Global Determination of Snow Cover using Remote Sensing and a Near Real Time Processing Chain

Global Snow Pack (GSP)

The daily MODIS snow products from Terra (MOD10A1) and Aqua (MYD10A1) are used for the Global SnowPack. So far, the application has been aimed at identifying differences and trends in annual snow cover globally. Therefore, the main product was the snow cover duration, derived from 113 potentially snow covered MODIS tiles (Figure 1).
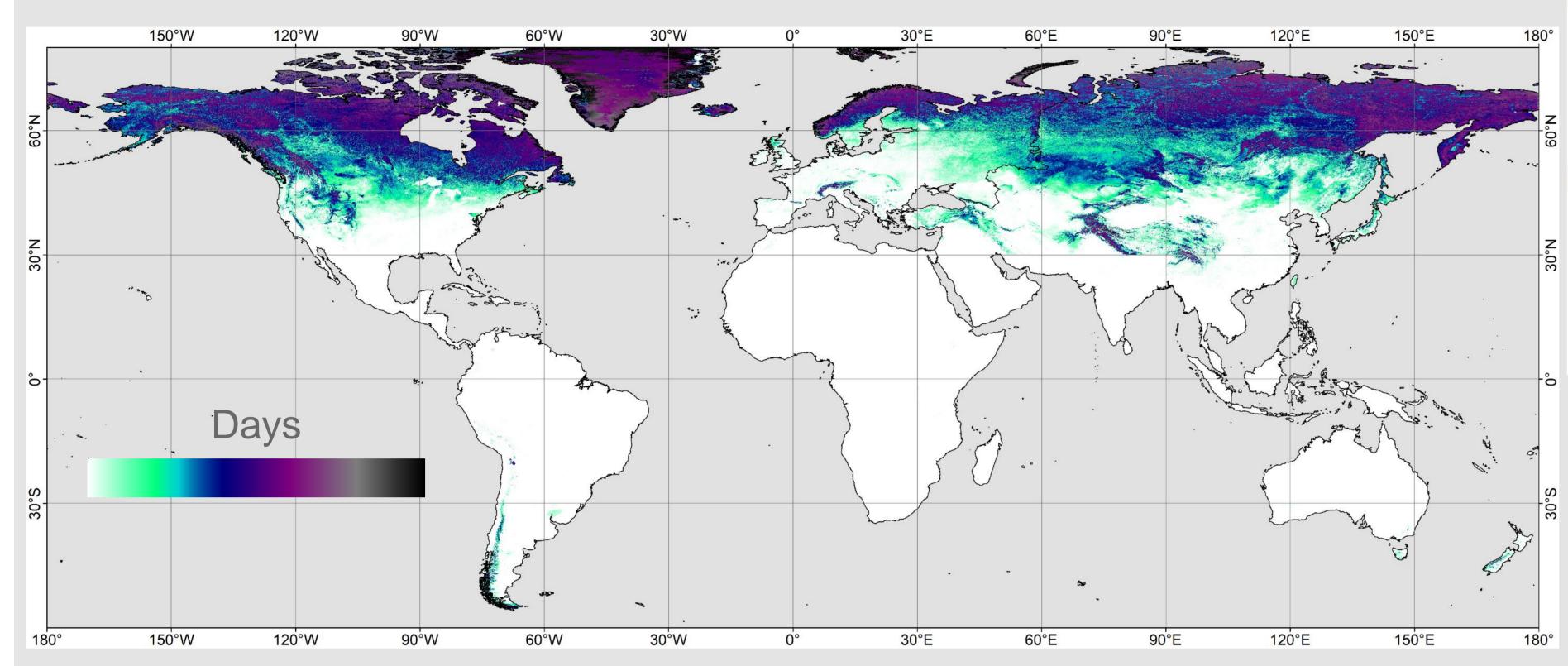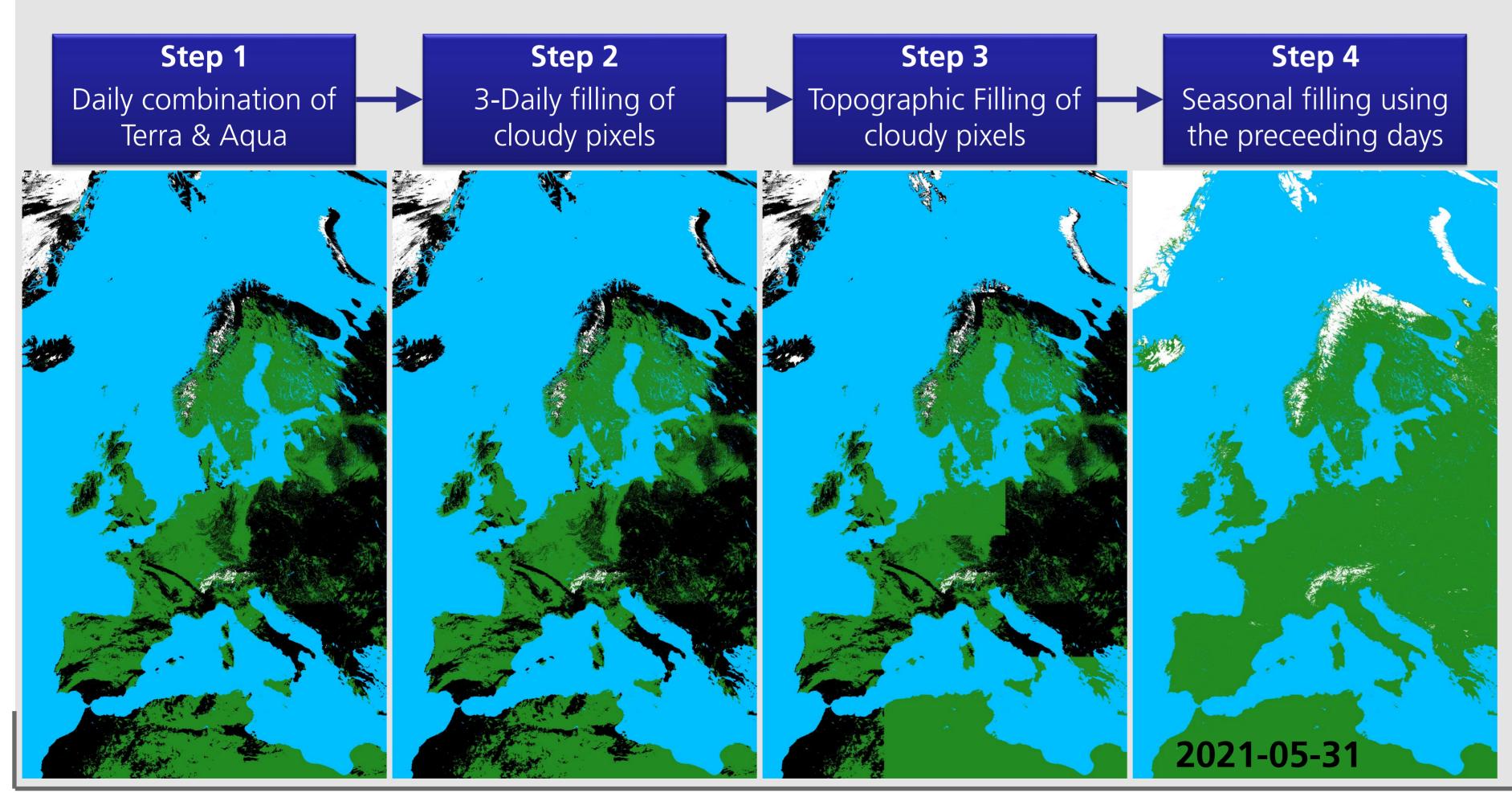

