Air temperature variability inside crevasses in the accumulation area of a maritime glacier in the Southern Alps, New Zealand

Heather Purdie, Peyman Zawar-Reza, Benjamin Schumacher, Marwan Katurji, and Paul Bealing
School of Earth & Environment, University of Canterbury, Christchurch, New Zealand

In mountain regions around the world, crevasses in glacier accumulation areas undergo cycles of burial and re-exposure between one melt season and the melt season that follows. However, climate warming is extending the length of the ablation season meaning that crevasses are now exposed at the glacier surface for longer. An analysis of air temperature inside crevasses in the accumulation area of a maritime glacier has found that air temperature inside crevasses can at times be higher than the overlying air temperature. Here we combine measurements of air temperature and wind-speed from inside crevasses with adjacent meteorological data to demonstrate that open crevasses trap incoming shortwave radiation and have complex relationships with wind shear. Results show that crevasse morphology influences warming with the effect more pronounced at wider (more open) crevasses. This highlights the potential of crevasses to enhance glacial melt by acting as heat source through positive radiative and sensible heat feedback. Therefore we hypothesis that energy balance models that treat glacier accumulation areas as smooth surfaces will be underestimating snow melt and possibly overestimating mass balance on alpine glaciers.