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From deterministic to probabilistic forecasts: the shift-target approach in the Milano urban area.

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The number of important natural catastrophes is increasing worldwide; among these, the hydro-meteorological events represent the worst scenario due to thousand dead and huge damages to private and state ownership they can cause (Munich Re, 2016). To prevent this, besides various structural measures, many non-structural solutions have been proposed in the recent years.
In this study, we suggest a low computational cost method to produce a probabilistic prediction system starting from a single forecasted precipitation scenario through a spatial shift.
In fact, it is well-known that accurate forecasts of deep moist convection and extreme precipitation are arduous due to uncertainties arising from the numeric weather prediction (NWP) physical parameterizations and high sensitivity to misrepresentation of the atmospheric state. These uncertainties in precipitation forecasts can be seen as a space misplacing.
In order to run hydro-meteorological simulations and forecasts, we use a flood forecasting system which comprises the physically based rainfall-runoff hydrological model FEST-WB, developed by the Politecnico di Milano and the Moloch meteorological model provided by ISAC-CNR. The areas of study are the hydrological basins of the rivers Seveso, Olona and Lambro, located in the northern part of Milan city. This system works every day in real-time and can be consulted at sol.mmi.it.
In this study we show the reanalysis performance carried out between the years 2012 and 2017, in particular, we explored an alternative way, a "pragmatic approach", starting from a deterministic precipitation forecast available, in order to obtain forty ensemble members, which we assume equally likely, equivalent to forty spatial shifts of the WRF model in all the directions (North, South, West, East, North-West, North-East, South-West, South-East) at each step of 10 kilometers from 0 to 50 (which approximately is the basin dimensions).
Performance results are shown through statistical indexes based on the exceeding threshold for different gauging sections over the three hydrological basins.