Figure 1: Snow Cover Duration (SCD) for the hydrological year 2020 (2019-09-01 until 2020-08-31) derived from 113 MODIS Tiles

Near Real Time GSP

The latest MODIS data (available after approx. 2 days) are interpolated on a daily basis with the previous days. The product will be available in the future through the Earth Observation Center's GeoService (https://geoservice.dlr.de/web/).

Step 1 Daily combination of Terra & Aqua
Step 2 3-Daily filling of cloudy pixels
Step 3 Topographic Filling of cloudy pixels
Step 4 Seasonal filling using the preceeding days

2021-05-31

Hydrological Application

We see an application of the NRT product in the estimation of the probability of occurrence of hydrological extreme events. While the winter of 2019/2020 was generally poor in snow in most of Europe, the opposite was evident in northern Europe (Figure 2).
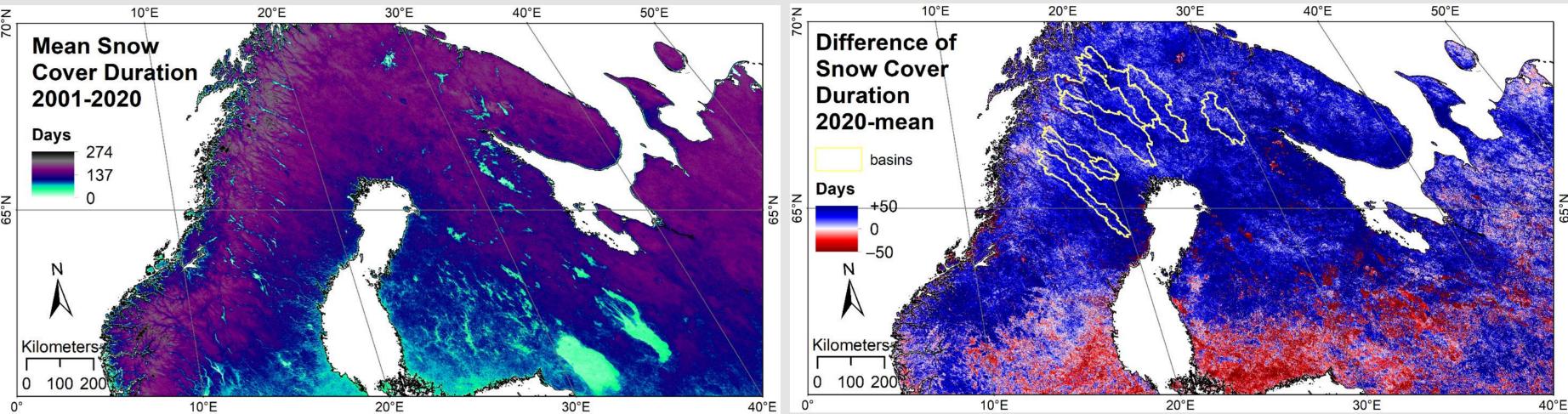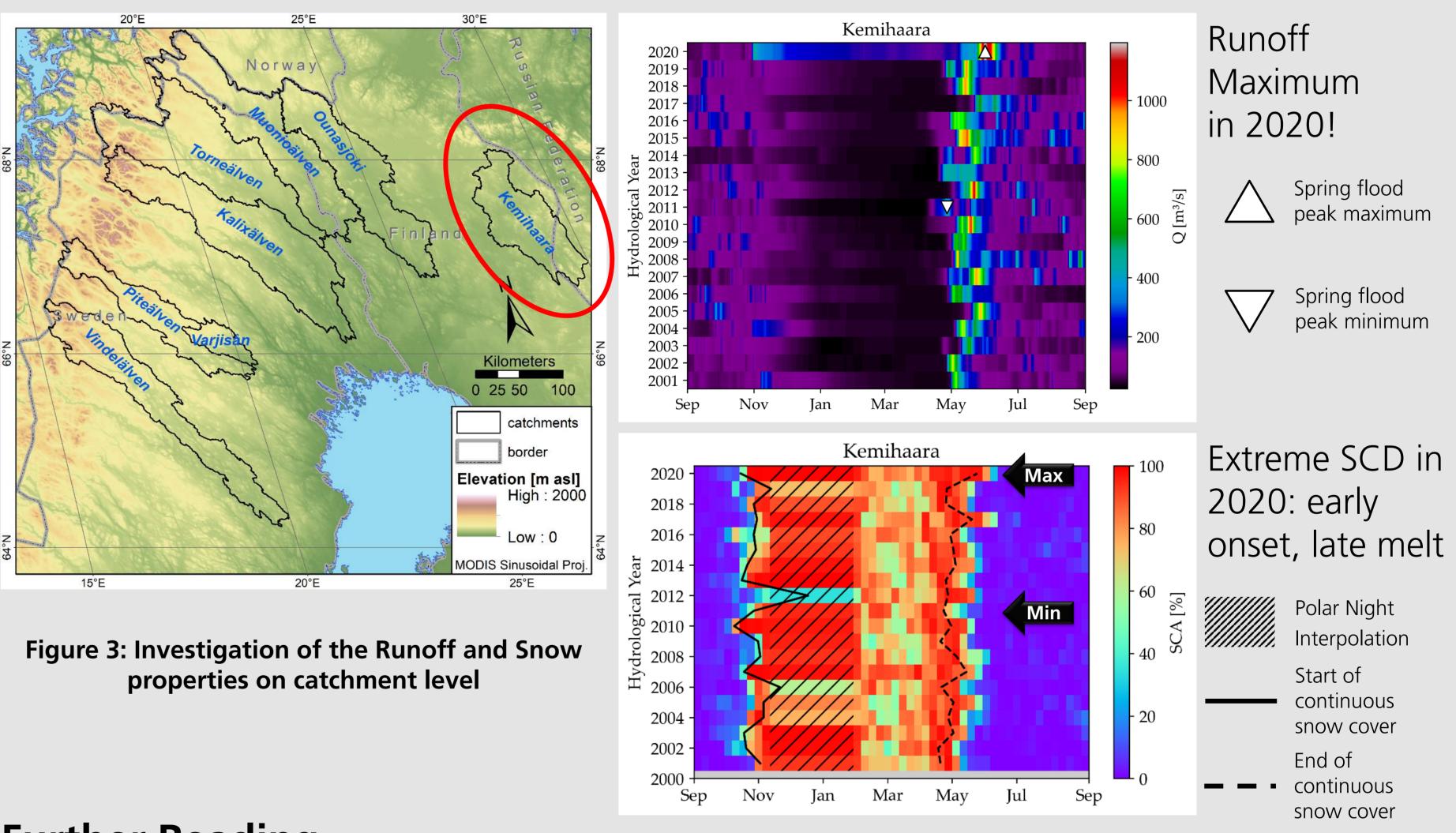

