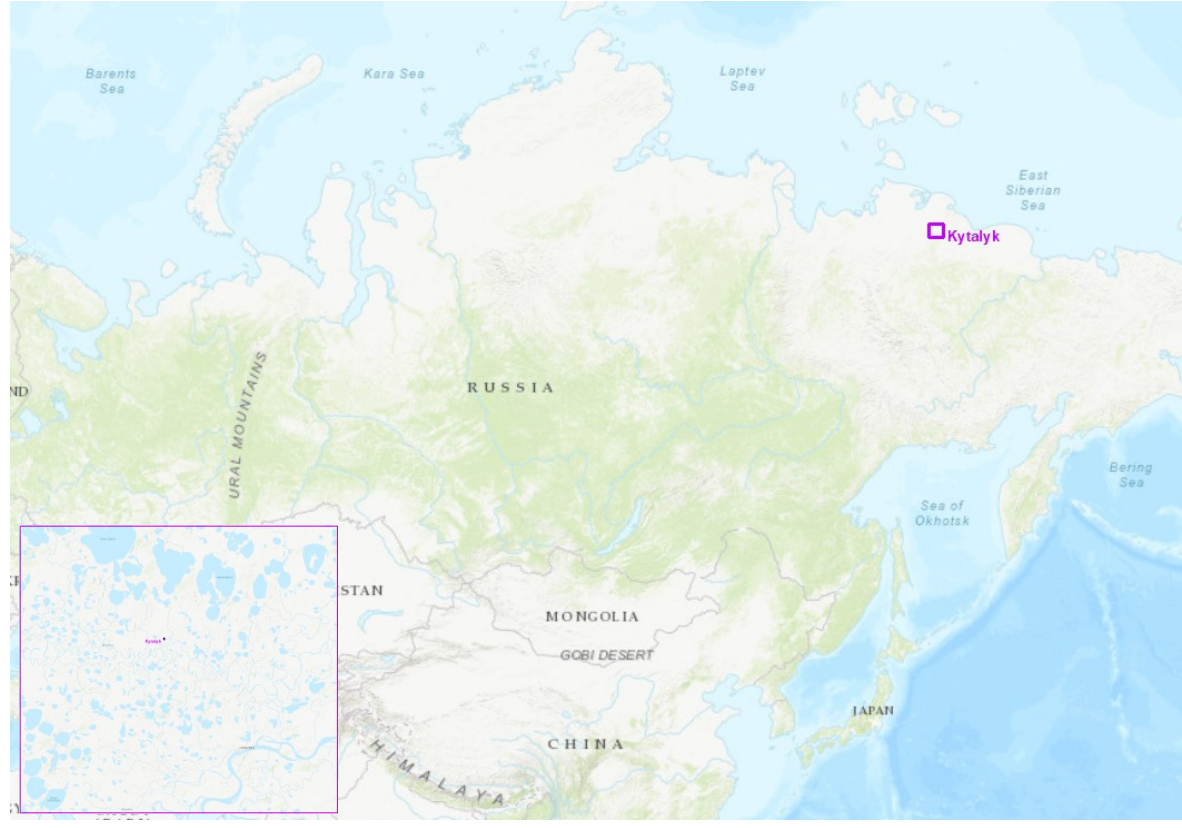


Seasonal permafrost changes from Sentinel time-series

Kanayim Teshebaeva, Ko J. van Huissteden, VU Amsterdam, Department of Earth Sciences. Hein Noorbergen, Mark van Persie, Netherlands Aerospace Centre, NLR.

