Assessment of Pollution Concentration and Emission Mapping at Regional and Local Scales Using New Generation Satellites in the Context of the GMES APMoSPHERE Project

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AbstractEarth observation by satellites gives new solutions in gathering spatial information on cities. The short repeat period of many satellites (often only a few days) and their broad geographic coverage offer an especially powerful tool for air pollution mapping and potentially valuable means of stratifying and linking ground-based measurements. The optical indicator for assessing atmospheric pollution load particularly in photochemical pollution conditions, and which is retrievable from EO data, is the aerosol optical thickness (AOT).This paper presents the potentiality of using Envisat MERIS observations for monitoring air pollution and obtaining AOT maps over the metropolitan area of Athens, Greece. It demonstrates methods of linking different ground-based and satellite-derived data sets and it aims to assess new technologies in the area of atmosphere monitoring and emission inventories, particularly in relation to aerosols and specific pollutants, in order to support EU air pollution and health policy.The Differential Textural Analysis (DTA) code was applied to the Envisat data. This code follows a common basic procedure consisting in a radiometric comparison of multi-temporal satellite data of the same area acquired by the same sensor and geometrically corrected, during different pollution conditions, allowing to assess variations of the magnitude of the optical atmospheric effects (OAE). The high correlation found between retrieved AOT values and PM10 ground-based measurements suggests that the application of the DTA algorithm on Envisat MERIS imagery could be used to provide accurate and reliable AOT maps depicting air quality information at least for the area of Athens. The accuracy of the method is however somehow limited by the moderate resolution of MERIS data. This could possibly be alleviated by the synergistic use of high spatial resolution imagery (e.g., SPOT).It becomes clear that the technique applied in this paper will not replace the conventional analytical methods in measuring physical-chemical atmospheric parameters. It can provide, instead, overall spatial information that complements the analytical measuring methods and enhances their reliability. The extension of the present-day monitoring network with new satellite observations will be important, given that emission inventories are characterised by large uncertainties. Still, in order to set up the AOT maps production on an operational basis, further work is expected on cross-validating the AOT extracted results with concurrent measurements from other EO sensors.