Convective and stratiform precipitation: A PCA-based clustering algorithm for their identification

Antonio Francipane[1], Gianluca Sottile[2], Giada Adelfio[2], and Leonardo V. Noto[1]

[1]Università degli Studi di Palermo, Dipartimento di Ingegneria, Palermo, Italy (antonio.francipane@unipa.it)

[2]Università degli Studi di Palermo, Dipartimento di Scienze Economiche, Aziendali e Statistiche, Palermo, Italy

The increasing occurrence of flood events in some areas of the Southern Mediterranean area (e.g., Sicily), over the last few years, has contributed to raising the importance of characterizing such events and identifying their causes. Since most of these events can be related to high-intensity rainfalls, which, in turn, are usually due to convective rainfall, it is very important to understand which factors could be recognized as drivers of such extreme events. Nevertheless, the way to distinguish between convective and stratiform rainfall is still an open issue and not easy to solve.

With this regard, starting from precipitation time series recorded at different rain gauge stations of Sicily, which is the greatest Mediterranean island, we propose an algorithm capable to classify precipitation distinguishing between their convective and stratiform components.

In order to do that, a dataset from the regional agency SIAS (*Servizio Informativo Agrometeorologico Siciliano* - Agro-meteorological Information Service of Sicily) has been used because of its high temporal resolution, quality, and availability of up-to-date data. Specifically, data from rain gauge stations spread over the entire island have been collected for the period 2003 - 2018 and with a temporal resolution of 10 minutes.

In order to classify the precipitation in convective and stratiform components, the functional PCA-based clustering approach (denoted by FPCAC) has been applied, which can be considered as a variant of a k-means algorithm based on the principal component rotation of data. In order to evaluate the validity of the proposed algorithm, finally, the results have been compared to some ERA5 reanalysis products.