The interaction of context and structural uncertainty in ice sheet modeling

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As indicated by this session's title, there is a call (scream?) to improve glaciological models for the purposes of century-scale sea level rise (SLR) prediction. Fully characterizing the uncertainty associated with these predictions is a daunting, and essentially impossible, task. Yet the effort is worthwhile, because policy tools employed in SLR assessment may differ depending on the nature and magnitude of model uncertainty. For policy makers, methodologies to cope with pervasive structural uncertainty may include imprecise probabilities [Kreigler et al. 2009], scenario-based [Betz 2007], and "robust" approaches [Lempert et al., 2004]; these policy tools may in turn influence the choice of scientific models used in risk assessment.

One existing typology [Walker et al., 2003] employs three criteria to characterize uncertainty in model-based risk assessment: its location, level, and nature. In this presentation, we suggest how SLR projections derived from glaciological models might be characterized by this typology, highlighting uncertainty introduced in the bounds of the analysis ("context uncertainty"). Historically, subjective bounds have resulted in the ignorance of key processes or have focused attention on regions that may be less vulnerable to rapid ice loss.

Context and model uncertainty often exhibit tradeoffs that hinder uncertainty analysis and aggregation. This interaction mandates that both end users (policymakers) and model developers (scientists) recognize the assumptions and boundaries of an assessment. It also implies that any one modeling framework is likely to be limited. Model hierarchies similar to those employed in climate assessment may offer a path forward, yet there remain difficulties in developing appropriate "reduced" ice sheet models.

References:

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