

Project acronym: GLARE

Project title: Glacier Aerodynamic Roughness Estimation

Project leader: Mark Smith, University of Leeds, UK

Discipline: Earth Sciences and Environment

Station(s): Station Hintereis, Austria

The proposed research seeks to better understand the link between ice surface topographic variability and the ice aerodynamic roughness (z_0), through the application of high resolution survey techniques (Terrestrial Laser Scanning and Structure-from-Motion) and validation of novel roughness metrics designed to capture the relevant components of topographic variability for z_0 estimation. z_0 remains a major uncertainty when determining turbulent heat fluxes over glacier surfaces, which are forecast to become more significant in a warmer, wetter climate.

We will validate z_0 estimates using wind tower data collected over the Hintereis valley and upscale these estimates using regular glacier-scale high-resolution 3D surveys from an in-situ TLS. Outputs from this research will allow distributed representation of z_0 in glacier melt models as required to accurately predict glacier responses to future climate warming. We will also investigate the potential for z_0 to be estimated directly from the airborne LiDAR which covers the whole Austrian Alps.

In future, we plan to obtain similar data from as number of climatically different sites across the Arctic to investigate potential feedbacks between climate warming-driven melt and ice surface roughness through its key influence on nonradiative energy fluxes.