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Hydrologic and hydraulic distributed modelling with radar rainfall input–Reconstruction of the 8-9 September 2002 catastrophic flood event in the Gard region, France

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On 8-9 September 2002, an extreme rainfall event due to a stationary mesoscale convective system occurred in the Gard region, France, resulting in 24 casualties and severe economic damages. This contribution is aimed at describing the distributed hydrologic and hydraulic modelling exercise that was conducted to put in coherence the various sources of data collected operationally and during the post-event field surveys. Due to its spatial location, high-quality radar rainfall products are available for this event. A careful examination of the occurrence in time and space of the flash floods over the head watersheds (50-250 km^2) indicates that they were controlled by the trajectory of the convective part of the MCS. The distributed hydrological modelling using nTOPMODEL with a spatially-uniform parameterization proved to be efficient in simulating the spatial hydrologic response in the upstream part of the Gardon watershed (2100 km^2). The peak discharge estimates realized during the post-event surveys allowed to evidence an underestimation of this distributed hydrologic simulation in the central part of the Gardon watersheds. This was attributed both (1) to the difference in the geological and soil properties between the two parts of the watershed and (2) to the possible impact of antecedent precipitation in the central part. The stationarity of the mesoscale convective system over the Gardon watershed during 28 hours is the main factor explaining the extraordinary magnitude of the flood at this scale. The flood dynamics was controlled by the Gardon gorges with a subsequent major inundation

of the upstream Gardonnenque plain and a very significant peak flow reduction downstream. The 1D non-permanent hydraulic modelling realized with CARIMA and the spatial description of rainfall were shown to be essential to reproduce the flood dynamics. The hydraulic modelling proves also to have a potential for the critical analysis of the operational discharge rating curves.