Supplementary Information

Figure SP1: Drainage basins used for the basal melting parameterization

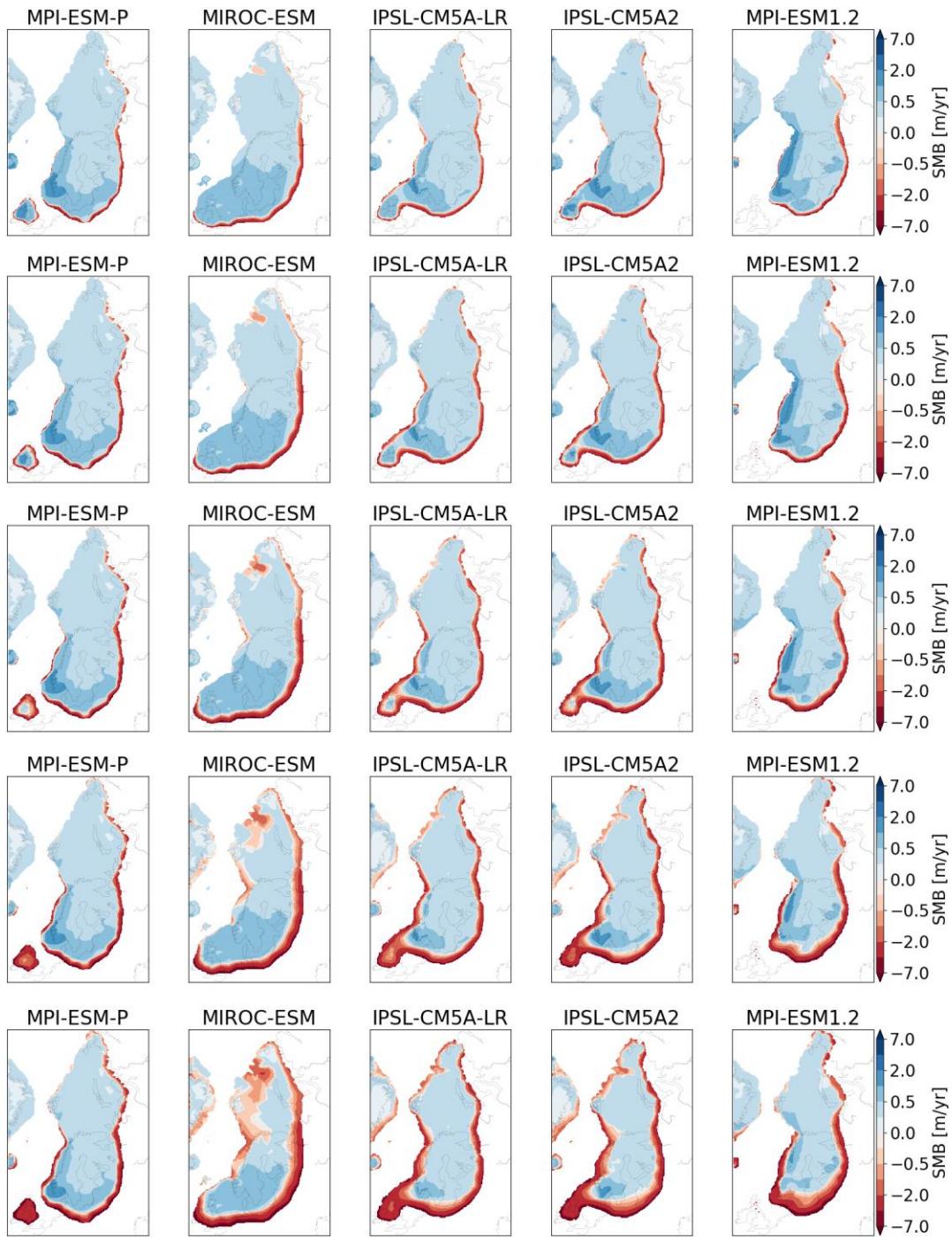



Figure SP2: Surface mass balance calculated with each GCM forcing for 1°C (top) to 5°C (bottom) atmospheric temperature perturbations.

