GLOBAL SNOWPACK
Global Snow Cover characteristics derived from medium resolution remote sensing data

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Global SnowPack background information

The Global SnowPack is a set of snow cover products derived from medium resolution remote sensing data. Daily snow cover maps are combined and analysed to produce information about early season (SCD_{ES}), late season (SCD_{LS}), and overall snow cover duration (SCD) within a hydrological year.

Data Sources and processing

For the years between 2000 and 2016, the MODIS daily snow cover products MOD10A1 and MYD10A1 are used as the basis for the calculation of the Global SnowPack. For years prior to 2000, AVHRR was selected as the primary data source. While the MODIS snow maps are available as thematic Level 3 products, the AVHRR data come as Level 1B and require additional pre-processing. This is performed relying on Terascan and the AVHRR Processing Over Land, cLoud and Ocean (APOLLO) scheme. Suomi NPP VIIRS and Sentinel 3 are additional data sources that can be included in the future.
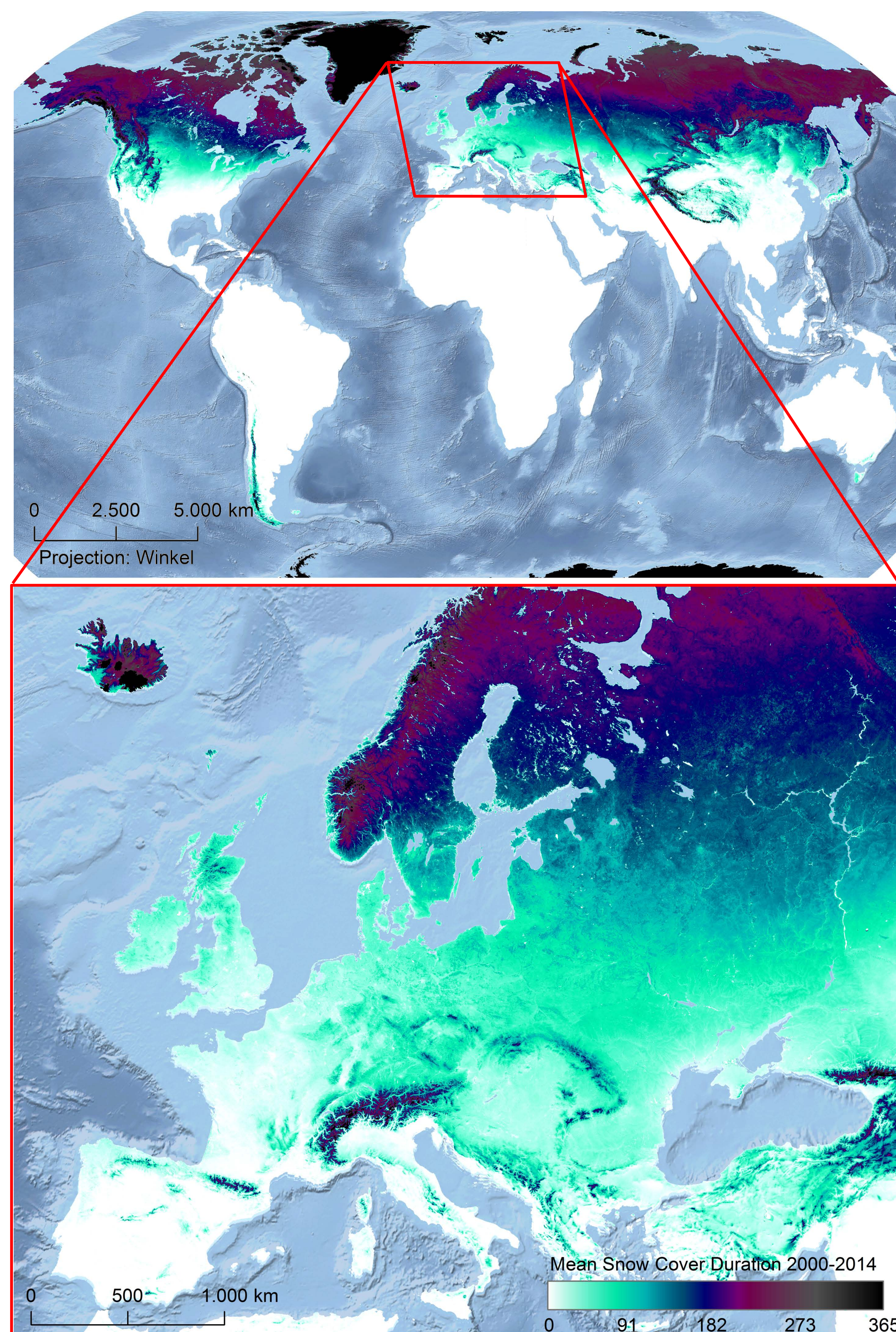

Fig. 1: Mean Snow Cover Duration 2000-2014 with a zoom to Europe

After pre-processing of AVHRR data both AVHRR and MODIS snow cover maps are post-processed to eliminate cloud covered pixels using four successive steps: Combination of all available daily observations, temporal interpolation of three days, snow line determination, and seasonal filtering. Snow Cover Duration (SCD) as well as additional parameters are calculated based on these cloud-cleared datasets.

