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Influence of supraglacial debris on glacier-atmosphere interactions in the Karakoram

Emily Collier (1,2), Fabien Maussion (2), Lindsey I. Nicholson (3), and Andrew B.G. Bush (1)

(1) University of Alberta, Earth & Atmospheric Sciences, Edmonton, Canada (eec@ualberta.ca), (2) Chair of Climatology, Technische Universität Berlin, Berlin, Germany (fabien.maussion@tu-berlin.de), (3) Institute of Meteorology and Geophysics, Universität Innsbruck, Innsbruck, Austria (lindsey.nicholson@uibk.ac.at)

The presence of supraglacial debris drastically alters surface conditions, as well as the glacier's surface energy and mass balance. However, to date, its influence on near-surface meteorological conditions and therefore on glacier-atmosphere interactions has not been quantified. Here we investigate the role of debris using an interactively coupled atmosphere (WRF) and glacier climatic mass balance (CMB) modelling system, which has been modified to include a treatment for debris cover. The model also includes a parameterization for infiltration and runoff of moisture in the debris layer as well as its phase changes. WRF-CMB is applied over the Karakoram, with a grid spacing of 2 km over the study region, for the ablation season of 2004. From the results, we elucidate regional-scale changes in near-surface meteorological conditions and glacier energy and mass fluxes that arise due to the presence of debris.