

# Snow Depth Distribution and Albedo through UAVs eyes

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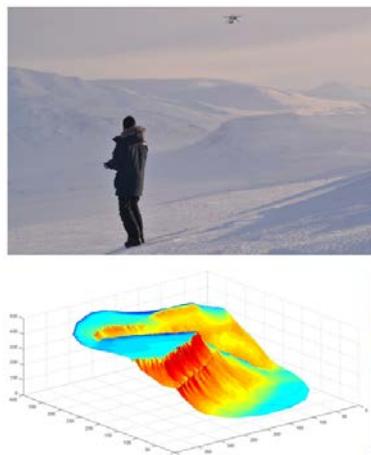
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## ABSTRACT

The snow cover and its characteristics have a relevant role in climate systems at micro and macro scales. The snow depth participates to the hydrological mass balance of Arctic and Alpine basins, while the snow surface albedo triggers positive feedbacks in the thermic balance of large areas, like the well-known Arctic Amplification. Nevertheless the techniques now available to determine the snow cover characteristics (satellite, manned aerial vehicles, empirical models, manual measurements) come with high costs or limited accuracy. Indeed, nowadays snow survey is still a limiting factor in climate change related research.

We designed and tested an innovative low-cost method for snow depth and surface albedo mapping mounting a consumer level camera on an Unmanned Aerial Vehicles (UAV). The snow surface is modelled using a method called Structure from Motion (SfM), which consists in the 3D reconstruction of a surface using digital pictures. The surface albedo is then modeled by calibrating the pixel characteristics with ground-taken spectrometer data. In this way is obtained a spatially continuous grid of these snow characteristics, solving the issues of resolution, precision and costs related to snow survey.

We tested the method in winter 2015 in two different Arctic Environments, Svalbard and West Greenland, and the data are still under process. The sites offer different challenges in terms of climate, light conditions and typical snow covers. The first results show a centimeter scale resolution of the modelled snow surface in both sites. This indicates that the method is capable of measuring snow depth despite the thickness of the pack and the optical quality of the surface, making it suitable virtually for any Arctic Environment. Further work will focus on calibrating the camera for albedo mapping. Finally, the dataset will be tested in the context of snow modeling, in order to assess the improvements that the method can contribute to this branch of the research.



**Figure 1** : Snow Depth Distribution and Albedo Concepts