



Testing the consistency between changes in simulated climate and European glacier length over the past millennium

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It is standard to compare climate model results covering the past millennium and reconstructions based on various archives in order to test the ability of models to reproduce the observed climate variability. Up to now, glacier length fluctuations have not been used systematically in this framework while it offers information on multi-decadal to centennial variations complementary to other records. One reason is that glacier length depends on several factors and so cannot be simply linked to simulated climate. However, climate model skill can be evaluated by comparing the glacier length provided by a global glacier model driven by the simulated temperature and precipitation to observations. This is done here using the version 1.0 of Open Global Glacier Model (OGGM) forced by fields derived from a range of simulations with global climate models over the past millennium. The model is applied to a set of European glaciers for which observations covers at least the 20th century. Sensitivity experiments are performed to estimate the uncertainty that can be related to the glacier model itself compared to the one that is due to the forcing derived from the climate model. These experiments show that the initialisation of the glaciers in 850 CE and the parameter needed to compute ice dynamics have only a marginal effect on the simulated glacier length fluctuations. Results are more sensitive to key parameters in the surface mass balance model and to the way climate model biases are taken into account. Additionally, simulated glacier length fluctuations are strongly influenced by the internal variability on the system, putting strong constraints on the model-data comparison methodology.