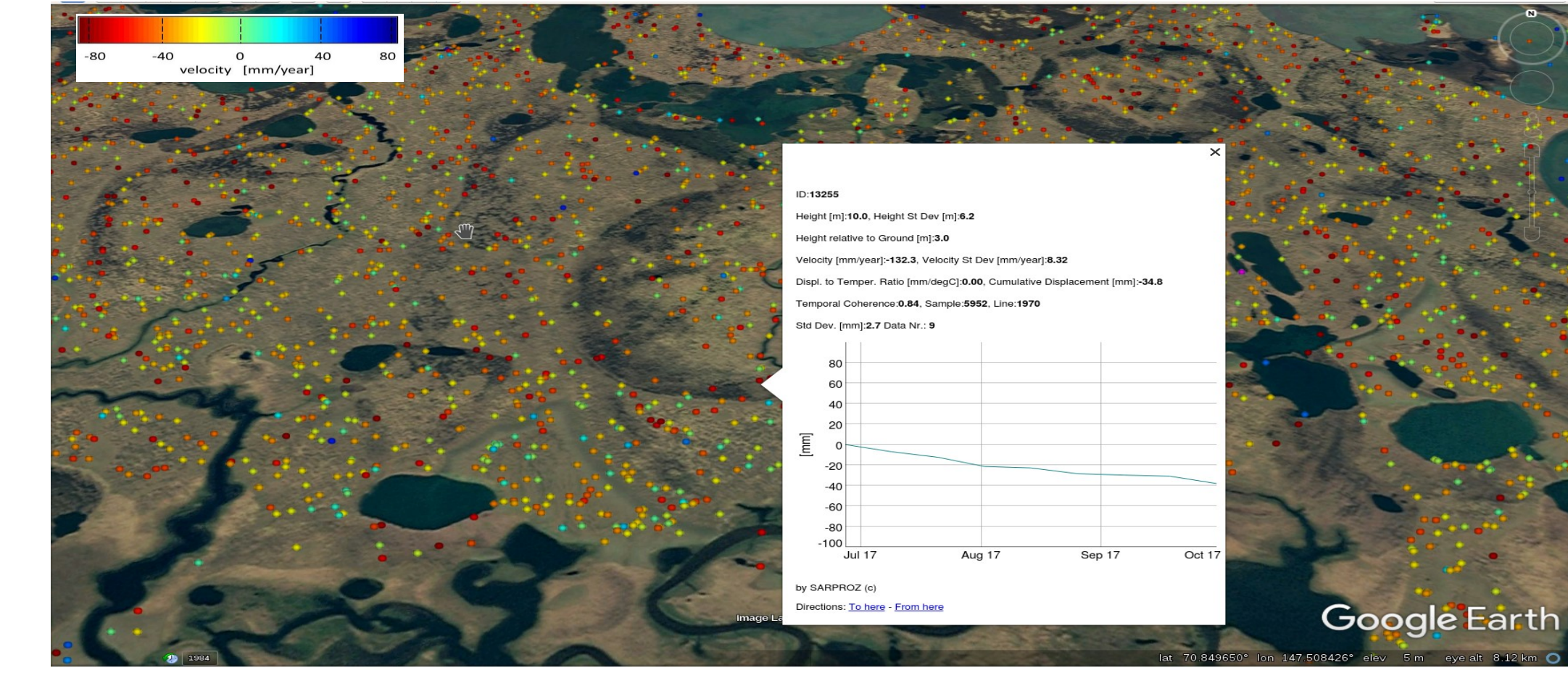
Widespread thawing of permafrost in the northern Eurasian continent cause severe problems for infrastructure and global climate.



