

EGU2020-12802

<https://doi.org/10.5194/egusphere-egu2020-12802>

EGU General Assembly 2020

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## Identifying the the key factors of uncertainty in Helheim Glacier's response to climate change

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Helheim Glacier is one of the largest glaciers in Greenland and, despite its importance, remains poorly understood. While this glacier has been relatively stable in the 1980s and 1990s, its terminus retreated dramatically by 6 km between 2001 and 2005. By 2006, the glacier stopped thinning, slowed down, and re-advanced 4 km and has been stable since 2007. Helheim is today the third fastest glacier of Greenland, reaching speeds  $>7$  km/a, and drains a surface area of 50,000 km<sup>2</sup>. It is not clear how this glacier will change over the coming century and if another episode of exceptional retreat will occur in the very near future. We construct here a large ensemble of simulations of Helheim glacier over the next century, using a numerical model that includes a dynamic ice front forced by oceanic and atmospheric scenarios. This large ensemble allows to quantify the uncertainty in future retreat and mass loss, and also to attribute the fraction of mass loss uncertainty due to poorly constrained model parameters using main-effect Sobol indices for each input variable. This work helps determine the processes that affect projections the most and provide error bars on model projections.