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A distributed water level network in ephemeral river reaches to identify hydrological processes within anthropogenic catchments

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In order to study the impact of land use change on the water cycle, distributed hydrological models are more and more used, because they have the ability to take into account the land surface heterogeneity and its evolution due to anthropogenic pressure. These models provide continuous distributed simulations of streamflow, runoff, soil moisture, etc, which, ideally, should be evaluated against continuous distributed measurements, taken at various scales and located in nested sub-catchments. Distributed network of streamflow gauging stations are in general scarce and very expensive to maintain. Furthermore, they can hardly be installed in the upstream parts of the catchments where river beds are not well defined.
In this paper, we present an alternative to these standard streamflow gauging stations network, based on self powered high resolution water level sensors using a capacitive water height data logger. One of their advantages is that they can be installed even in ephemeral reaches and from channel head locations to high order streams. Furthermore, these innovative and easily adaptable low cost sensors offer the possibility to develop in the near future, a wireless network application.

Such a network, including 15 sensors has been set up on nested watersheds in small and intermittent streams of a 7 km^2 catchment, located in the mountainous “Mont du Lyonnais” area, close to the city of Lyon, France. The land use of this catchment is mostly pasture, crop and forest, but the catchment is significantly affected by human activities, through the existence of a dense roads and paths network and urbanized areas. The equipment provides water levels survey during precipitation events in the hydrological network with a very accurate time step (2 min). Water levels can be related to runoff production and catchment response as a function of scale. This response will depend, amongst other, on variable soil water storage capacity, physiographic data and characteristics of raining events.

Several raining events, with different characteristics, have been extracted from a large data set collected during two years. From these numerous hydrographs, analyses of flow dynamic through rising limbs, falling limbs and lag times show different behaviour pattern according to instrumented reaches. The paper will present first results from this synoptic survey. It shows the dynamic spatial pattern of stream flow along the water pathes. At finer scale, this synoptic survey could show the impacts of anthropogenic features on water concentration and their hydrological connectivity to natural river network.