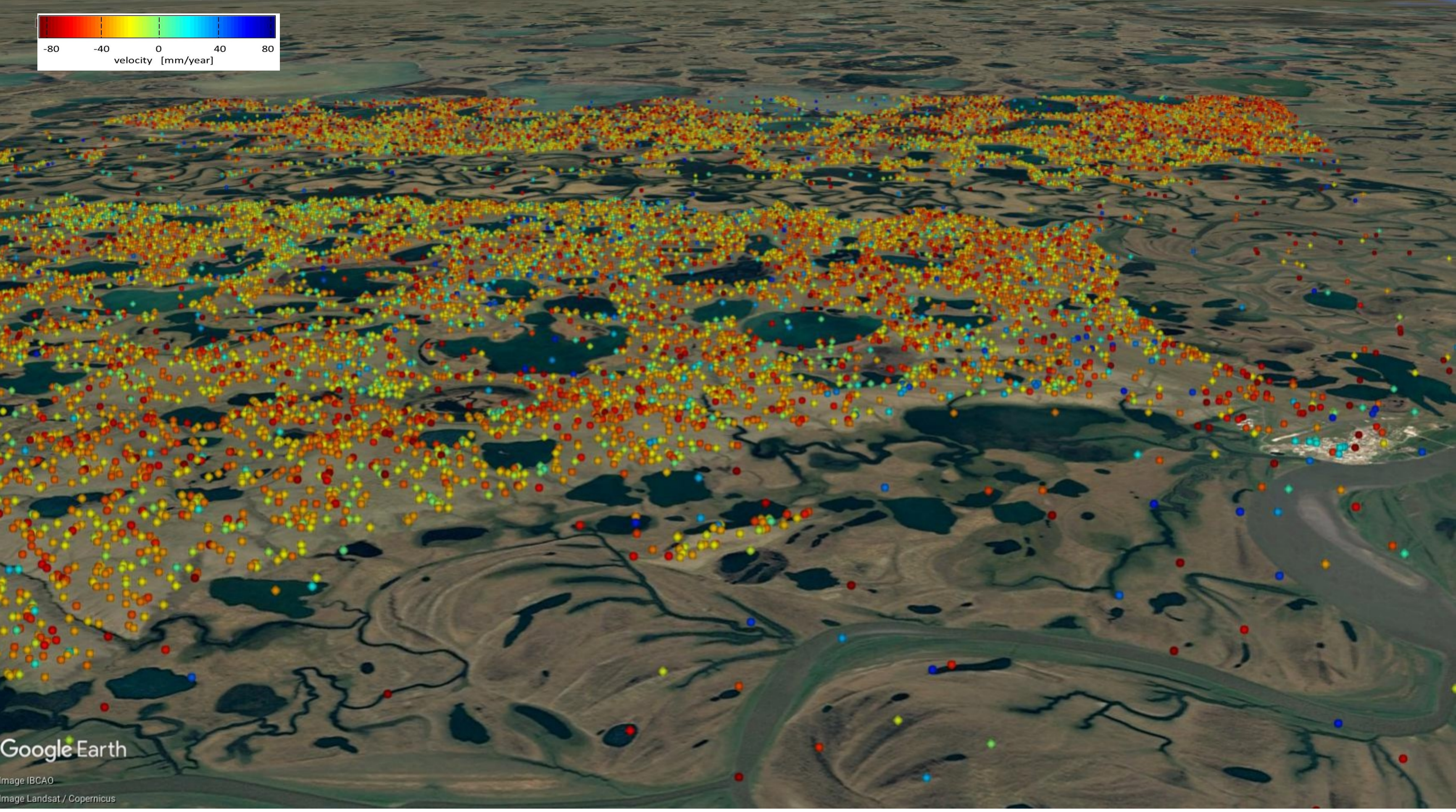
We test the potential of Sentinel imagery to enhance detection of surface changes in the Siberian lowlands of the northern Eurasian continent at Kytalyk research station site.