Mean Snow Cover Duration 2001-2020
Days
274
137
0

Difference of Snow Cover Duration 2020-mean
basins
Days
+50
0
−50

Figure 2: Mean SCD in Northern Europe and Deviation of the boreal winter 2019/2020

Combination with Runoff

The investigation of snow cover patterns at the catchment level allows us to draw conclusions about the significance of the duration of the snow cover and snow melt and the occurrence of extremes.(Figure 3).

Figure 3: Investigation of the Runoff and Snow properties on catchment level

Runoff Maximum in 2020!

Spring flood peak maximum
Spring flood peak minimum

Extreme SCD in 2020: early onset, late melt

Polar Night Interpolation
Start of continuous snow cover
End of continuous snow cover

Further Reading

Dietz, A.J., Kuenzer, C., Dech, S., 2015. Global SnowPack: a new set of snow cover parameters for studying status and dynamics of the planetary snow cover extent. Remote Sensing Letters 6, 844–853. https://doi.org/10.1080/2150704X.2015.1084551

Rößler, S., Witt, M.S., Ikonen, J., Brown, I.A., Dietz, A.J., 2021. Remote Sensing of Snow Cover Variability and Its Influence on the Runoff of Sápmi's Rivers. Geosciences 11, 130. https://doi.org/10.3390/geosciences11030130

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