

## **Differential Optical Absorption Spectroscopy (DOAS): Ground-based and space-borne deployments devoted to environmental and climatic monitoring**

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This work presents DOAS as remote sensing technique for observations from the ground and from space and its implementation for environmental and climatic monitoring.

The interplay between natural and anthropogenic factors influencing the Earth's climate and climate change is extremely complex. The depth understanding of climate changes requires not only adequate policy actions, but appropriate tools for monitoring on a long-time scale the impact of these factors to achieve their reliable assessment. The evaluation of interference between anthropogenic activities and ongoing natural climate change appears key issue in attempt to assess the probability climate forcing factors to trigger irreversible processes threatening human life.

For this reason large extend of advanced satellite technologies implemented for observation of the Earth from space is foreseen during next years, requiring integration of the knowledge in various scientific fields. Climate Change Initiative of ESA is expected to complete synergy among the many space observation activities. Particular attention is devoted to the GMES Sentinel missions devoted to maintenance of systematic data set to be used as indicators of climate changes and their predictions through continuous monitoring of atmospheric chemistry, pollution, ozone content aerosols and other key atmospheric parameters.

Nevertheless the progress in the satellite technologies, the observations from the space need further improvements in order to provide data regarding near-surface pollution with accuracy required by national environmental agencies.

DOAS is one of remote sensing methods largely implemented during the last decades for atmospheric studies. Based on characteristic spectral absorption properties of atmospheric constituents, it allows retrieving of their concentration deploying Bouguer-Lambert-Beer law in differential form. Satellite data validation procedures are considered as an integral part of satellite DOAS observations. Different methods to perform validation: ground-based, airborne, balloon, etc. are described and discussed.

The results obtained during several field campaigns devoted to validation of SCIAMACHY and OMI instruments within EU or national projects are presented. A part of the work outlines specific problems of satellite and ground-based DOAS observations integration devoted to evaluation of air quality in Po valley (Italy) within QUITSAT project of Italian Space Agency. Regarding ground-based DOAS monitoring for climatic studies, we report results obtained from long-term DOAS measurements performed at "Otavvio Vittori" Mt.Cimone (Italy) and Stara Zagora (Bulgaria) stations.

Opportunities for future larger collaborations aimed to contribute for improvement of existing or developing of new repayable methods and algorithms allowing for reproducing of near-surface pollution from the space observations are discussed and welcome.