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Characterization of the upper Arve watershed at Chamonix (French Northern Alp) from an integrated glacial-snow-hydrometeorological point of view

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The upper Arve watershed (205 km^2) is characterized by a high elevational gradient (altitude ranges from 1000 to 4810m asl), a significant glaciated area (about 33% of the total area) and a strong contrast between the bordering Mont Blanc and Aiguilles Rouges massifs in terms of land use , surface conditions and meteorological forcing. While the rainfall regime in the valley is relatively stable during the year, the thermal regime shows strong diurnal and seasonal variability. The hydrological regime of the main stream and its tributaries is dominated by snow and glacier melt, with high flow rates in summer and low flow rates in wintertime, when snowfalls accumulate on the ground.

Water transfers from a compartment to another are particularly rapid, with flash floods having lag times of about 4 to 6 hours and significant sediment transport associated with liquid flow rates. Since 2014, a project involving local communities, stackeholders and researchers and aiming at understanding the flood generation processes and their evolution with climatic and environmental changes has been started. The project aims at characterizing the catchment behaviour from an integrated glacial-snow-hydrometeorological point of view and to develop a flood forecasting system for anticipate as much as possible a possible crisis and improve its management. As a part of this project and in the continuity of existing long-term measures in the valley (particularly within the GLACIOCLIM research observing system and the operational Météo-France frameworks) a new instrumentation network has been implemented in order to observe simultaneously the different components of the water cycle (atmospheric, hydrological, snow and glaciological variables) and their spatial, temporal and altitudinal gradients. We will present the instrumental network and the measurement strategy, as well as an analysis of the data collected during the 2014 and 2015 summers, which are quite contrasted from a climatological point of view - a 10-year return period flood having been observed during the first and an extended hot period having affected the region during the latter. First simulations of such extreme events will be also presented.