Objectives:

- Detecting and quantifying movement related to permafrost active layer changes
- Improve quantification and process knowledge of hotspot methane emissions
- Improve detection of deeper permafrost dynamics by remote sensing

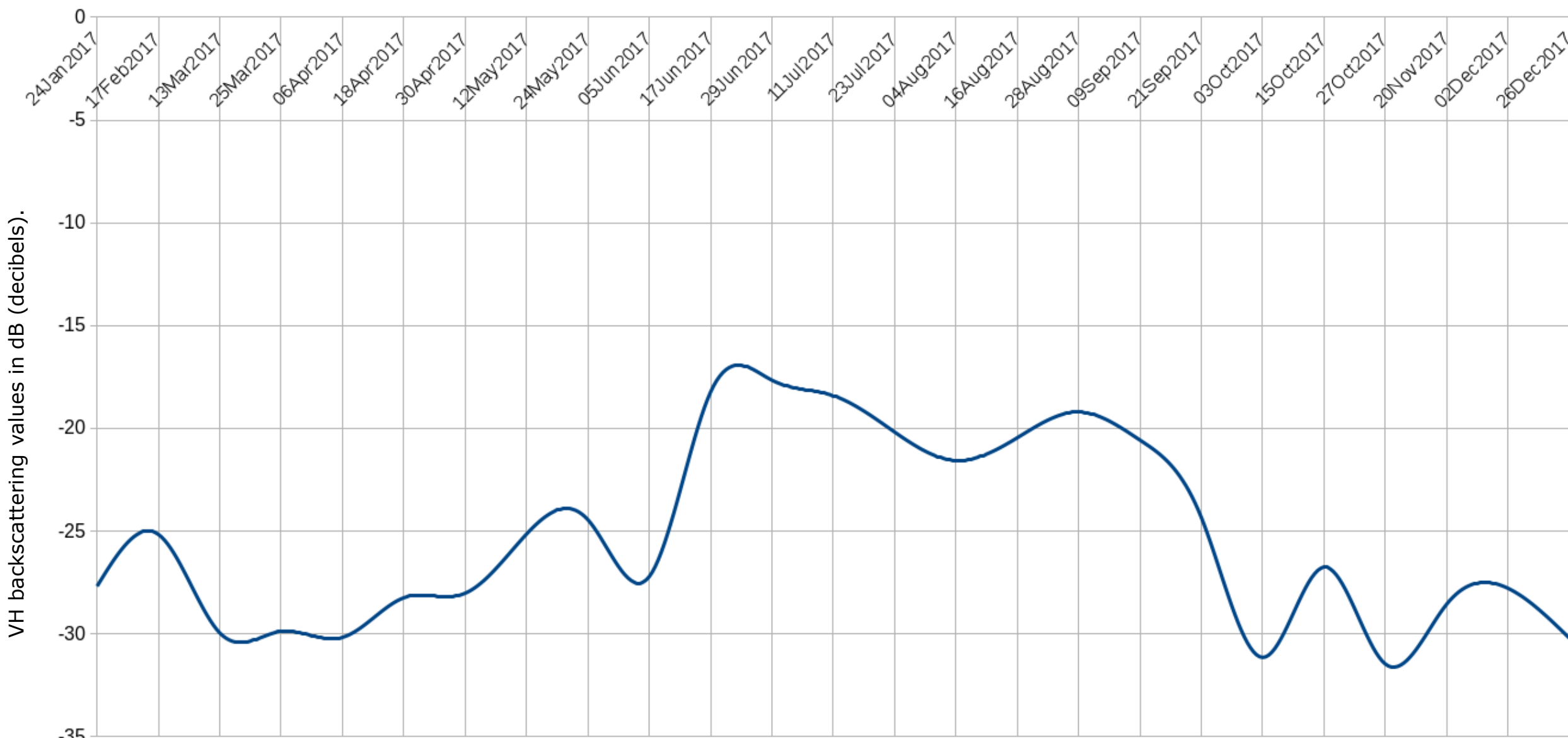
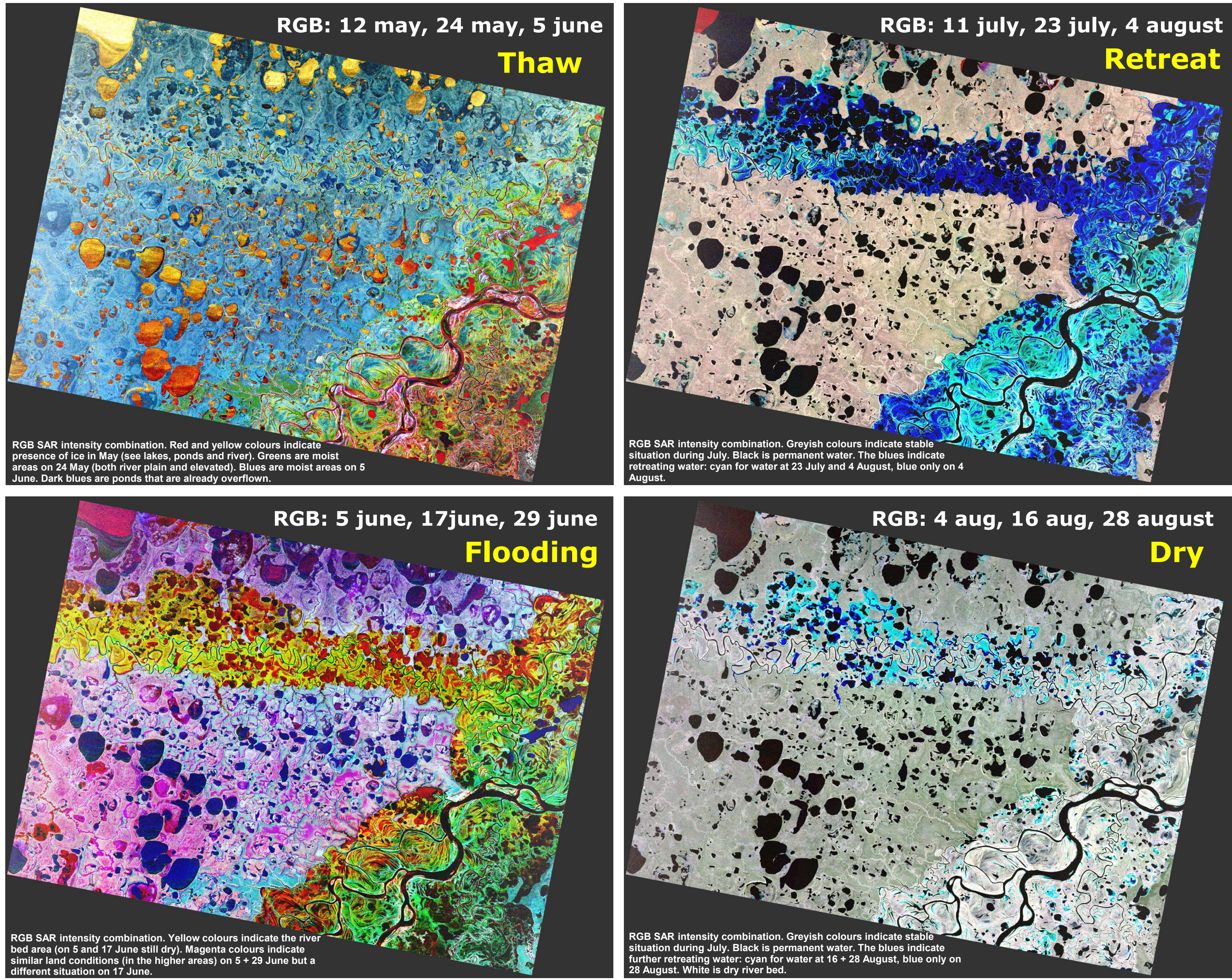


