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Supplementary Materials for

Combustion of available fossil fuel resources sufficient to eliminate the Antarctic Ice Sheet

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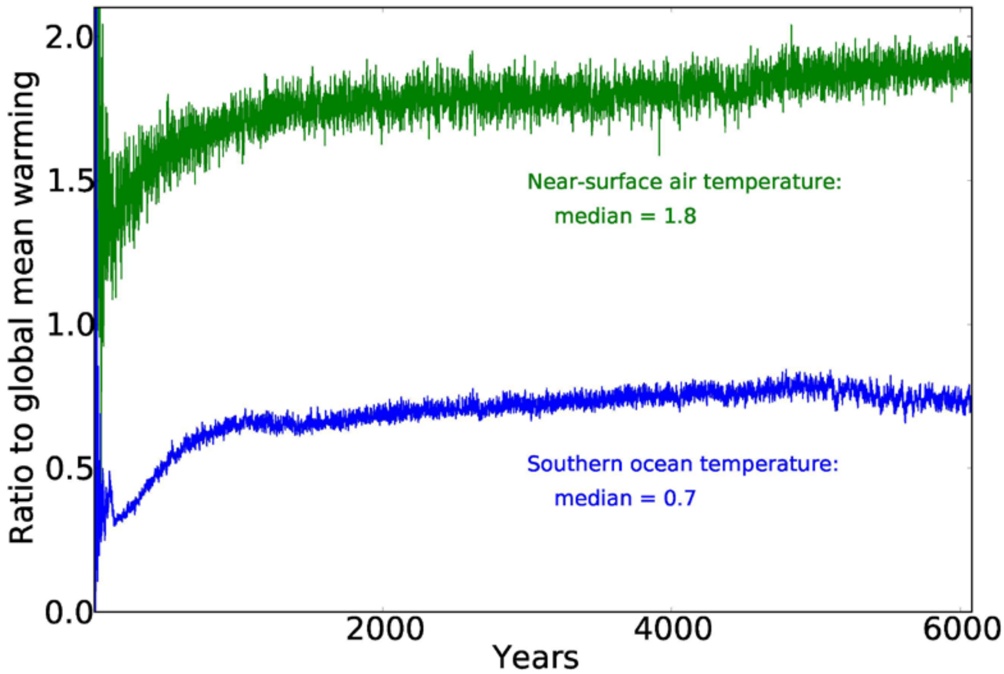

Fig. S1: Surface and ocean warming in Antarctica. Shown are the long-term evolution of the ratios of the surface (green) and ocean (blue) warming in the region South of 66°S to the global mean temperature change, based on simulations with the coupled climate model ECHAM5/MPIOM for a CO_2 quadrupling scenario *(21)*. The ratios with median values of 1.8 and 0.7, respectively, are used to scale the global mean temperature timeseries (see Fig.1c).

