Submitted Abstract

ID IMC22-FSAbstr- 376

First Author First Name Last Name	 Martina (1) Barandun
Submitting Author First Name Last Name	 Martina Barandun
Correspondence	martina.barandun@eurac.edu
Co-Authors **>> E-Mails will be not listed**	Callegari, Mattia (1); Hanzer, Florian (2); Mayer, Christoph (3); Strasser, Ulrich (2); Notarnicola, Claudia (1)
Organisations	1: Institute of Earth Observation, Eurac Research, Bolzano, Italy 2: Department of Geography, University of Innsbruck, Innsbruck, Austria 3: Geodesy and Glaciology (KEG), Bavarian Academy of Sciences and Humanities
Country	Italy
Region	Western Europe
Title	Using Close-To-Daily Snowline Observations From Multi-Sensor Satellite Images To Calibrate A Process-Based Glacier Mass Balance Model For Data Sparse Regions.
Keywords	Glacier Mass Balance Modelling, Sub-Seasonal Transient Snowlines, Close-To-Daily Glacier Monitoring
Type	List Of Focus Session
Focus Session ID	23

Abstract

Glacier melt is an important fresh water source. Seasonal changes can have impacting consequences on downstream water resources management. Today's glacier monitoring lacks an observation-based tool for sub-seasonal observation of glacier surface mass balance and a quantification of the associated meltwater release at high temporal resolution on mountain range to regional scale.

The snowline on a glacier marks the transition between the ice and snow surface, and is, at the end of the summer, a proxy for the annual glacier mass balance. Using transient snowlines for model calibration to derive annual mass balance time series for glaciers on regional scale has shown great potential to better grasp the glacier response to climate change for remote regions. Model simulations directly integrating sub-seasonal snowline time series based on optical satellite imagery are improving conventional modelling, but glacier-specific, continuous snowline observation remained sparse.

We developed an approach that can automatically handle classification of multi-source and multi-resolution satellite image stacks. The combination of SAR and optical Sentinel 2 and MODIS data in a complementary way improves the temporal and spatial resolution of snow depletion monitoring on glacier scale. This provides a unique solution for continuous snowline mapping since the beginning of the century when sensor availability and quality was still limited.

With the provided close-to-daily transient snowlines, we provide the basis for a new strategy to directly integrate multi-source satellite image classification into glacier mass balance modelling. This helps to better understand glacier-atmosphere coupling and glacier meltwater production and release for data spares region such as Central Asia. The openAMUNDSEN (open Alpine Multiscale Numerical Distributed Simulation Engine), an open source, physically based process model designed to quantify the energy and mass balance of ice and snow is used. We use a calibration strategy for openAMUNDSEN, using the sub-seasonal snowline maps for annual model calibration. This setup is tested and validated with close-to-daily mass balance measurements at Vernagtferner, Austria and applied on regional scale in Central Asia. We aim for a highly resolved, observation-based glacier monitoring on regional scale. The developed approach is applicable for remote and inaccessible glaciers and will help to better understand the impact of climate change on regional water availability for remote and data sparse regions.