Results for Kytalyk InSAR Sentinel-1 June-October 2017



We used InSAR time-series technique to detect seasonal surface movements related to permafrost active layer changes. The InSAR time-series derived seasonal ground displacement patterns align well with lithology and reflect the thaw of Yedoma plateaus for the Kytalyk test site. The SAR data is used to derive soil moisture of the area. We detected seasonal freeze and thaw for Kytalyk test site from 17th June to 3rd October for 2017 year.

Results for Kytalyk SAR data seasonal thaw June – October 2017

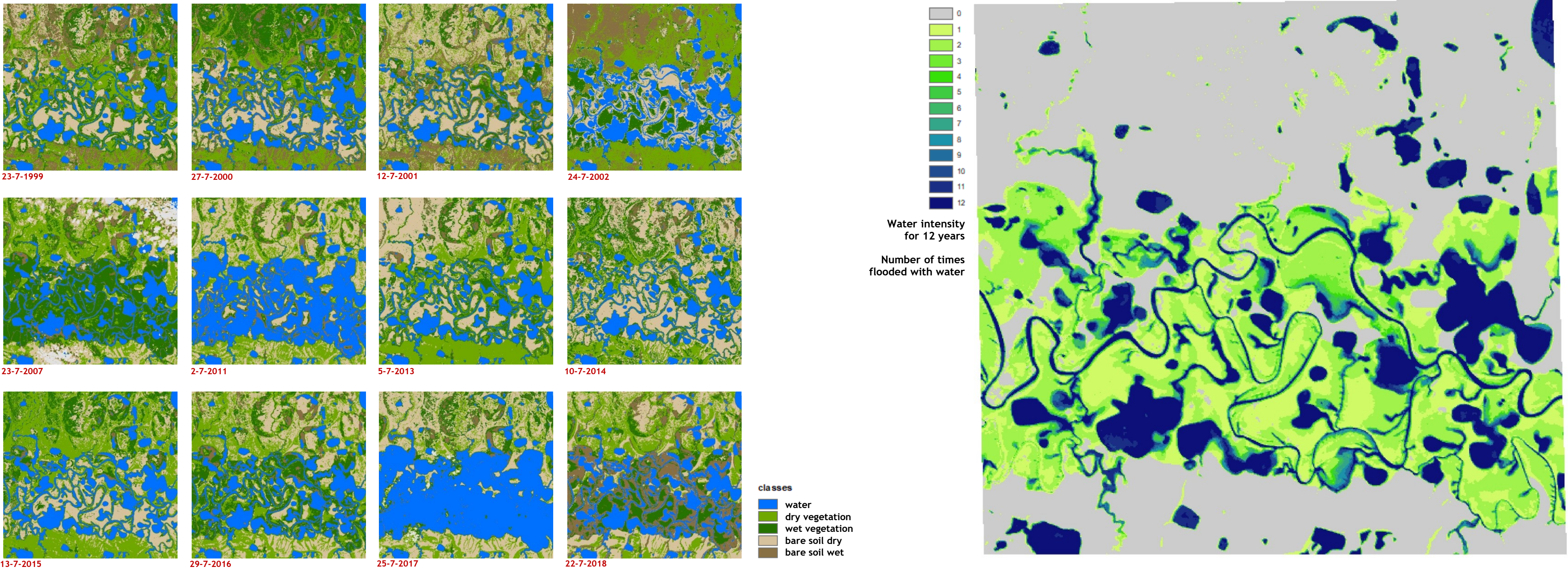


The graph shows seasonal freeze/thaw around Kytalyk station during 2017. The thaw season starts from 5th June with about 7 db difference and continues until first week of October 2017. The state of the soil moisture is very clear in the season from June to October.



