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Subseasonal prediction of two extreme precipitation events over Italy

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The Mediterranean basin is often affected by potentially disruptive precipitation events. Particularly during late summer and autumn, a slowly moving deep trough represents the typical synoptic configuration that, causing a continuous inflow of humid southerly currents on the exposed slopes, yields intense and persistent rainfall. Recent studies of extreme precipitation and flood events affecting the Alpine area in northern Italy have revealed that, besides the local contribution due to evaporation from the Mediterranean Sea, a relevant amount of moisture may move from remote areas towards the Mediterranean within narrow and long corridors, i.e. atmospheric rivers.

Subseasonal forecasting of precipitation extremes is less skillful than other meteorological extremes, however the occurrence of large-scale factors may favor a successful forecast beyond lead week 2. In this work, we test this hypothesis evaluating the predictive ability of the ECMWF and CNR-ISAC operational subseasonal forecasting systems for two extreme precipitation events occurred over Italy in November 2016 and October 2018, the latter also known as the Vaia storm.

The two forecasting systems predicted positive precipitation anomalies, although underestimated, and higher probabilities for the upper tercile of the model climatological distribution. The analysis of the ensemble members shows that, by reproducing the low/high dipole of geopotential anomaly over the Mediterranean basin on week 3 (days 15–21), a few members are responsible for the precipitation forecast. The higher-skill members are then used to identify the dynamical processes providing enhanced predictability for the selected precipitation events. In both cases, the circulation evolving between North America and North Atlantic in the previous 2 weeks favored the occurrence of an atmospheric river entering the Mediterranean area, a feature more relevant for the Vaia event.

Although limited to a couple of case studies, this work confirms the possibility to predict precipitation extremes beyond week 2, and the benefit of exploring the whole forecast ensemble to take advantage of the potential useful information provided by a few higher-skill ensemble members.

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