

Modeling the Mass Balance of Arctic-Asian Glaciers using the WRF data: case study in the Altai Mountains

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The Altai Mountains are located in the southern periphery of the Asian Arctic basin and the most northern periphery of the central Asia mountain system, which contains 1281 glaciers covering an area of 1191 km². These glaciers are at the headwaters of many prominent rivers, which affects the water discharge of large rivers such as the Ob and Yenisey Rivers. Although several studies have been proposed for glacier changes in this region based on satellite data, so far no study focuses on glacier mass change in the whole Altai Mountains. Therefore, we implement a temperature-index-based glacier model that considers the glacier area evolution and the refreezing of meltwater, to reconstruct glacier mass balance of the Altai Mountains, forcing the model by a Weather Research and Forecasting (WRF) model simulations with 5-km resolution and glacier inventory data. Compared to available observed mass balances on three glaciers of this region, the model can reproduce reasonably well the decadal glacier mass changes. According to our calculations, most of Altai glaciers have experienced negative net surface mass balance over the period 1989-2012, especially in the western part of the Altai Mountains. In addition to rising temperature, decreased precipitation in the western part of the Altai Mountains and increasing precipitation in the eastern part is probably driving these systematic differences.