Geophysical Research Abstracts
Vol. 20, EGU2018-17022, 2018
EGU General Assembly 2018

Predicting flash-floods in small Mediterranean catchments: application and results of a probabilistic hydrological nowcasting technique.

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In the last century, severe rainfall events produced flash-floods and landslides causing serious damages to urban areas in terms of economic damage and of human losses in the worst events. These events have been particularly harmful in the urban areas of Mediterranean coastal cities, generally densely-inhabited. The temporal scale of these events is strictly linked to the size of the catchments involved: in the Mediterranean coastal area a great number of catchments have a small drainage area (less than 100 km2) and a corresponding hydrologic response timescale in the order of a few hours.
A suitable nowcasting chain is essential for the on time forecast of this kind of events, which are small both at spatial (few km) and temporal (hourly) scales and the the meteorological forecast systems are unable to predict precipitation at such scales. Nowcasting models, covering the time interval of the following two hours starting from the observation try to extend the predictability limits of the forecasting models in support of real-time flood alert system operations.
The nowcasting model PhaSt, furnishing an ensemble of equi-probable ensemble forecasts of precipitation intensities on scales of the order of a few kilometers, up to a few hours in advance starting from the most recent radar observations, can be the suitable instrument to forecast this kind of event.
This technique is now keeping constant the initial volume of water along the following hours of forecast but this assumption does not allow to include the possible variations due to the birth and death of precipitation cells. This is one of the limits that set the lead time of the nowcasting chain in a time window of a couple of hours.
Different ways has been investigated in order to find the best solution for taking into account the volume variation and have a better forecast of the rain field. A first attempt estimates the future volume of water starting from the trend of variation of the volume in the steps prior the run of the nowcasting model. Another solution is the estimation of the volume from the meteorological model corrected with the observed rainfall field through a simplified assimilation technique, nudging, that allows to take into account the observations.
The coupling of the nowcasting model PhaSt with the hydrological model Continuum allows to forecast the flood with a few hours in advance and to be more detailed in an urban environment in which the spatial distribution of the event is essential.