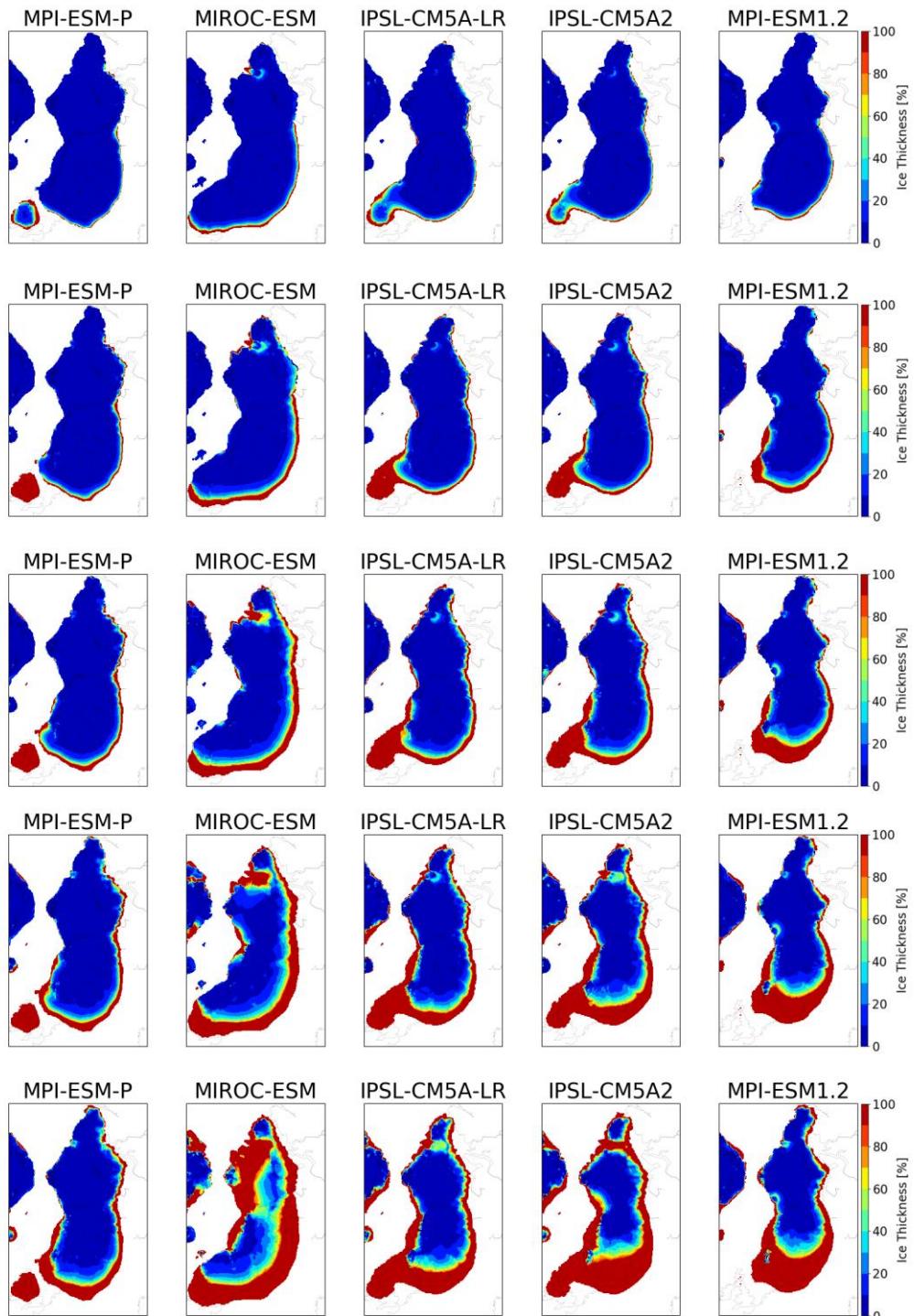
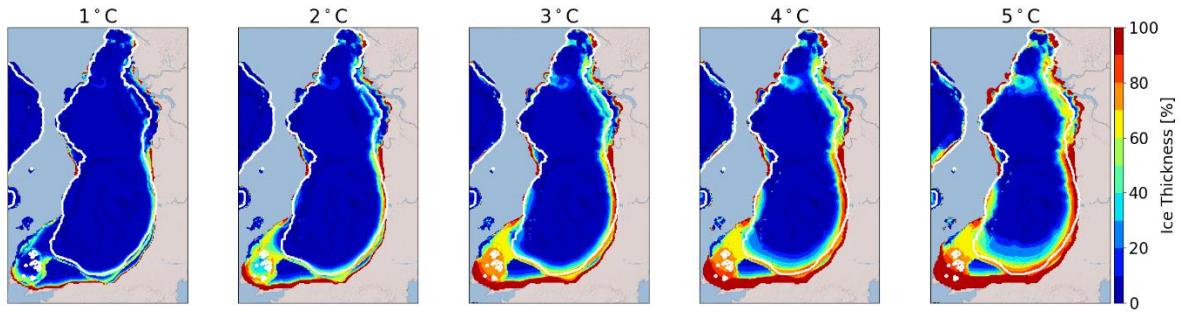



