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Modelling the snow from high spatial and temporal temperatures and snow cover maps

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One important parameter for the understanding and modelling of hydrology in mountain catchment is the snow. In this communication, we suggest an original approach to better observe and model this variable with a sensor based on the terrestrial photography to calculate the snow cover with a high spatial and temporal resolution. Thus in a first part, we will make a short presentation of the system and the main results obtain the last pas years. In a second part, we will show how we can use this information to constraint a snow stock model specifically develop on this catchment based on the degrees/day method.

The first part of the communication will present the techniques and methods used to calculate the snow cover from a simple picture. Firstly, we realized a transformation from 2D information to a 3D environment automatically by automatic recognition of geo referenced ground control points and geometrical matrix transformations. Secondly, the snow detection is performed automatically. Indeed, we must treat 5 or 7 pictures for each day and each camera and this work can't be made manually (more that 4000 images per season and camera). The recurrent problem is the changing of luminosity, shading effect and cloud cover of the catchment. An original automatic auto-calibrating algorithm leading to robust snow identification was then developed and will be discussed. Finally, we obtain automatically, for each picture the snow cover map associate and we obtains a lot of information on the localization and quantity of snow using a simple picture. All these information can be used to understand the snow evolution during a season.

In a second part, we show how the meteorological network installed on the catchment can generate temperatures maps with a high spatial and temporal resolution. Indeed, we have more that 40 temperature sensor on the catchment with 3 meteorological reference stations. From all these hourly temperature record, we are able to calculate different thermic gradient according to the elevation, the localisation or the aspect of each point of the catchment. These gradients are use in a model to generate a hourly map of temperature on the air on the basin.

The last part of the communication shows how we can use all these maps to constraint the snow stock model develop on the catchment. Thus, a simple model based on degrees/day method has been implement on our study site with the data get by the meteorological network. The calibration of different parameters like the melting factor can be lead with the snow cover map. Indeed, we know the storage capacity of the system (meteorological data and temperature map), but we don't know the potential discharge of the snow stock. The snow cover will be use to constraint the snow stock model during the melting period in particular.

Finally, the multiplicity of sensor will give us a great database to model the snow on the mountain catchment. The first results of this simulation model on our catchment will be present in conclusion of this communication. Thus, we used these results for study the spatial heterogeneity of hydrometeorology of mountain catchment and better understand the essential rule of the snow in hydrological processes in mountain. This model take place in a more large project to create a reliable hydrological modelling of the hydrology on mountain catchment with the goal to cooperate in the water resources management especially in conditions of flash flood and water scarcity events.