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Detection of extreme rainfall events by a network of microwave links in the area of Milan

Roberto Nebuloni[1], Greta Cazzaniga[2], Cristina Deidda[2], Michele D'Amico[3], and Carlo De Michele[2]
[1]IEIIT, CONSIGLIO NAZIONALE DELLE RICERCHE, Milan, Italy (roberto.nebuloni@ieiit.cnr.it)
[2]DICA, POLITECNICO DI MILANO, Milan, Italy
[3]DEIB, POLITECNICO DI MILANO, Milan, Italy

The use of non-conventional rainfall sensors can help to close the gap on rainfall characterization, which is one weak link in the modelling of the Earth's water cycle. This has been an hot topic in hydro-meteorology for the last decade. In this frame, the EU COST ACTION named OPENSENSE (Opportunistic precipitation sensing network) has been recently approved and is running since October 2021 [1].

Specifically, the point-to-point wireless links massively used by the cellular networks for backhauling, namely, commercial microwave links (CML) have some unique features that render them attractive for rainfall detection [2]. The ubiquitous deployment of CML, the relatively high density of sensors, especially in urbanized areas, and the availability of raw data as outputs of the link quality control process are a strong plus. On the other hand, CML data are owned by mobile operators, hence they are not of public domain, and they are usually not optimized for rainfall measurements. It is therefore important to assess the capability of CMLs to detect the temporal and spatial patterns of precipitation and to quantify precipitation intensity by validation against conventional rainfall sensors where the latter are present and sufficiently dense [3].

In this work, we investigate the capability of CMLs to detect extreme rainfall events analyzing a case study in a large area North of Milan, where a mesh of more than 200 links is present. The region is covered by an operational network of rain gauges owned by ARPA Lombardia and by MeteoSwiss weather radar. Due to the different spatial sampling of CML, rain gauge and radar observations, specific procedures must be envisaged to carry out a fair data comparison. Even though individual CMLs may return large discrepancies in rainfall intensity values with respect to nearby rain gauges, especially in the case of short high-frequency links, it is possible to obtain a good reconstruction of the rainfall patterns of extreme events, without an in-advance calibration through ground truth data.

References:

[1] OPENSENSE COST ACTION official site, https://www.cost.eu/actions/CA20136/ (last accessed on May 2, 2022)

[2] Messer, H. Rainfall monitoring using cellular networks [in the spotlight]. IEEE Signal Processing Magazine 2007, 24, 144–142.

[3] Nebuloni, R.; Cazzaniga, G.; D'Amico, M.; Deidda, C.; De Michele, C. Comparison of CML Rainfall Data against Rain Gauges and Disdrometers in a Mountainous Environment. Sensors 2022, 22, 3218. https://doi.org/10.3390/s22093218