Submitted Abstract

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Abstract

Recently, a number of glacier models have assessed the effects of debris-cover on glacier mass balance on the scale of individual glaciers or a regions (e.g. High Mountain Asia). In this study, we focus on Alaska, which is the region most strongly contributing to ocean mass gain outside of the ice sheets. Currently, about 7 % to 14 % of Alaska's glacier area is debris-covered. Debris cover can enhance ice melting if less than a few centimeters thick, or decrease ice melting through insulation of the underlying ice by a thick layer of debris. Ice cliffs and supraglacial ponds are special features of debris cover that can absorb more solar radiation and increase ice melting. These physical processes are an important source of uncertainty for projecting sea-level change, and the impact of parameterizations in glacier models needs to be assessed. Here, we introduce effects of debris cover on the mass balance of glaciers in the Open Global Glacier Model (OGGM), by applying an elevation-dependent temperature sensitivity parameter ("degree-day factor") and introducing a debris-related melt modification factor. We also simulate the future evolution of glaciers in Alaska until 2100, using different climate scenarios.