EGU21-6902
https://doi.org/10.5194/egusphere-egu21-6902
EGU General Assembly 2021

Cloud forcing of glacier surface energy balance in diverse mountain environments

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Glaciers are iconic features of mountain landscapes with significant cultural, environmental, scientific, and economic value. While we know that glaciers are sensitive to changes in their local climate, the extent to which cloud cover will amplify or reduce the melting of a glacier in response to future atmospheric warming is uncertain. Clouds alter the solar and infrared radiation available for glacier melt and can enhance or dampen the influence of surface meteorology, albedo feedbacks and subsurface processes (e.g. refreezing) on melt. How these processes interact in different mountain glacier environments and climate regimes has not been well established. To address this knowledge gap, published surface energy and mass balance datasets from 15 mountain glacier sites around the world have been collated and analysed in a common framework. The framework seeks to reveal how melt rate is altered by cloud cover in each environment and which processes are more important for determining how cloud cover modifies melt. For example, does a decrease in incoming solar radiation dominate the effect of clouds on melt, or does covariance between clouds and other meteorological forcing moderate this effect in different environments? By unravelling the interacting effects of clouds and other atmospheric processes on glacier melt in diverse mountain locations, we hope to add fundamental understanding of the processes determining mountain glacier response to climate change.