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Flash floods in Europe: state of the art and research perspectives

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Flash floods, i.e. floods induced by severe rainfall events generally affecting watersheds of limited area, are the most frequent, destructive and deadly kind of natural hazard known in Europe and throughout the world. Flash floods are especially intense across the Mediterranean zone, where rainfall accumulations exceeding 500 mm within a few hours may be observed. Despite this state of facts, the study of extremes in hydrology has essentially gone unexplored until the recent past, with the exception of some rare factual reports on individual flood events, with the sporadic inclusion of isolated estimated peak discharges. Floods of extraordinary magnitude are in fact hardly ever captured by existing standard measurement networks, either because they are too heavily concentrated in space and time or because their discharges greatly exceed the design and calibration ranges of the measurement devices employed (stream gauges).

This situation has gradually evolved over the last decade for two main reasons. First, the expansion and densification of weather radar networks, combined with improved radar quantitative precipitation estimates, now provide ready access to rainfall measurements at spatial and temporal scales that, while not perfectly accurate, are compatible with the study of extreme events. Heavy rainfall events no longer fail to be recorded by existing rain gauge and radar networks. Second, pioneering research efforts on extreme floods, based on precise post-flood surveys, have helped overcome the limitations imposed by a small base of available direct measured data. This activity has already yielded significant progress in expanding the knowledge and understanding of extreme flash floods.

This presentation will provide a review of the recent research progresses in the area of flash flood studies, mainly based on the outcomes of the European research projects FLOODsite, HYDRATE and Hymex. It will show how intensive collation of field data helped better define the possible magnitudes of flood volumes and discharges during flash floods, their spatial distribution and rates of occurrence, as well as the factors that control the hydrological response of watersheds to heavy rainfalls explaining the large spatial variability in flood hazard. Developments in the fields of flood frequency analyses and flood forecasting based on the recently acquired data or adapted for the valuation of this specific data will also be presented.

The presentation will end suggesting some perspectives for future research activities on flash floods.