Submitted Abstract

ID IMC22-FSAbstr- 572

First Author First Name Last Name	 César (1,2,3) Deschamps-Berger
Submitting Author First Name Last Name	 César Deschamps-Berger
Correspondence	cesar.deschamps-berger@csic.es
Co-Authors **>> E-Mails will be not listed**	Gascoin, Simon (2); Dumont, Marie (3); Berthier, Etienne (4); Luks, Bartłomiej (5); López-Moreno, Juan Ignacio (1); Lafaysse, Matthieu (3); Shaw, Thomas (6); Brun, Fanny (7); Koch, Franziska (8); Gallet, Jean-Charles (9); Revuelto, Jesus (1); Haddjeri, Ange (3)
Organisations **>> for readability limited to 6** **>> full list can be found online**	1: Instituto Pirenaico de Ecologia, Spain 2: CESBIO, Université de Toulouse, CNES, CNRS, INRA, IRD, UPS, Toulouse, France 3: Université Grenoble Alpes, Université de Toulouse, Météo-France, CNRS, CNRM, Centre d'Etudes de la Neige, Grenoble, France 4: LEGOS, Université de Toulouse, CNES, CNRS, IRD, UPS, Toulouse, France 5: Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland 6: Swiss Federal Institute for Forest, Snow and Landscape Research (WSL),Birmensdorf, Switzerland
Country	Spain
Region	Western Europe
Title	Watching Mountain Snowpacks From Space: Recent Advances In Snow Depth Mapping From Satellite Photogrammetry.
Keywords	Mountain Snowpack, Satellite, Photogrammetry, Model
Type	List Of Focus Session
Focus Session ID	36

Abstract

Developing methods to map snow depth at high resolution (<10 m) is an active field of research as snow depth is a key variable for water resource and avalanche risk assessment. Close range remote sensing is commonly used, combining lidar or photogrammetry with an airplane or a drone. However, drones acquisition are limited to small basins (<10 km^2) and airborne campaigns require logistics hard to meet in many mountains of the world. Recent improvements in satellite photogrammetry provide an alternative to map the snow depth in any place of the world at high spatial resolution (~3 m) by differencing digital elevation models with and without snow derived from satellite stereoscopic images.

Here, we present approaches to monitor the high spatial variability of the snowpack by using a collection of snow depth maps calculated from images of the Pléiades satellite in the Alpes, the Andes, the Himalayas, the Pyrenees, the Sierra Nevada (USA) and Svalbard. First, the comparison with a reference snow depth map measured with airborne lidar in the Sierra Nevada (140 km^2) provides a robust estimation of the Pléiades snow depth error. At the 3 m pixel scale, the standard error is about 0.7 m. The error decreases to 0.3 m when the snow-depth maps are averaged over areas greater than 103 m2. With this accuracy, Pléiades snow-depth maps allow the observation of the impact of the processes shaping mountain snowpack (wind transport, avalanches) and the description of the high spatial variability of the snow depth. Then, we describe statistically the structure of the snow depth distribution with semi-variograms and relate it to the various climates, relief and processes of the study sites. Finally, a multi-annual time series of snow depth maps in the Pyrenees is assimilated in a distributed snowpack model. The assimilation corrects precipitation bias in the meteorological forcing and the lack of spatial variability of the modeled snowpack.