The accuracy of the interpolated cloud-cleared products has been evaluated using station data as well as cloud simulations (overlaying cloud-free scenes with artificial clouds and then removing them using our post-processing scheme). The overall accuracy reaches between 78% and 84% (depending on the land cover, duration of cloud cover and polar darkness).

Results, status of processing, and outlook

Figure 1 illustrates the mean SCD for the years 2000 to 2014. ~1.200.000 MODIS tiles have been processed. The analysis of AVHRR is only finished for selected study sites in Central Asia and Europe.

Figure 2 shows an example for a possible application: Snow cover percentage within major hydrological catchments over time. Such information is valuable in terms of flood forecasting or the identification of climate change impacts on the hydrology of a drainage basin. While the processing for years after 2000 is finished, the AVHRR time series is still incomplete.
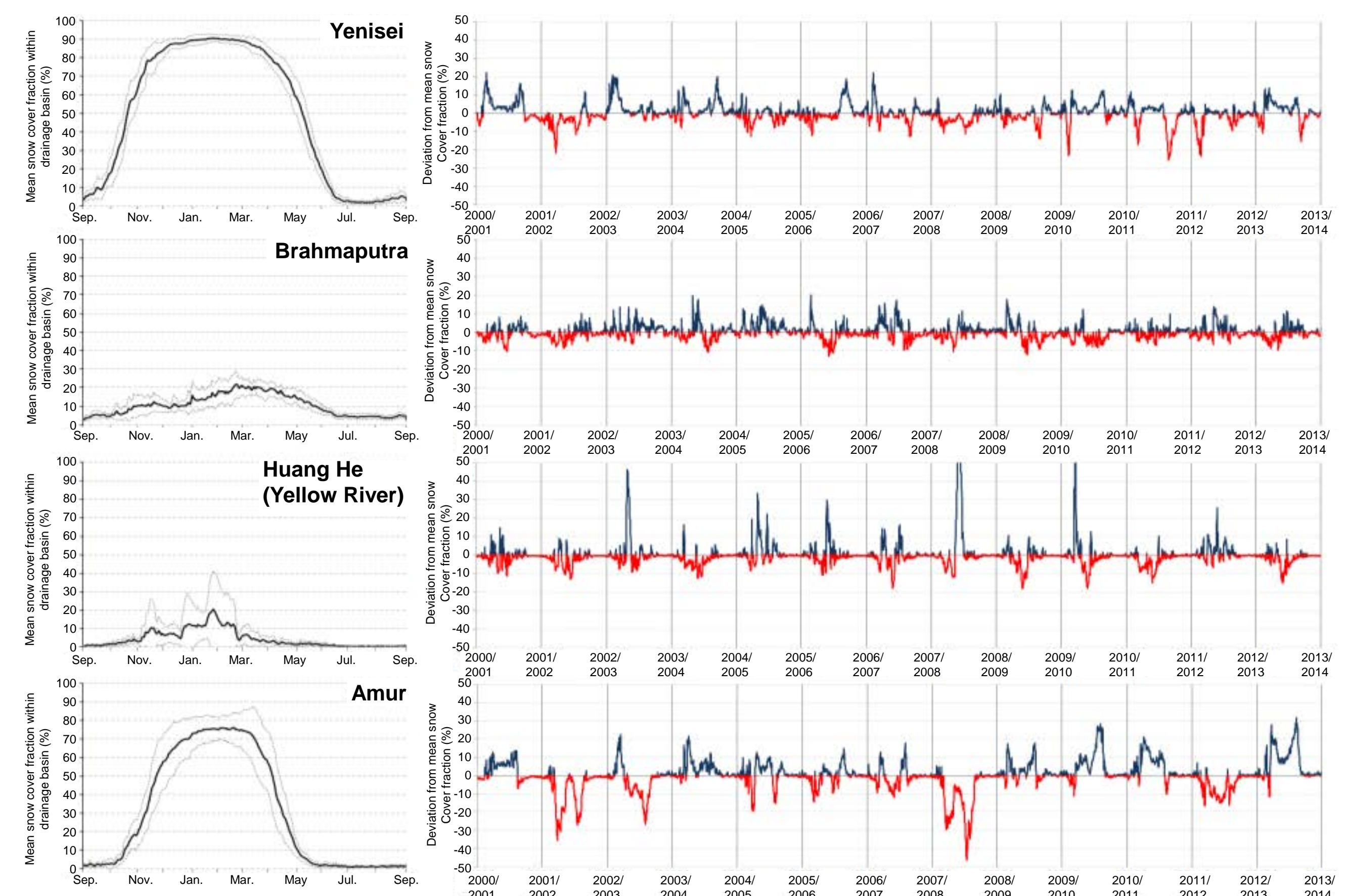

