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Commitments to future retreat of Antarctic and Greenland ice sheets

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The agreement reached at the COP21 United Nations Conference on Climate Change is aimed at limiting future increases in global mean temperature below 2ºC. Here, we use a continental ice sheet/shelf model with new treatments of meltwater-enhanced calving (hydrofracturing) and marine terminating ice-cliffs, to explore future commitments to sea-level rise given limits of global mean warming between 1 and 3ºC. In this case, ice-sheet model physics are calibrated against past ice-sheet response to temperatures warmer than today. The ice-sheet model is coupled to highly resolved atmosphere and ocean-model components, with imposed limits on future warming designed to mimic the idealized limits discussed at COP21. Both the short and long-term potential rise in global mean sea level are discussed in light of the range of allowances agreed in Paris. We also explore the sensitivity of Greenland and Antarctic ice sheets to plausible ranges of atmospheric versus ocean warming consistent with global mean temperatures between 1 and 3ºC; and the resulting long-term commitments to sea-level rise over the coming centuries and millennia.