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An expert judgement assessment of future sea level rise from the ice sheets

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A major gap in predictive capability concerning the future evolution of the ice sheets was identified in the Fourth Assessment Report of the IPCC (AR4). As a consequence, it has been suggested that the AR4 estimates of future sea level rise (SLR) from this source may have been underestimated. Various approaches for addressing this problem have been tried in addition to improving deterministic model ice sheet model skill. These include, for example semi-empirical models and conceptual studies of kinematic limits to mass loss. Here, we report a formalized pooling of expert views on uncertainties in future ice sheet contributions using a structured elicitation approach. A novel aspect of this study was that it was repeated after two years to assess the robustness and repeatability of the findings. In addition, we use a rigorous weighting approach of the expert assessments, similar to Bayesian calibration of GCMs.

We find that the median estimate of the combined ice sheet contributions is 29 cm - substantially larger than in the AR4 - while the upper 95th percentile value is 84 cm, implying a conceivable risk of a sea level rise of greater than a metre by 2100. Our results are smaller than from semi empirical approaches but substantially larger than most recent simulations using deterministic ice sheet models. We also find, not surprisingly, that the PDFs for each ice sheet, particularly for West Antarctica, a non-Gaussian, with long upper tails, implying a conceivable risk of partial disintegration of the WAIS during the 21st Century. Interestingly, the probability of this occurring increased between the first and second assessment. On the critical question of whether recent ice sheet behaviour is due to variability in the ice sheet - climate system or reflects a long-term trend, expert opinion is shown to be both very uncertain and undecided.