Figure SP3: Ice thickness lost obtained in the EXP1 experiments for each GCM forcing compared to the initial LGM ice sheet for 1°C (top) to 5°C (bottom) atmospheric temperature perturbations.

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31 **Figure SP4:** Multi-model mean of the ice thickness lost after 1000 years compared to the initial ice sheet for the
32 EXP2 experiments. (Red: 100% lost). White line indicates the areas where the multi-model mean is done on the 5
33 models.

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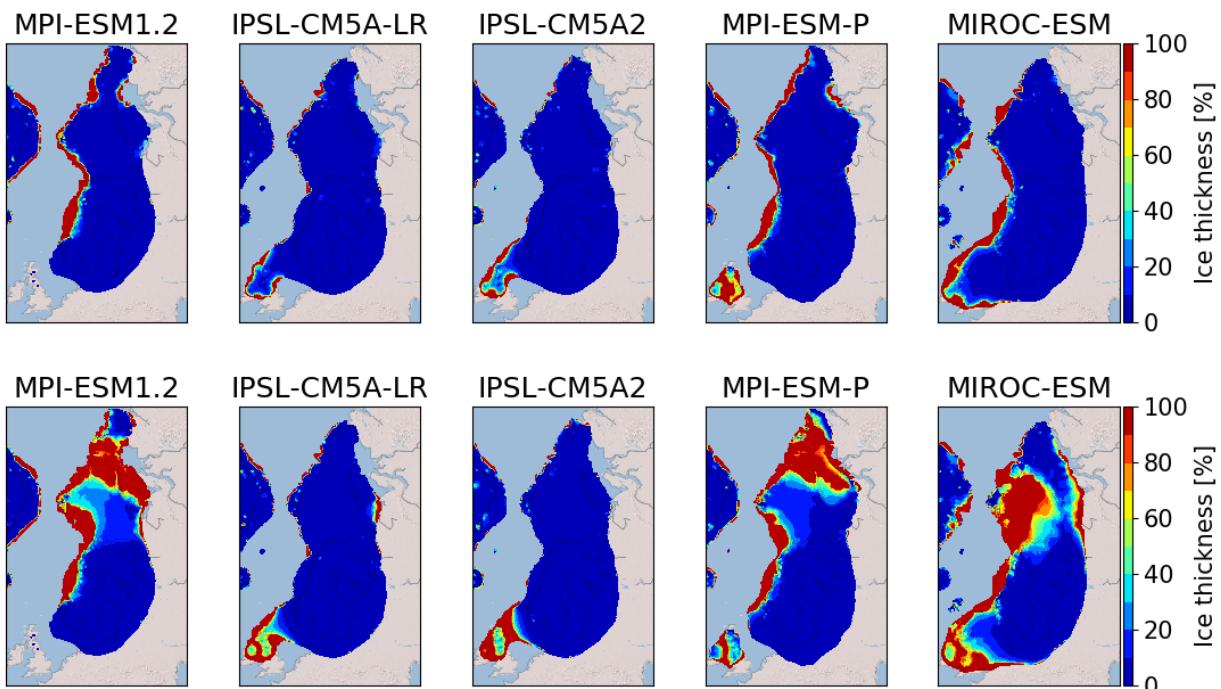
35 **Figure SP5:** Ice thickness lost after 1000 years (top) and 10000 years (bottom) compared to the initial ice sheet
36 for a basal melting perturbation of $Kt = 50$ m $°C^{-1}$ yr^{-1} for each GCM forcing. (Red 100% lost).

