Synergy of ground-based weather radar network and geostationary satellite observations for extending rain rate estimation beyond radar coverage

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High-resolution and high-repetition rain rates estimates are highly needed for meteorological and hydrological monitoring. These may be obtained from weather radar networks, where available. However, the spatial coverage of weather radar networks is usually limited to land and coastal regions. Here, a method to extend the rain rate estimate beyond the spatial coverage of a radar network is proposed, using the synergy with satellite geostationary infrared (GEO-IR) observations. This method builds on the heritage of other methods developed in the last decade to couple GEO-IR with low-resolution and low-repetition rain rate estimates from low-earth-orbit passive microwave (LEO-MW). These methods, such as the Microwave-Infrared Combined Rainfall Algorithm (MICRA), were developed for combining the appealing coverage and spatial/temporal resolution of GEO-IR observations with rain rate estimates from a higher accuracy source with limited spatial/temporal resolution and coverage. In the proposed method, called MICRAdria, the Italian C-band weather radar network is taken as the source of rain rate estimates.

MICRAdria consists in a background process and a foreground process. During the background process, a relationship between radar rain rates and collocated GEO-IR brightness temperatures (BT) is calibrated through a statistical integration technique. During the foreground process, the established relationship is applied to estimate the rain rate from the GEO-IR observations on an area larger than actual radar coverage (in our case Italy and the central Mediterranean area). The process is operationally iterated every 30 minutes, providing rain rate estimates over the above domain at original GEO-IR resolution (~4.4 km).

In this paper we present the details of the MICRAdria implementation and discuss preliminary results during high impact weather.