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Operational particle matter (PM 10) monitoring using MODIS satellite data in South Tirol, Italian Alps

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In this work we critical discuss the applicability of satellite based aerosol retrievals for operational particle matter (PM10) monitoring in mountain regions. In South Tirol, Italian Alps, the PM10 concentration is constantly monitored at 14 ground locations including background, urban and sub-urban measurement stations. MODIS satellite data is available in near real-time from the recently established satellite receiving station. Since July 2009, we test the production of daily PM maps for the Local Authorities of South Tirol using MODerate Resolution Imaging Spectroradiometer (MODIS) and in-situ data.

Emili et al. (2009) has presented reasonable correlations between the NASA standard MODIS aerosol optical depth (AOD) normalized by the boundary layer height and daily PM10 at some ground location in the Swiss Alps. We apply here the same approach to compute PM10 for each ground stations in South Tirol. We have used two different MODIS AOD products: The standard 10 x 10 km2 NASA MODIS standard product and a 1 x 1 km2 MODIS AOD product generated via the algorithm of Li et al. (2005) for each ground station. We discuss uncertainties, highlight error sources and underline pros and cons of high-resolution AOD data for aerosol monitoring in mountain regions. First results indicate that the linear correlation for daily 2009 data varies strongly by the location between 0.3 and 0.8 for the NASA standard MODIS AOD product.

We currently test the method to produce area-wide PM10 maps in South Tirol. As a first step we have established a relationship involving PM10, AOD and boundary layer height for each ground station in South Tirol using historic MODIS NASA AOD data. The linear regression coefficients are interpolated into a map, which is then used to obtain area-wide estimates of PM10 from AOD and boundary layer height (from ECMWF numerical model). Validation of these maps is performed on independent data.

The total number of valid satellite AOD retrievals is a strongly limiting factor for operational air quality monitoring. We have observed that for some locations in South Tirol, up to 80 % of the AOD data are not computed for the standard NASA MODIS product for 2009. The areas are either cloudy or the surface is considered as too bright by the NASA standard AOD algorithm. Here, we present detailed statistics about the total number of valid AOD data in South Tirol for both NASA standard and high-resolution MODIS AOD data.

Emili et al.: PM10 remote sensing from geostationary SEVIRI and polar-orbiting MODIS sensors over the complex terrain of the European alpine region, submitted to Remote Sensing of Environment.

Li et al.: Retrieval, validation, and application of the 1-km aerosol optical depth, 2005 ieee transactions on geoscience and remote sensing, vol. 43, no. 11.