Snow Cover Monitoring in the Swiss Alps Using Webcam Images

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In Switzerland, several thousands of webcams are currently connected to the web resulting in a relatively dense sampling, which can be used to study snow cover variability over a large area. They not only offer unique potential for complementing satellite-derived snow cover retrieval under cloudy conditions but could also serve as a reference for improved validation of satellite-based approaches. The main drawback of using webcam data is that mostly no information about the webcams and its parameters is available. Existing georectification approaches are not capable to process this data at a low expenditure of time, either because the methodology depends on known or estimated camera parameters, or because a large amount of manual user input is required.

Here we present a procedure to generate snow cover maps from webcam images with almost no manual user input. Our registration approach automatically resolves all webcam parameters (camera orientation, principal point, field of view) by using an estimate of the webcams position and a high-resolution digital elevation model (DEM). Combined with other methods, i.e. an automatic snow classification approach by Härer et al. (2016) and image alignment using SIFT features (Lowe, 2004), our procedure can be applied to arbitrary images to generate snow cover maps with a minimum of effort. Resulting snow cover maps have the same resolution as the digital elevation model and indicate whether each grid cell is snow-covered, snow-free, or not visible from webcams' positions. We analyzed the mapping accuracy using manually selected ground control points (GCPs) and present methodological limitations and potential improvements.

Härer, S., M. Bernhardt, J. G. Corripio, and K. Schulz (2013) Practise – photo rectification and classification software (v.1.0). Geosci. Model Dev. 6 (3), 837–848.

Lowe, D. G. (2004) Distinctive image features from scale-invariant keypoints. Int. J. Comput. Vision 60 (2), 91–110.