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## Prestorm root zone soil moisture conditions critical for flood forecasting in Europe

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Recent evidences suggest that in Europe, flood frequency and precipitation frequencies are often not aligned. Beside other factors pre-storm conditions exert a significant impact on flood generation thus their knowledge is paramount for a proper flood forecasting. A number of predictors have been used in the past to understand how much precipitation is transformed into runoff (i.e., runoff coefficient, RC). Notable examples are the antecedent precipitation index (API), the prestorm river discharge and soil moisture. On top of these new products potentially available from satellite observations like surface soil moisture and total water storage anomalies (TWSA), root zone soil moisture from reanalysis and hydrological models can be used along with precipitation to predict in advance the severity of the storm runoff. Our goal here is to provide an objective description of the role played by different predictors for hydrologic forecasting in Europe. In particular, we aim at answering the following research questions:

- How variable is runoff coefficient across the European catchments?
- How much are surface and root zone soil moisture, river discharge, antecedent precipitation and total water storage anomalies able to explain the RC variability across European floods?
- Under which conditions (climate period, location and flood magnitude) are the different pre-storm indices able to predict this runoff coefficient variability?

We answered these questions using long term (1980-2016) precipitation and river discharge observations from more than 100 basins covering different European regions. Results demonstrated that root zone soil moisture and TWSA are the best predictors of prestorm conditions under a variety of climatic and geographic features and thus their correct representation in land surface and hydrological models is strategic for an effective flood forecasting.