SIMULATION OF THE FENNOSCANDIAN ICE SHEET DURING THE LAST GLACIATION USING A HIGH-RESOLUTION ICE SHEET MODEL

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The aim is to explore the envelope of physically realistic scenarios that can account for the behaviour of the linked ice-earth-climate system controlling the Fennoscandian Ice Sheet during the last glacial cycle. We attempt to integrate three strands of knowledge: the varying extent of the ice sheet in time derived from the geological record; the isostatic rebound history of the region; and fully coupled model reconstructions of the ice sheet and lithosphere. Simulations of the Fennoscandian ice sheet during the last ice age (120ka BP to present) are carried out using a high-resolution thermo-mechanical ice sheet model fully-coupled to a separate isostatic adjustment model. The Earth is approximated by a thin elastic plate (the lithosphere) above a relaxed half space (the mantle). The model predicts thermal conditions at the ice base, the location and magnitude of ice streams and overall flow patterns. We hypothesise that the four variables most influencing the form of the modelled ice sheet in time are, the ice rheology, the basal boundary condition, the effective lithospheric thickness and the climatic signal. Given that these controlling parameters are not well known, we consider the range of compatible situations that might best account for ice sheet behaviour as we know it. The ice sheet is initially driven with estimated values for ice rheology, effective lithospheric thickness and basal sliding and uses climate functions constructed from palaeoclimatological proxy data. The initial climate forcing is then adjusted using an inverse procedure such that the forcing signal is altered to produce modelled glacial limits that match those reconstructed from geological data. Keeping this climate signal fixed we then explore the sensitivity of the ice form to the other parameters with reference to the reasonableness of the modelled reconstructions produced.