Fig. 2: Mean snow cover percentage (black lines, with standard deviation in grey lines; left side) and annual deviations (right) for selected drainage basins of Eurasia

Figure 3 illustrates the tendency of SCD between 2000 and 2014: It gives an outlook to what will be possible once AVHRR processing is finished: Trend analyses of SCD for a 30-year lasting time series of medium resolution daily snow cover data for the whole globe. The resolution is high enough to analyse the impact of climate change on small scale entities such as narrow valleys or mountain ridges. Shifts in snow cover presence (earlier/later snow cover onset/melt) can be identified thanks to the daily snow cover information.
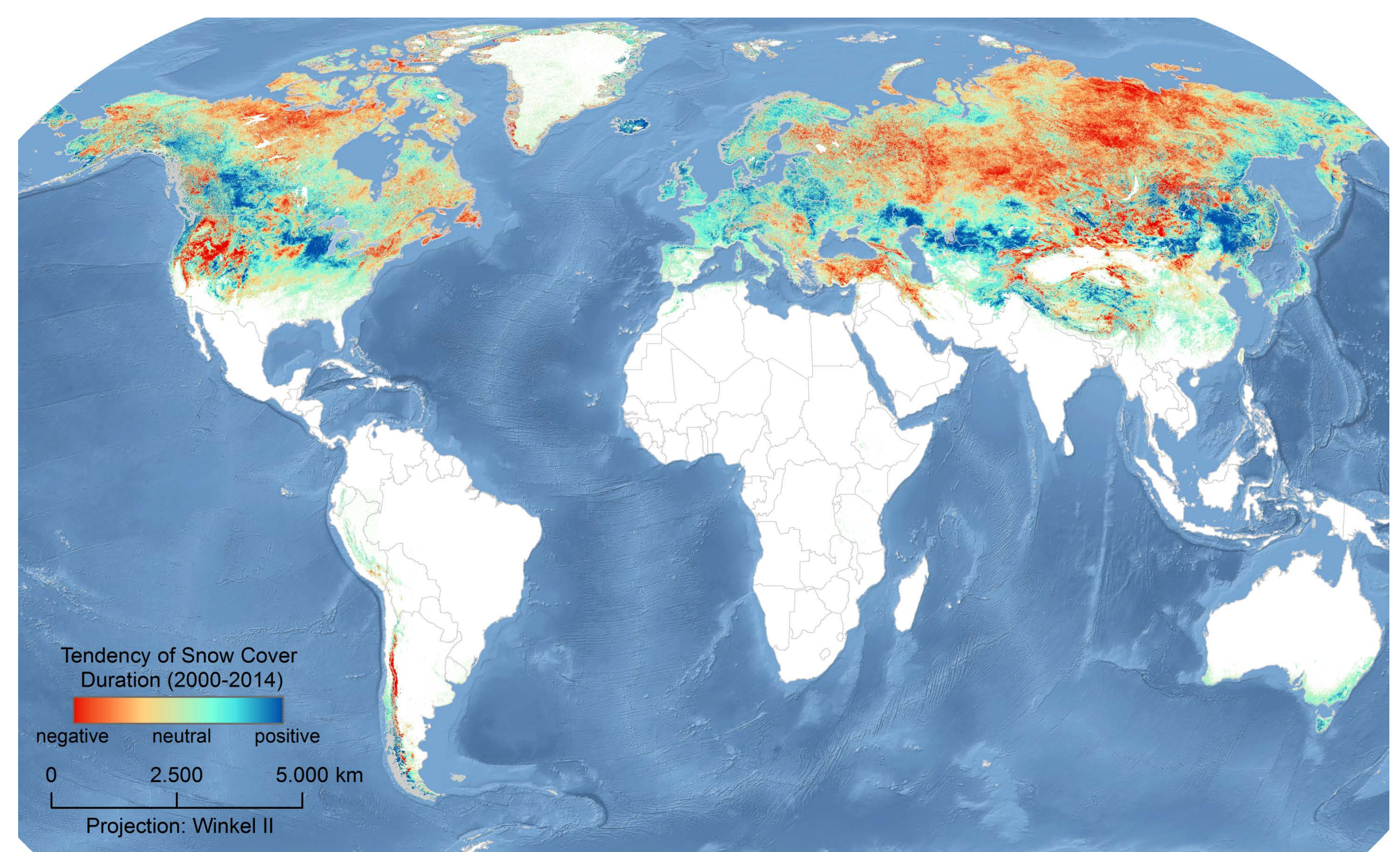

Fig. 3: Tendency of SCD between 2000 and 2014

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