Photo Kytalyk station 2017 10th July flood

Time series of Landsat optical imagery from 1999 until 2018

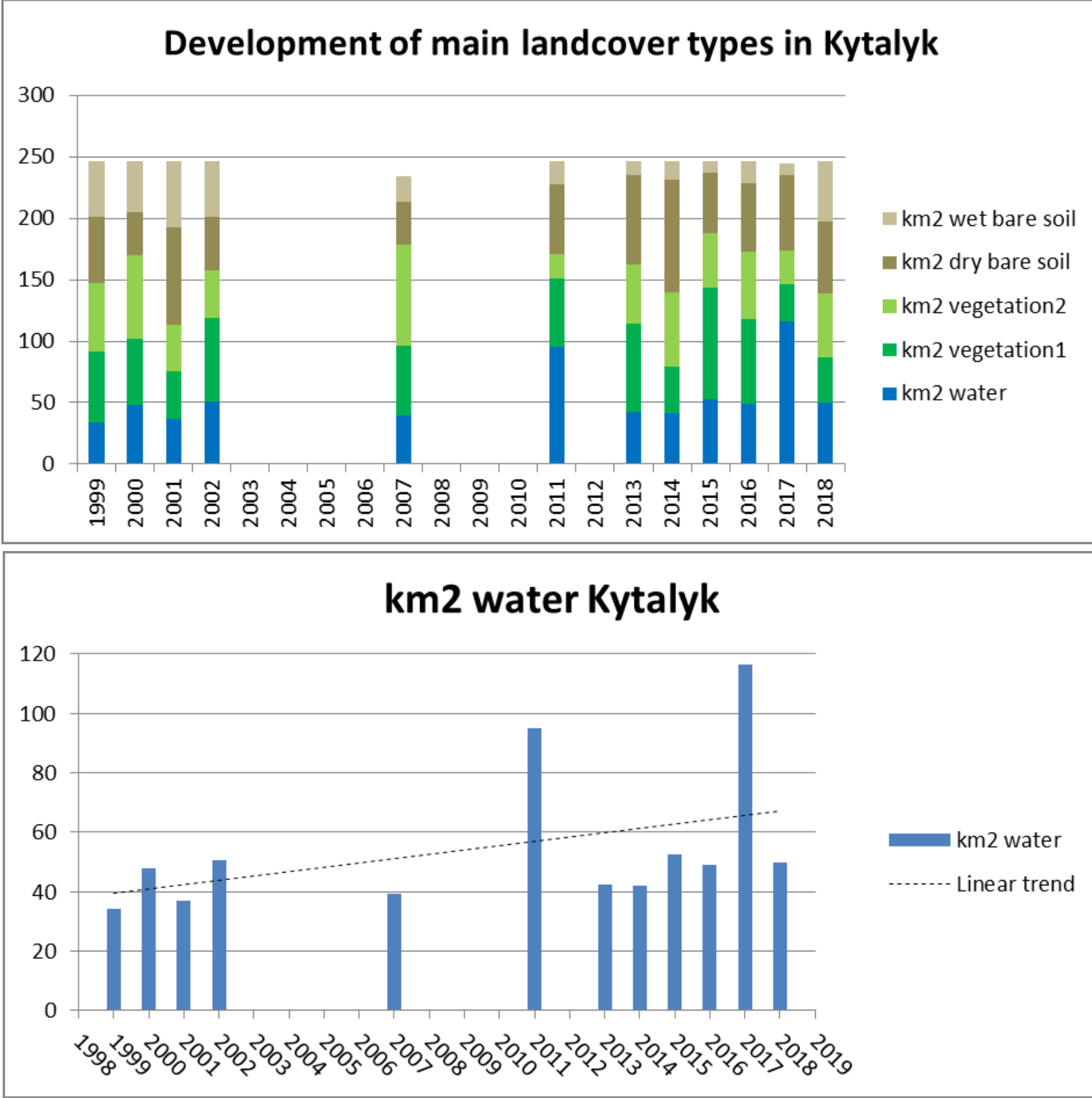


Classification

Landsat images from July were collected and classified in five main classes of land use. The maximum likelihood classification was carried out with uniform signature sets (in trying to automate the process).

Combination product

The water classes of all years can be combined in a so-called water intensity map. The map reveals areas that are always water but also areas that are occasionally flooded.



Analysis

The classification leads to quantitative figures of surface area of land features. Visible is a trend of increasing water area (also when the high water peaks in 2011 and 2017 would be excluded).