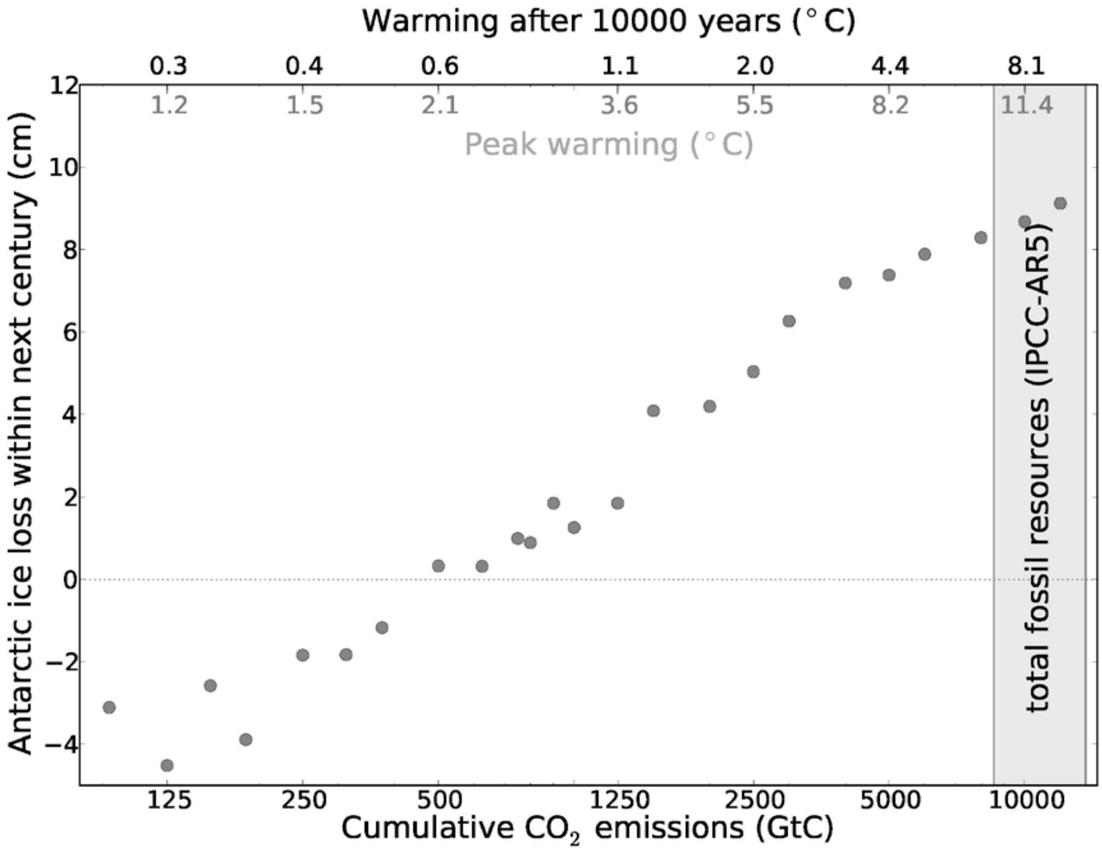

Fig. S2: Sea-level change within the next century. Given is the ice volume change from Antarctica in meters sea-level equivalent within the 21st century. The values are consistent with the IPCC-AR5 projections for the Antarctic Ice Sheet which range from -6 to 14 cm within the 21st century. For each scenario, the maximum temperature anomaly and the temperature anomaly after 10 000 years are given on the upper x-axis. See Fig. S5 for the respective ice loss after 300, 1000, 3000 and 10 000 years.

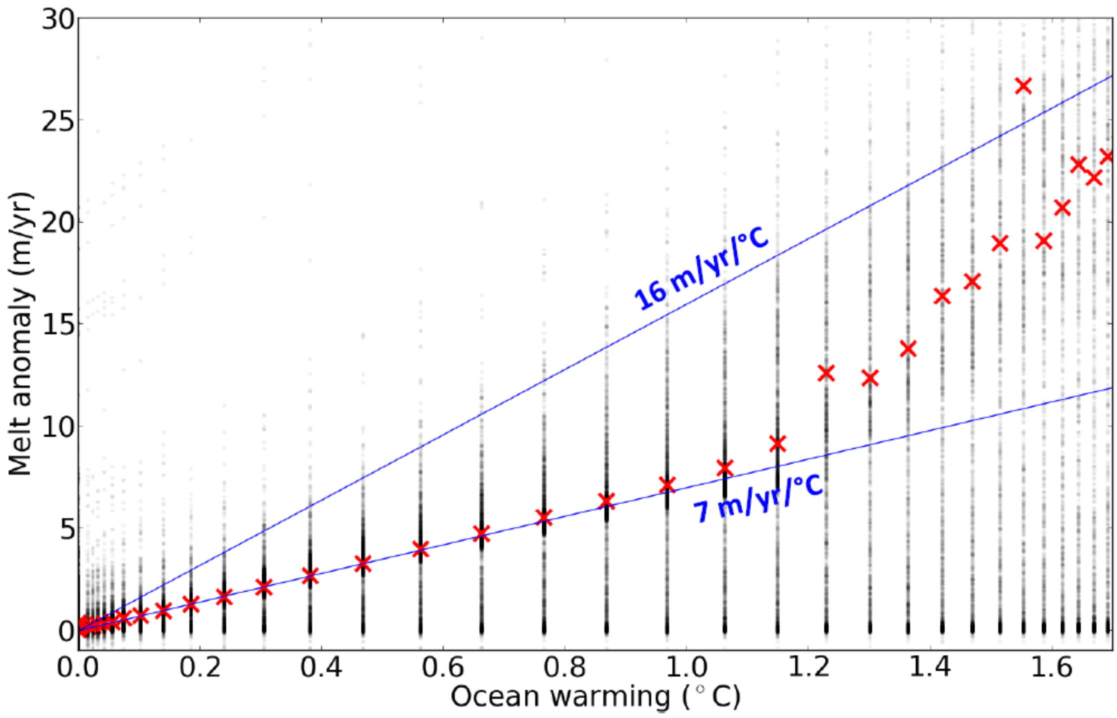

Fig. S3: Sub-shelf melt sensitivity. Shown is the simulated increase in sub-shelf melting with respect to the temperature anomaly employed in the Southern Ocean in the 1250 GtC scenario. Mean values are depicted by red crosses. The observed range of 7 to 16 m yr^{-1} $°C^{-1}$ *(24,25)* is shown in blue. Towards higher warming levels, most of the ice shelves have retreated significantly, so that the mean values are taken over a few grid cells of very thick ice and the melt sensitivity increases beyond the observed range.

