PhD in AGRIFOOD AND ENVIRONMENTAL SCIENCES

CALL 2024 – CYCLE 40

Reserved scholarship:
J - Characterisation of atmospheric transport and ground deposition processes of volcanic emissions by means of WRF-Chem model simulations and assimilation of data from observations for the development of forecasting systems / Caratterizzazione dei processi di trasporto in atmosfera e deposito al suolo delle emissioni vulcaniche mediante simulazioni con modello WRF-Chem e assimilazione di dati da osservazioni finalizzata allo sviluppo di sistemi previsionali

Funding Body:
National Institute of Geophysics and Volcanology (INGV)

Supervisor 1: **Prof. Dino Zardi (UniTN)**

Supervisor 2: **Dr. Mauro Coltelli (INGV)**

Context / Synthetic description of the project and research outcome

The simulation and prediction of air quality in general, and volcanic plumes in particular, is a complex problem involving both meteorological factors and chemical processes. In the real atmosphere, physical and chemical processes are coupled. Chemistry can influence meteorological processes (e.g. interactions between aerosols and condensation nuclei) in clouds, and precipitation can greatly influence chemical transformations and removal processes, just as changes in wind and turbulence can influence transport. The simulation and prediction of these phenomena requires numerical models capable of solving the complex equations that govern these processes. Among the models capable of predicting the dispersion and transport of volcanic ash, WRF-Chem is undoubtedly the most flexible and the only one capable of coupling chemical-physical processes with the complex dynamics of the atmosphere,

In order to minimise the aeronautical risks due to the presence of ash in the atmosphere, a forecasting system based on the WRF-Chem model has been designed, developed and installed at the INGV's Etnean Observatory of Catania, for the prediction of atmospheric transport and ground deposition of volcanic ash.

The proposed project proposal consists in the study and implementation of the WRF meteorological model and its WRF-Chem extension, for the part concerning volcanic emissions, through the analysis of the interactions occurring between the atmospheric meteorological fields and the eruptive column, and the development of data assimilation techniques from Etna's instrumental monitoring network, in particular from Doppler radar and lidar ceilometers. The quality of the forecast produced by the model must subsequently be verified by means of statistical techniques and comparison with data recorded during the volcano's numerous recent explosive eruptions.