Monitoring of Particulate Matter in Northern Italy by using Satellite Remote Sensing Observations combined with Meteorological Modelling and in-situ Samplings

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Satellite remote sensing of aerosols and trace gas constituents is a well established technique which has been mainly applied to radiative forcing and climate studies. Over recent years growing attention has been paid to its potential application in the field of air quality and in particular to the possibility of monitoring surface Particulate Matter (PM) concentrations.

Actually the relationship between the aerosol optical depth (AOD) at 550 nm wavelength and surface PM concentrations has been subject to several investigations. Such a relationship between a measure of the columnar aerosol extinction in the visible and a concentration in-situ sampling is substantially influenced by the region, the season, as well as the vertical distribution profile and microphysical properties of the suspended aerosol polydispersion. On the basis of these remarks, a semi-empirical method has been developed to estimate PM2.5 concentration at ground level employing MODIS (Terra-Aqua/NASA platforms) aerosol optical properties. This approach fuses PM2.5 samplings at the ground, meteorological fields simulated by MM5 model, ground-based remote sensing measurements and MODIS aerosol optical depth to convert AOD into PM estimates. Thus, daily maps of satellite-based PM2.5 concentrations over Northern Italy were obtained. Comparison with daily PM2.5, sampled at six validation sites of the Po valley in summer 2007 and winter 2008, showed good agreement (presenting regression coefficient R $\sim$0.82 and R $\sim$0.77 for MODIS/Terra and MODIS/Aqua, respectively), with the satellite-based concentrations tending to underestimate the values by no more than $\sim$20%. Monthly averaged values were also compared finding a good agreement, with R $\sim$0.83 for each platform.

The results were carried out in the frame of the QUITSAT/ASI and PROMOTE/ESA projects, and encouraged us to continue in improving this methodology in the frame of EU 7th Framework MACC and PASODOBLE projects.