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Evaluating the skill of satellite data on the individuation of extreme precipitation events in Calabria (southern Italy)

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In this study, the skill of TRMM Multi-Satellite Precipitation Analysis (TMPA) data to locate spatially and temporally extreme precipitation has been tested over Calabria, a region in southern Italy.

Calabria is a very challenging region for hydrometeorology studies, as i) it is a mainly mountainous region with complex orography; ii) it is surrounded by sea, providing an abundance of available moisture; iii) it belongs to the Mediterranean region, a hot-spot for climate change.

TMPA, which provides daily data at a 0.25° resolution (i.e., about 25 km at southern Italy latitudes), was tested with regards to three extreme precipitation events that occurred between 1998 and 2019, i.e., the years of TMPA's operational time frame. The first event, taking place on 07-12/09/2000, lasted for several days and involved most of Calabria. The second (01-04/07/2006) was a very localized midsummer event, which hit a very small area with destructive consequences. Finally, the 18-27/11/2013 event was a ten-day long heavy precipitation event that hit the region in spots.

TMPA daily data were compared against validated and homogenized rain gauge data from 79 stations managed by the Multi-Risk Functional Centre of the Regional Agency for Environmental Protection. TMPA was evaluated both in relative and absolute terms: i) the relative skill was tested by checking if TMPA evaluated correctly the presence of extreme precipitation, defined as daily precipitation passing the 99th percentile threshold; ii) the absolute skill was tested by checking if TMPA reproduced correctly the cumulated precipitation values during the events.

TMPA proved sufficiently able to locate areas subject to heavy cumulated precipitation during large spatially distributed events over the region. However, it showed difficulties in reproducing very localized events, as the 2006 case study was not detected at all, showing that 25-km spatial resolution and daily time resolution proved inadequate to resolve this type of rainfall event.

Results might give insights into the possibility of using satellite data for real-time monitoring of extreme precipitation, especially since the transition from the old TMPA to the new Integrated Multi-satellite Retrievals for GPM (IMERG) set was completed in January 2020.

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