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Use of new, diverse and widely distributed in situ hydrological measurements to improve catchment flow dynamics understanding

D. Maréchal (1), P.A. Ayral (1), J.S. Bailly (2), C. Puech (2), S. Sauvagnargues-Lesage (1), and H. Ayrol (3)

(1) Ecole des Mines d'Alès, LGEI, Natural Hazards, Alès, France; denis.marechal@ema.fr, (2) UMR TETIS, Montpellier (France); jean-stephane.bailly@teledetection.fr, (3) IMFT, Toulouse (France); ayroles@imft.fr

In Mediterranean areas, catchments are yearly affected by flash floods during autumnal seasons. However, the hydrological community has little knowledge on the genesis of these events and on the surface processes driving the hydrological response of a catchment. Lots of questions are still unanswered, particularly on the role of catchment morphology governing flow dynamics into hydrographic networks. The main question about hydrographic networks is concerning their impact on the discharges evolution at a catchment outlet: how networks morphological parameters affect the velocity and magnitude of a flash flood event?

In this paper, we try to identify some characteristics of the water pathways on a small pilot catchment located in the Cevennes region, in the south of France, yearly subjected to flash floods events. Various types of hydrological data coming from different in situ measurements are analyzed in order to have a complete, widely distributed and dynamic view of surface flow within our catchment.

For that purpose, we used numerous and different light sensors, spatially distributed within the catchment, giving simple hydrological informations along hydrographic networks (water level, flow presence). Some of them were specifically developed for this study. This combination of sensors with additional in situ measurements and observations during rainfall events gives a complete view of a catchment response, depending on the initial condition.

The first data analysis refers to the maximum extension of the network in relation with rainfall intensity. This analysis permits to characterize the trigger of surface flow and drainage density in the perennial and intermittent networks. However, it seems also interesting to look for relations between several morphological networks parameters (such as slope, drainage area and length, extracted from a Digital Elevation Model algorithm previously developed) and simple characteristics of the hydrographs (such as base time, time of rising and falling, magnitude). Furthermore, this method allows calculating transit times between observations points from which can be deduced the type of flow occurring on slopes (surface or subsurface) using the calculation of flow velocity. The catchment time of response is also calculated since we have several rainfall data, allowing calculating catchment storage volume.

This hydrological spatio-temporal data analysis represents a first essential step to adapt and improve hydrological models to local situations. Indeed, it contributes to a better understanding of the different process occurring during a flood and thus helps model makers to progress in the domain of flood forecasting.