Project acronym: ALBICE

Project title: Albedo observations on mountain glacier ice in Greenland

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Discipline: Earth Sciences & Environment: Global change & Climate observation

Station(s): Sermilik Research Station (Greenland)

The Mittivakkat Glacier located near the Sermilik Research Station, SE Greenland, will be our main research location. Glacier surface albedo (reflectivity) plays a key role in the amount of absorbed energy from incoming solar short-wave radiation on glaciers and ice caps (GIC). A change in albedo will therefore have immediate consequences for snow and ice ablation rates and surface mass balance (SMB). In Greenland, GIC peripheral to the ice sheet have undergone rapid thinning and recession over the last decades (e.g., Jiskoot et al. 2003; Yde and Knudsen 2007; Kargel et al. 2012; Mernild et al. 2012). For instance, since the mid-1980s GIC in SE Greenland have on average lost c. 27 ± 24 % of their area (Mernild et al. 2012). The best examined GIC in this region is Mittivakkat Gletscher (MG) (26.2 km2; 65°41´N, 37°48´W), which has lost 17 % in area, 15 % in ice thickness, and 30 % in volume since mid-1980s (Mernild et al. 2013). To our knowledge no GIC albedo studies have yet been published from GIC in Greenland besides Mernild et al. (2015). Previously, Box et al. (2012) showed that for the Greenland Ice Sheet the end-of-season albedo dropped from 75% to 68% during the period 2000 to 2012, indicating that 7% more of the incoming short-wave solar radiation was available for surface ablation. Does a similar or greater drop in albedo occur for GIC peripheral to the ice sheet? If so, what is the specific impact from a changing albedo on the GIC ablation and SMB, how does the albedo vary within short distances on the glacier surface? How are the changes we observe in stake mass-balance and MG SMB related to changes in surface albedo rather than simply the increase in summer air temperature and/or decrease in winter snow accumulation? Changes in SMB related to a lowering in annual surface albedo are of interest regarding the GIC SMB contribution to sea-level rise. Therefore, we will spatiotemporal measure albedo over snow, ice, slush areas, algae, black carbon, and debris on MG to better understand conditions and change - changes in surface albedo which can occur even over short distances (tens of centimeters).
So, far we have collected data for the field period to get an understanding about the small scale variability in surface albedo on a Greenland glacier - a glacier not attached to the ice sheet. The data will soon be analyzed, and compared to observations from earlier years and other glaciers, fx. the Greenland ice sheet. By doing so we will get a detailed picture of albedo variability's between the coastal zone (in Greenland where Mittivakkat is located) and the ice sheet. This is better understand trends and changes in albedo between glacier located in different environments, elevations and distances from the coast.