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From potential to real hydrographical network by use of DTM and synoptic in situ measurements

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Remote sensing techniques provide large amount of distributed values all over the catchments. But to be able to use correctly these data in hydrological modelling, it seems important to revisit the classical in situ surveys, in order to have, at least on experimental basins, a good equilibrium between the number of descriptive categories from RS and hydrological data from in situ measurements. Let's focus for instance on the hydrographical network. The hydrographical network is defined as the natural or artificial, permanent or temporary channels which take part in the surface flow. It strongly influences the hydrological response during precipitation events.

To extract the hydrographical network from DEM, two issues seem important : have a good algorithm to define the potential channels, i.e. correct location , correct confluences ... and have an idea of the real network, ie the active channels where the water flows. Here we present our works on these two steps.

1) Extracting the network is possible from DEM and leads to the potential network – i.e. channels dry or not-. This first point relates to algorithm issues to obtain a realistic network. It appears that the usual procedure (D8 from raster format) is not sufficient for small basins and too uniform areas. D8 allows to obtain hydrographical networks, but presents many artefacts on too smooth areas. On many hillslopes, parallelism of water paths appears generalized. D8 implies a bad description of upstream water paths and gives bad computation of drained area at fine scale. In many geographical situations like smooth relief and regular hillslope, it fails to produce schemes well fitted to the catchment's reality. We tested an algorithm based on TIN model able to gener-

ate a more realistic scheme for elementary channels. The results appear much better than the D8 one : the very elementary gullies are very well described. It provides finest information about the potential network, with possibility to calculate correctly the upstream drainage area.

2) To obtain the true network –i.e. the one with active channels-, the DEM alone is not sufficient. Defining the real hydrological network by detecting the only gullies with active stream flow is the next issue. We need to know where the channels begin, with the difficulty that these locations are dynamic depending on the rain events. To better know the real network and its temporal variability we encourage to observe the dynamic of the discharges not only at the outlet but also through a great number of places during the hydrological year. To be operational these observations must be simple and not expensive : to obtain a great number of measurement places all over the catchment. In our case, in a first attempt, we tried to measure discharges in small channels by volumetric method. Such a monitoring offers a good comprehension about the inflating and deflating of gullies, and is able to help to a better distributed modelling.

Theses concepts have been applied on the Tourgueille catchment (1km ^{2}) located in Cevennes Mountains in the south of France. The potential network by TIN methods appears very realistic. Then a synoptic survey - 40 in situ plots - has been tested. Discharges have been measured from September 2005 to June 2006, during five days of in situ measurement, just after each big rain event. These data provides a dynamic representation of drainage density evolution during several months. This is a new and precious information to better understand the hydrological functioning in complementation to the classical discharge at the outlet.