EGU21-14499
https://doi.org/10.5194/egusphere-egu21-14499
EGU General Assembly 2021

A new glacier inventory for Svalbard from Sentinel-2 and Landsat 8 for improved calculation of climate change impacts

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Svalbard is famous for its numerous surge-type glaciers as well as for the harsh weather conditions of a highly maritime Arctic island, making regular observations of its glaciers challenging. However, the rapid changes of glacier geometry require a frequent update of their extent to perform accurate glacier-specific calculations such as their mass balance or contribution to sea level. The last inventory for Svalbard has been compiled by Nuth et al. (2013) from about 40 satellite scenes acquired by three different sensors (ASTER, Landsat, SPOT) on 30 unique days over a period of 10 years. Accordingly, any change assessment or other time dependent calculations are difficult to perform and a temporarily more consistent dataset is urgently required.

In this study we present the results of a new glacier inventory for Svalbard that has been derived from two Sentinel-2 swaths acquired for the main island within 3 days of 2017 and on 1 day in 2016 from Landsat 8 for Nordaustlandet. The images had overall very good snow conditions but in some regions late seasonal snow was hiding glaciers. Glacier mapping under local clouds in the very north and south could be performed by using further scenes from 2017 processed with GEE. We applied a simple red/SWIR band ratio to map clean ice and corrected wrong classifications (sea ice, lakes) or missing parts (debris cover) manually. New drainage divides and topographic parameters were derived from the ArcticDEM.

The new inventory counts 3136 glaciers >0.01 km^2 covering an area of 32,948 km^2. Of these, glaciers < 1 km^2 cover 1.3% of the area but nearly 44% of the number whereas glac-iers >10 km^2 cover 91% of the area and 10% by number. Compared to the previous inventory we have 1468 glaciers more and 2.5% area less. However, when excluding the 2025 glaciers <1 km^2, we only identified 1111 glaciers, i.e. 557 less than in the previous inventory. The differences are mostly due to newly considered entities, different drainage divides, glacier retreat and advance/surging. By excluding surge-type glaciers, a more meaningful determination of climate-related area changes can be performed. The presentation will discuss the differences of the new inventory to the RGI dataset, the specific glacier mapping challenges and our approach to solve them.