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GLAC-1b: A new data-constrained global deglacial ice sheet reconstruction from glaciological modelling and the challenge of missing ice

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I will present a new global ice-sheet reconstruction for the last deglaciation. Unlike other global deglacial chronologies, GLAC-1b includes a posterior distribution of deglacial chronologies (currently for the three largest ice sheets) relative to observational constraints. As such, confidence intervals can be defined. The Eurasian and North American components are from recently completed Bayesian calibrations of the 3D MUN glacial systems model (GSM), while the Antarctic component is from an initial scored ensemble of 2929 runs with the MUN/PSU GSM. Both versions of the GSM include thermo-mechanically coupled glaciological ice-sheet models, visco-elastic bedrock response with the VM5a earth rheology, various climate representations, and a range of components to enable comparison of model output against observational records. The calibration and scoring is against a diverse and large set of constraint data, include relative sea level (RSL), marine limits, strandline elevations, present day rates of uplift, and the current configuration of the Antarctic ice sheet. The Greenland chronology is from an earlier glaciological model hand-tuned against RSL data.

An ongoing issue is an apparent shortfall of at least 10 m eustatic sea-level equivalent when model results are compared against far-field RSL datasets. Such a shortfall is not new. An examination of the evolution of past geophysically-constrained global deglacial ice sheet and ice load reconstructions will reveal a reliance of sticking extra ice where there's no data in order to fit far-field constraints. As new data has arisen, this extra ice load as been sequentially shifted to new regions. I will describe the key observational and physical constraints that limit continental ice volumes in GLAC-1b, and finish with a few ideas of how this shortfall may be resolved.