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Intercomparison of Snow Melt Timing Estimates from Optical and Microwave Satellite Instruments over the Northern Hemisphere for the Period 1982-2015

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Robust melt season timing and length estimates are important for hydrological and climatological applications; due to the large area and sparse in situ measurements, snow melt monitoring at the continental scale is only possible from satellites. The aim of this study is to intercompare melt season timing and length estimates obtained from optical and microwave satellite sensors over the Northern Hemisphere (NH). Our study covers land areas between latitudes 50°N and 80°N and period between 1982 and 2015. The optical satellite data are based on the mean surface albedo from the Satellite Application Facility for Climate Monitoring (CM SAF) CLouds, Albedo and RAdiation second release Surface ALbedo (CLARA-A2 SAL) dataset. The microwave satellite data are based on temporal variations in the differences of the brightness temperature from satellite passive microwave radiometers. The analysis shows that the microwave-based method detects melt onset on average ten days later than the albedo-based method. The albedo-based method observes the point when the spring snow metamorphism begins to have a detectable effect on snow albedo, whereas the microwave-based method detects the appearance of meltwater in snowpack. The difference decreases in forests, because canopy protects snow from sunlight delaying snow metamorphism. We also analyzed the melt onset date estimates for trends across the NH and separately for Eurasia and North America. A statistically significant negative trend towards earlier melt onset exists in all cases. The comparison between melt end date estimates is still ongoing; the results will include a general overview of agreements and disagreements, as well as delineation of differences according to land cover class. Additionally, we will study connections between the albedo-based melt season timing estimates and microwave-based snow water equivalent (SWE) of GlobSnow project. Understanding the connections will help climate models which use SWE to characterize development of snow cover.