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On the precipitation errors in the RU satellite technique

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Satellite rainfall monitoring is up to date the only feasible way to have a global and homogeneous coverage of rainfall distribution, amount and occurrence. Their value is unquestioned for all remote regions of the Earth not covered by raingauge networks or covered by old ground networks that provide precipitation data at spatial and temporal scales inadequate for the majority of the applications. However satellite precipitation operate at time and spatial scales consistent with the nature and development of cloud raining systems, and even with hydrological processes, so that, in addition to their scientific value, they result effective also in nowcasting activities and in rainfall spatialisation processes, even in areas well covered by modern ground networks.

Several techniques exist in literature to estimate rainfall intensity, which range from the use of purely-based statistical methods to neural networks (Joyce et al., 2004; Sooroshian et al., 2005).

Among the more widespread statistical technique, nowadays considered as a standard, it is the Rapid Update (RU) technique, developed by J. Turk at the Naval Research Laboratory (NRL), based on a blended technique that which takes advantage of both the newer polar sensors and Geostationary product (Turk et al, 2000a; 2000b).

Since 2004, an adapted version of the RU for the Mediterranean area was implemented at LAMMA laboratory (Laboratory for Monitoring and Environmental Modelling for the sustainable development), which provides maps of estimated rainfall every 15 minutes, in a near real-time fashion (http://www.lamma.rete.toscana.it/previ/eng/rain_msg_eng.html), using Meteosat Second Generation (MSG) data.

Among the principal limitations of this kind of technique is the assessment of the accuracy to be associated with the precipitation estimates. A number of validation campaigns have been planned and realized to the purpose, and they have shown how it is difficult to define an error in a statistical sense, as errors in satellite-based estimations appear strongly dependant on the underway phenomenology (in addition to the reference validation networks). Thus they cannot respond on an objective basis to the need of a global knowledge of the accuracy of rainfall patterns, remaining valid locally and for a specified meteorological conditions (not known a priori).

In this work we want to analyse some of the above issues on a number of precipitation events over the Mediterranean area and show how the problems on the error assessment reside in large part on conceptual limitations inherent to the algorithm, that are investigated on an analytical basis and through numerical simulations.

A way towards an algorithm for satellite rainfall estimations with associated errors is finally discussed.