Abstract

Integration of multi-sensor data from satellite, airborne and ground-based sensors for point-wise gas emission sources in natural and urban environments

Environmental monitoring is one of the challenges of present times: climate change, volcanic emissions, pollution, impact of anthropogenic emissions on climate and air quality in urban environments. Monitoring atmosphere composition and air quality has never been so crucial to retrieve accurate and reliable proxies for understanding Earth's surface processes and anthropogenic impact on local climate.

From a scientific-technical point of view, there are open questions that need to be addressed in order to improve our capability to:

- Increase the accuracy of the quantitative estimates of gas fluxes from point-wise sources and height estimation along the vertical column;
- Correlate sparse measurements of gas emissions from in situ sensors that are quite precise but limited to a spatial sample with more distributed estimates across the whole extent of the emitting source that could be instead achieved from airborne and/or satellite measurements

To address the above challenges, we propose the integration of satellite observations and puntual measurements with ground sensors and/or avionic sensors given that, in the current practice and published literature, the majority of the existing approaches rely either on single-sensor data or, when more sensors are exploited, on time-limited observations (few days to few months). For volcanological applications, for instance, ground-sensor networks are often operated but, without drone-based surveys or satellite observations, gas flux quantification frequently do not include height estimation. In urban environments that encompass a multitude of emitting sources (either private or public, permanent or temporary), it is yet to be demonstrated how recurrent satellite observations can fully integrate with in situ measurement stations to achieve multi-scale quantitative assessment and, in turn, improvement of urban climate modeling.

Therefore, these will be the research lines that the present MSCA research proposal specifically aims to investigate and innovate compared to the existing state-of-the-art. To fully support this research activity, ASI will provide satellite data either from ASI's missions or Copernicus Programme, as well as development of in-situ sensors based on laser absorption spectroscopic sensors and lasers available at ASI's Geodesy Centre in Matera.

The expected impact of the proposed research is advancing methods for data analysis of spatial and time series of gas emissions and improving existing models for urban sustainability.