Geophysical Research Abstracts
Vol. 18, EGU2016-9751, 2016
EGU General Assembly 2016

The influence of snow cover on alpine floods reconstructed from the analysis of satellite images. The case of the Hasli-Aare river basin, Berner Oberland (1987-2012)

Paula Cabrera-Medina (1), Lothar Schulte (1), Filipe Carvalho (1), Juan Carlos Peña (2), and Carles García (3)

(1) Fluvalps, University of Barcelona, Barcelona, Spain (filipe.geography@gmail.com), (2) Servei Meteorològic de Catalunya, Fluvalps, Barcelona, Spain (jpena@meteo.cat), (3) Institut Cartogràfic i Geològic de Catalunya, Barcelona, Spain (iltrueno@gmail.com)

Regarding the hydrological hazards in the Hasli-Aare river over the last century, instrumental and documentary data show that flood frequency and magnitude increased since 1977. One of the main water inputs contributing to peak discharges is given by the thaw of the stored snow. Therefore, the knowledge of the evolution of snow cover is considered essential for the assessment of alpine floods.
Snow cover studies can be made by different approaches such as the analysis of data provided by field work or by nivometeorological stations. However, these methods are usually expensive and do not present adequate spatial or temporal coverage data. For this reason, satellite images with different spatial and temporal resolution are an interesting complementary source for the understanding of the snow cover dynamics.
The aim of the paper is to study the influence of snow cover variations during years of severe floods that occurred in the upper Aare basin from 1987 to 2012. Three satellite images have been selected for each of the 9 studied events: 1) maximum snow cover during winter, 2) the last image before the event and 3) the first image after the flood. Each image has been processed with the ArcGIS software applying a statistical method of supervised classification. This image processing allows the spatial quantification of the variation of the snow cover in the Aare headwater catchment.
Because the melting of snow cover is related to the changes of weather situations before and during the flood episode, it is important to analyse also the nivometeorological data of stations located in the catchment (snow depth, temperature and precipitation). From these data we determined 4 types of flood, which can be classified according to their nivometeorological variables and synoptic situation (500 hPa geopotential and Sea Level Pressure) into two patterns. The first group of events can be associated to an Atlantic pattern recording decreasing temperatures, moderate to high precipitation and an increment of the snow cover after the event. The second group, associated to a Mediterranean influence, shows a reduction of the covering due to a temperature rise combined with heavy rain fall. With regard to the severest floods of both patterns there is a common outcome: the catastrophic events of 1987 (Atlantic) and 2005 (Mediterranean) show highest precipitation values and the satellite images record a minimum of snow cover before the event (10-20% of the catchment area).
From the record of the monthly depth of snow cover (1986-2012) and the analysed satellite images it has been observed that the heritage of the snow cover is not a key factor for flooding whereas higher temperatures (higher snowline) and a minimum of snow cover promotes surface runoff and higher discharges. However, melting process related to snowfall during the event and the properties of the snowpack are not yet considered in our study and the temporal distance between images and events may introduce an important range of uncertainty.