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High resolution space characterization of water vapor from satellite measurements and local area model

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Synthetic Aperture Radar (SAR) is a well established microwave imaging system from which measurements of surface deformations of the order of centimeters can be derived and than several useful land applications (e.g.: the analysis of progressive tectonic motions, or to the improvement of a Digital Terrain Model) can be provided to the community. Among the main limitations affecting the Interferometric SAR (InSAR) measurements, especially at C and X frequency bands, the atmosphere surely plays a relevant role. When two interferometric SAR images are not simultaneously acquired, the electromagnetic wave received from the SAR sensor, mounted on a satellite platform, after interactions with the ground, may be differently affected by the atmosphere which induces an unwanted component on the received signal. In particular, the random nature of the atmospheric state (i.e.: different humidity, temperature and pressure) between the two acquired SAR observations will have a visible and fatal consequences on the interferometric phase. Among others, the water vapor is an important contributor to the error budget of InSAR data and for this reason its spatial and temporal characterization plays an important role.
In this work, the spatial characterization of vertical Integrated Water Vapor (IWV), as seen from various satellite sensors, will be dealt with. Data acquired from Envisat-Meris, and Terra-Modis and Aqua-Modis spectrometer, operating at infrared frequencies at spatial resolution of 0.3, 1 and 1 km respectively, will be compared with simulations derived from MM5 weather forecast model at 1km resolution as well. The InSAR signal from ASAR of Envisat platform and RadarSat is also exploited to derive estimates of differential IWV (dIWV) at very high spatial resolutions (about 100 m). dIWV estimates are analyzed as well and compared together with those derived from previously mentioned spectrometers in terms of correlation structures.
The results of the comparisons here presented will put the basis for developing new algorithm for merging water vapor information from different observations.