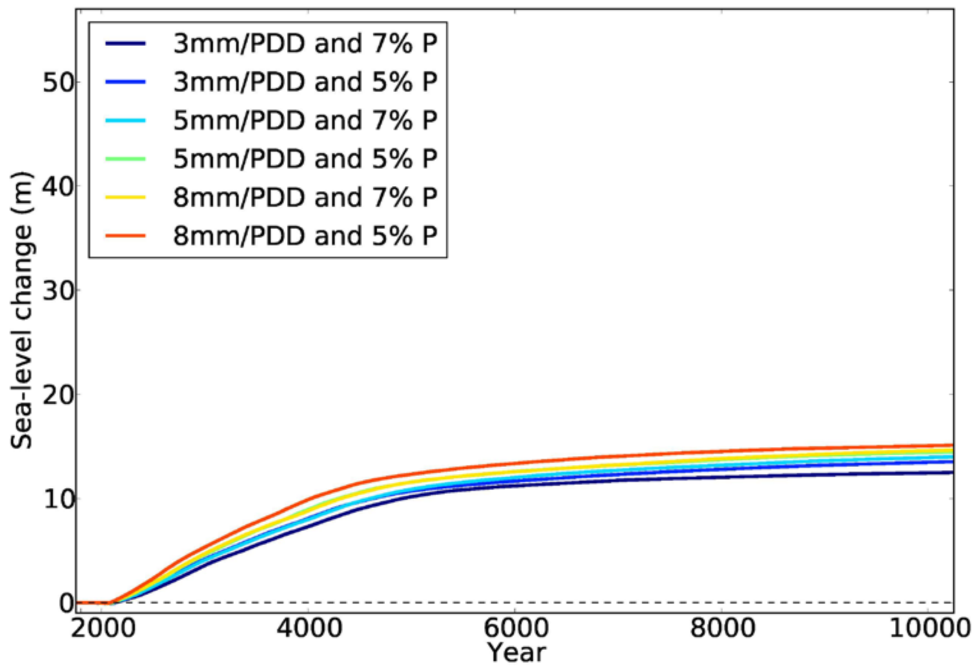

Fig. S4: Sensitivity to climate parameters. The sensitivity of the projected ice loss to the two most important climate parameters in PISM is explored: The positive degree day (PDD) factor determines, how much additional surface melt can be expected for a day with temperatures above freezing *(32)*. Literature values range from 3 mm/PDD to 8 mm/PDD *(33)*. In PISM, the precipitation rate depends directly on the temperature. Recent results from ice core data as well as regional and global climate models suggest that the increase in accumulation can be well-approximated by assuming a linear relation to the temperature anomaly, with factors between 5 and 7% per degree of warming *(23)*. For each combination of positive-degree day factor and percental increase in accumulation, the ice loss is shown (for the 1250 GtC scenario). The resulting uncertainty range is also depicted by error bars in Fig. 2.

