

The APOLLO (monitoring Atmospheric POLLution with Earth Observations) project: an integrated platform for air quality monitoring over Italy

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Abstract

Over the past half-century, scientists have learned much more about the causes and impacts of atmospheric pollution. Many nations have greatly reduced their emissions, but the problem is far from solved. In addition to threatening human health, air pollutants damage ecosystems, weaken Earth's stratospheric ozone shield, and contribute to global climate change. Understanding of pollutants is still evolving, but we have learned enough to design emission control policies that can limit their harmful effects.

At operational level, the ozone monitoring is currently mainly based on ground measurements networks. Though in several cases this is a meaningful step forward a widespread distribution of information on air quality, it suffers from important limitations. In fact, only a limited number of ground stations is available and a reliable coverage for extended areas is hard to be achieved. The use of EO data may have the potential to fulfil the requirement of a systematic and complete coverage of ozone concentration over large regions of interest.

The project presented in this paper is named APOLLO (monitoring Atmospheric POLLution with earth Observation) and aims at addressing the issue of air pollution monitoring over Italy, following the requirements of the Italian governmental institution ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale, Italian Ministry for the Environment and Protection of Land and Sea-Department for the Environmental Protection and Research). Its goal is the development of an integrated platform based on local ground measurements and EO data, capable to provide a national coverage and a full characterization of Tropospheric Ozone in Italy, both in metropolitan and in rural/remote areas. The kernel of the system is a new neural network technology for the processing of the satellite data provided by instruments for atmospheric monitoring such as SCIAMACHY and OMI. The retrieval approach relies on two separate phases. The first one concerns the algorithm design and gives as output the definition of the network parameters. The second phase deals with the implementation of the designed network in the operational processing chain which, once fed with the satellite measurements, delivers the Total Tropospheric Column information. Ozone ground measurements from the territorial network managed and controlled by ISPRA are integrated in the service to exploit the maximum information from both EO and local measurements. To this purpose appropriate procedures for spatialization of ground measurements have been designed. The project is active in the framework of the ESA Data User Element Innovators II programme (www.esa.int/due).