



A mass balance model for the Eurasian Ice Sheet for the last 120,000 years

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The simulation of ice sheets throughout ice ages is very sensitive to the description of past climate conditions, and their conversion into ice melt or accumulation, i.e. mass balance. GCM experiments for LGM, such as performed in the Paleoclimate Modelling Intercomparison Project (PMIP1,2), provide information on climate changes during the ice ages. Nevertheless, there are some severe drawbacks. A major issue is the sensitivity of precipitation and surface temperatures to the ice distribution used in the GCM. Also, local precipitation and temperature are not well resolved in areas such as Norway where the topography is variable and the land-sea contrast large. Interpolation between time slices is difficult, and so interactive coupling with an ice sheet model is necessary. We present a mass balance model for Eurasia which is based on the calculation of accumulation from a moisture balance concept. The model is used as forcing for a dynamical ice model. The precipitation model is tuned to present day conditions only, and otherwise evolves freely together with the ice sheet. As such, the model is ideally suited for sensitivity experiments for important components in the climate system. The model is forced with 500 hPa temperatures from GCM time slices at LGM and present day. The model simulates key characteristics, such as control on the size of ice sheets through the advection of moisture, asymmetric ice sheets due to advection of moisture and orography, and the drying of ice sheets as they grow. A simulation of the Eurasian ice sheet through a full glacial cycle shows that the model reproduces realistic ice sheets that compare well with geomorphological data. During the Middle Weichselian and the Late Weichselian, the model accurately simulates the Scandinavian part of the ice growing towards the south and east whilst the ice sheet covering the Barents and Kara Seas remains relatively stable. However, the model

seriously underestimates the observed ice extent in the Baltic area.