

EGU21-10047

<https://doi.org/10.5194/egusphere-egu21-10047>

EGU General Assembly 2021

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Using a CMIP5 multi-model ensemble to model glacier mass balance on decadal scales

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Glaciers fulfil several important roles in the earth system, including being clear indicators of climate change and providing essential freshwater storage and downstream runoff to 22% of the global population. In addition, they are the main contributors to sea level rise and are expected to remain so throughout the 21st Century. In order to monitor glacier development, observing and predicting glacier mass balance on different spatial and temporal scales is essential. The current study aims to improve the understanding of glacier mass balance prediction on the decadal scale (5-15 years), a rarely studied time scale in the context of glaciers, but if reliable, highly applicable for glacier related water resource management and sea level rise predictions. This is achieved through the use of CMIP5 decadal climate prediction multi-model ensembles (re-forecasts) to force the mass balance component of the Open Global Glacier Model (OGGM). This method is applied to 254 reference glaciers, distributed throughout 17 of the 19 Randolph Glacier Inventory (RGI) regions. The re-forecasts are initialized in 1960 and 1980 and bias corrected to the glacier scale. The following statistical analysis then gives a good indication of the skill of climate re-forecasts in mass balance modelling on this glacier atypical time scale.