

Project acronym: GLARE

Project title: GLacier Aerodynamic Roughness Estimation

Project leader: Mark Smith, University of Leeds

Discipline: Earth Sciences & Environment

Station(s): Tarfala Research Station (Sweden)

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 3 glaciers in Tarfala valley, northern Sweden and upscale these estimates using glacier-scale high-resolution 3D surveys.

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 ArcticDEM, a 2 m resolution Digital Elevation Model (DEM) that will soon provide coverage of the entire Arctic. In future, we plan to obtain similar data from a 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.