Geophysical Research Abstracts
Vol. 13, EGU2011-8584, 2011
EGU General Assembly 2011

Modelling the retreat of Great Aletschgletscher in a changing climate

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We address the future evolution of Great Aletschgletscher, Switzerland – the largest glacier in the European Alps. A three dimensional surface mass balance and ice flow model is applied. The ice flow dynamics are described using the full Stokes model. The glacier surface is obtained by solving a transport equation for the volume of fluid. Daily surface melt and accumulation are calculated via climate data. The combined model is validated against several types of measurements throughout the 20th century. For future climate change, scenarios based on regional climate models in the ENSEMBLES project are used. According to the median climatic evolution, Aletschgletscher is expected to lose 90 % of its ice volume. However, also when the model is driven with current climate conditions (last two decades) the glacier tongue experiences a considerable retreat of 6 km indicating its strong disequilibrium with present climate. By including a model for the evolution of supraglacial debris and its reducing effect on glacier melt, we show that this factor could significantly slow down future glacier retreat.