



CONSTRAINING THE EVOLUTION OF A DYNAMIC 3D THERMO-MECHANICAL ICE SHEET MODEL USING RELATIVE SEA LEVEL RECORDS

M. Hagdorn and G. Boulton

Department of Geology and Geophysics, The University of Edinburgh, Edinburgh, EH9 3JW,
UK (Magnus.Hagdorn@glg.ed.ac.uk)

Computer simulations of past ice sheets can be treated with increased confidence if they can be favourably compared with different strands of independent data.

The aim of this research is, therefore, to derive a methodology, that compares relative sea level records with simulations of past sea level that result from modelling past ice sheets with a dynamic, high-resolution thermo-mechanical ice sheet model coupled to an isostatic adjustment model.

Relative sea level during the Quaternary is mainly affected by a) changes of water volume (sea water is stored in/released from ice sheets) and b) isostatic adjustment of the lithosphere due to changing surface loads. The ice sheet model is driven by a climatic forcing function determined so that the simulated ice sheet resembles the past ice sheet as reconstructed from geomorphological evidence. The Earth is approximated by a thin elastic plate (the lithosphere) above a relaxed half space (the mantle). Changes in water volume are derived from a global sea level curve and enter the model as a forcing function.

This coupled ice sheet/isostatic rebound model is used to simulate the evolution of the Fennoscandian ice sheet during the last glacial cycle. Relative sea levels calculated by the simulation are compared to relative sea level records.

This comparison provides an important constraint on the thickness of past ice sheets which is otherwise rarely available. Mismatches of the simulation with the relative sea level data indicate shortcomings of the model forcing. However, this approach illustrates the benefit of using a model coupling realistic ice physics to a realistic Earth

model to help constrain unknowns of Earth rheology and ice thickness. Ultimately, relative sea level data together with other strands of data, such as geomorphological evidence, and a coupled ice sheet/isostatic rebound model can be used to infer past climates.