at INGV.





In the context of EPL-RADIO, it is expected four campaigns will be conducted: two in the summer of 2016 (successfully carried out in June/July) and two in the summer of 2017. The volcanic aerosol source will be characterised by determining the size-resolved aerosol emissions, with cascade impactors and a Microtops-II optical spectrometer and the primary fraction of the emitted sulfate aerosols (with respect to the secondary sulfate aerosols produced by in-plume conversion of SO₂ emissions) by Fourier Transform Infra-Red spectroscopy. Complementary three-dimensional aerosols information will be obtained by means of a scanning AMPLE LiDAR (Aerosol Multi-wavelength Polarization Lidar Experiment - Light Detection And Ranging) system. The radioactivity characterisation of the plume will be identified through direct sampling, thanks to new instruments developed specifically for these campaigns. In one case, during

the 2016 campaign, all measurements (direct sampling at the craters, remote aerosols and gas observations at a medium-range distance – a few hundred of meters from the craters, LiDAR observations at Serra La Nave observatory – a few kilometers from the craters) were collected simultaneously, thus producing a unique synergistic dataset to gain insight into these volcanic and atmospheric processes. The 2016 campaign data is now being analysed in anticipation of a number of publications being submitted to scientific journals in the next coming months.

Photo 2: Walking through the plume at Mount Etna's summit (about 3500 m altitude). In the picture (from left to right): Pierre-Jean Gauthier, Senior Researcher at the Blaise Pascal University, Clermont-Ferrand; Luca Terray, student of the Geosciences Department of the ENS; Giuseppe Salerno, Senior Researcher at INGV; Alessandro La Spina, Researcher at INGV.



Photo 3: Collaboration and mutual help is crucial, at the extreme conditions of a volcano summit crater area. In the picture (from left to right): Luca Terray, student of the Geosciences Department of the ENS; Pierre-Jean Gauthier, Senior Researcher at the Blaise Pascal University, Clermont-Ferrand.



All photos have been taken by the emerging photo-reporter Andrea Miconi (www.andreamiconi.com), who participated at the expeditions of this year to document the campaigns.