EGU2020-18683, updated on 07 Jul 2022
https://doi.org/10.5194/egusphere-egu2020-18683
EGU General Assembly 2020

Modelling the surface mass balance of the Greenland Ice Sheet from 6000 BP to the year 2200

Uta Krebs-Kanzow, Shan Xu, Hu Yang, Paul Gierz, and Gerrit Lohmann
AWI Bremerhaven, paleo climate dynamics, Schiffdorf, Germany (uta.krebs-kanzow@awi.de)

The surface mass balance scheme dEBM (diurnal Energy Balance Model) provides a novel interface between atmosphere and land ice for Earth System modelling, which is based on the energy balance of glaciated surfaces. In contrast to empirical schemes, dEBM accounts for changes in the Earth's orbit and atmospheric composition. The scheme only requires monthly atmospheric forcing (precipitation, temperature, shortwave and longwave radiation and cloud cover) and is computationally inexpensive, which makes it particularly suitable to investigate the response of ice sheets to long term climate change.
Here, we analyze the surface mass balance of the Greenland Ice Sheet (GrIS) based on a climate simulation which covers the last 6000 years and a climate projection which extends to the year 2200. We validate our results with recent surface mass balance estimates from observations and regional modelling. Our model results allow to compare two distinctly different warm periods: the Mid Holocene (approx. 6000 years before present), which is characterized by intensified summer insolation, and the next centuries, which will be characterized by reduced outgoing long wave radiation. We also investigate whether the temperature - melt relationship, as used in empirical schemes, remains stable under changing insolation and atmospheric composition.

Krebs-Kanzow, U., Gierz, P., & Lohmann, G. (2018). Brief communication: An ice surface melt scheme including the diurnal cycle of solar radiation. The Cryosphere, 12(12), 3923-3930.