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Quantifying past ice sheet evolution uncertainty through Bayesian calibration of glacial models

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Reconstructions of past Earth system evolution that lack uncertainty estimates have zero information content. We generally compensate for the lack of explicit uncertainty estimates with our own interpretations. For complex environmental systems, such implicit uncertainty assessments can be quite divergent and heavily dependant on individual expertise, an unsatisfactory situation. Scientific understanding will progress much faster if uncertainties are clearly quantified, enabling the determination of rigorous probability distributions for past glacial evolution.

Through concrete examples of the major ice sheets from the last deglaciation, I will outline the key issues that must be addressed and describe an evolving Bayesian approach to generating posterior probability distributions for deglacial evolution. Invariably this involves the merging of observational data and modelling. I therefore offer suggestions of how both the data-gathering and modelling communities can better aid each other and cooperate to improve our collective window on the past. Emphasis will also be placed on ongoing challenges, especially in quantifying structural uncertainties in the model system and improving the representation of climate in large ensemble glaciological modelling of ice-sheets over a glacial cycle.