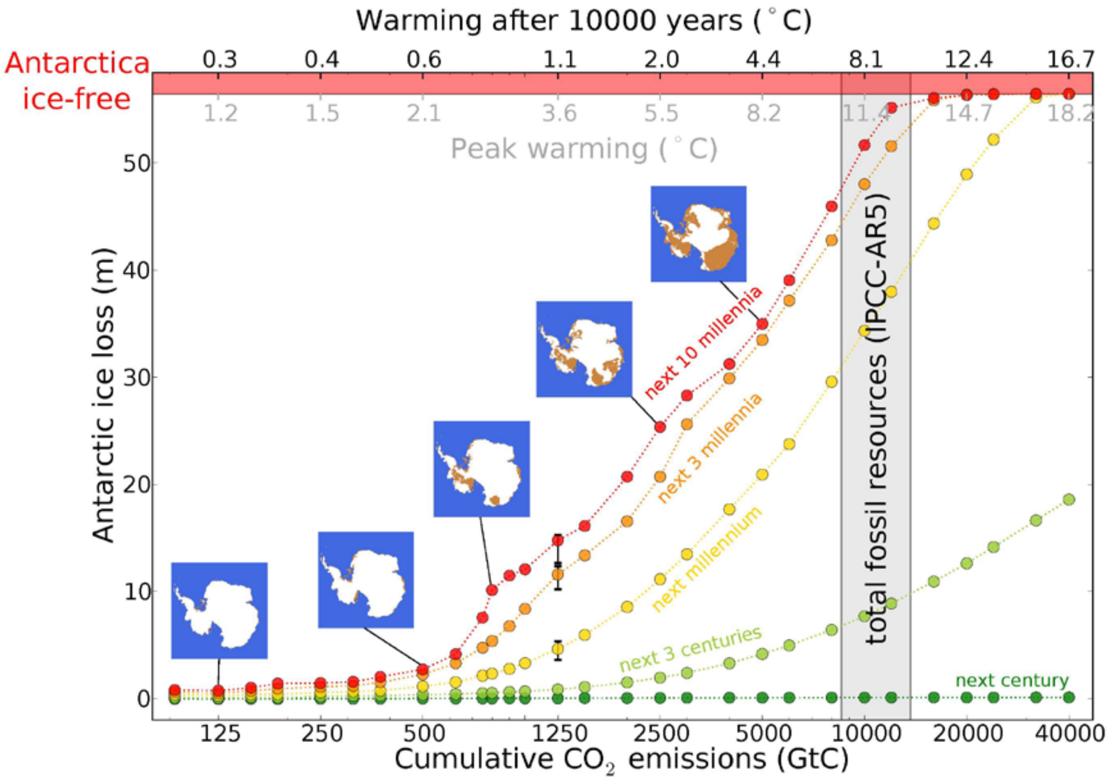

Fig. S5: Sea-level commitment from Antarctic ice loss. Given is the total sea-level change after 100 years (green), 300 years (light green), 1000 years (yellow), 3000 years (orange) and 10 000 years (red) after year 2000 for each of the scenarios depicted in Fig. 1. The maximum temperature anomaly and the temperature anomaly after 10 000 years are given on the upper x-axis. If all of the currently attainable carbon resources (estimated to be between 8500 and 13 600 GtC *(4)*) were burned, the Antarctic Ice Sheet would lose most of its mass, raising global sea-level by more than 50 meters. For the 125 GtC as well as the 500 GtC, 800 GtC, 2500 GtC and 5000 GtC scenarios, the ice-covered area is depicted in white (ice-free bedrock in brown).

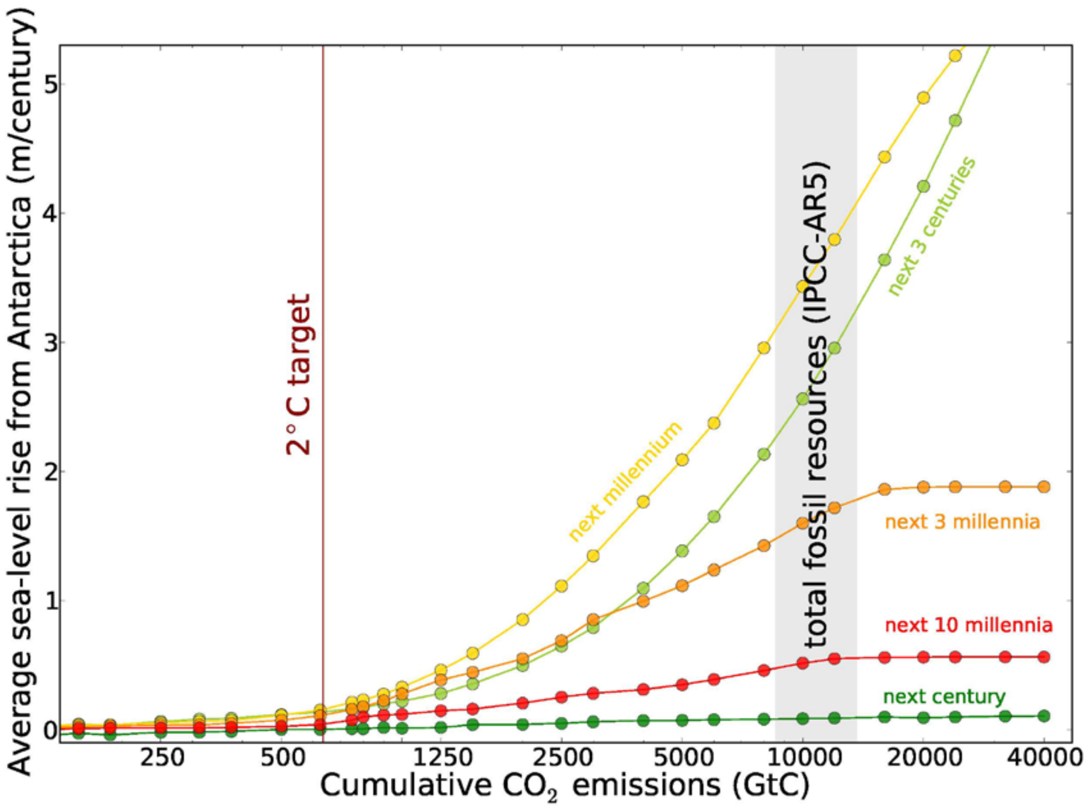

Fig. S6: Rate of sea-level rise. Given is the average rate of sea-level rise for the 21st century (green) and within the next 300 years (light green), 1000 years (yellow), 3000 years (orange) and 10 000 years (red). Between 2010 and 2014, there has been an increase in cumulative emissions of about 40 GtC. To avoid exceeding the 2°C limit, the cumulative emissions need to be restricted to another 600 GtC.