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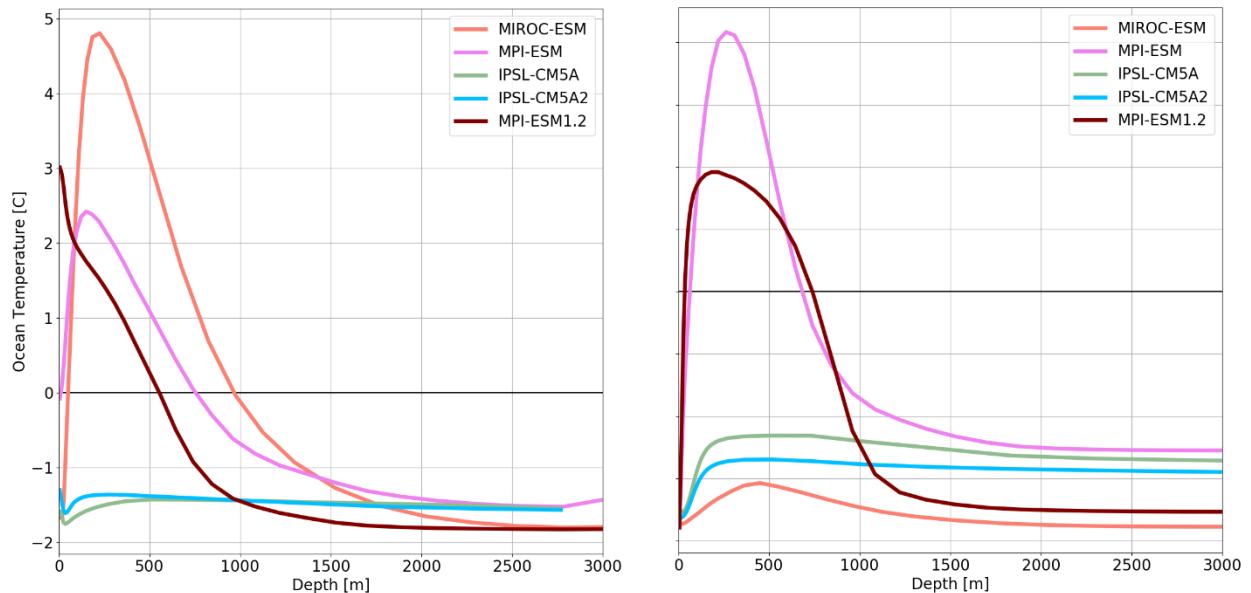
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48 **Figure SP6:** Average ocean temperature in the BJR (left) and SA sectors as a function of ocean depth.

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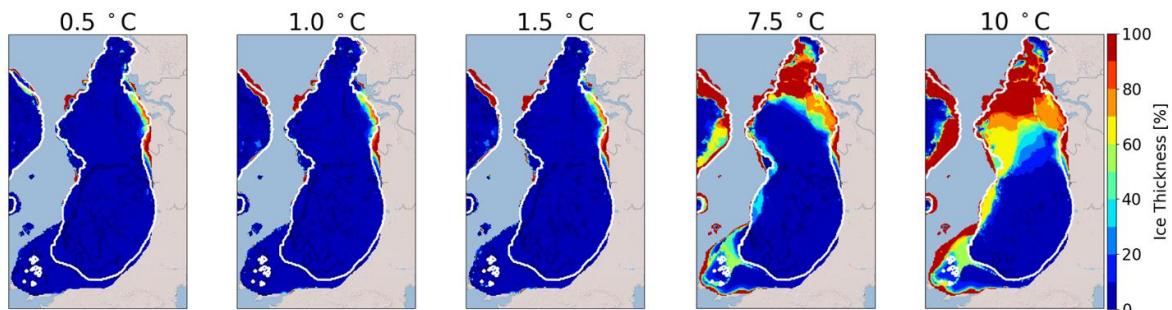
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52 **Figure SP7:** Multi-model mean of the ice thickness lost after 10000 years compared to the initial ice sheet for

53 EXP3.2. (Red: 100% lost). For this experiment, Kt has been fixed to 7 m °C^{-1} yr^{-1}. The white line represents the

54 most credible extent derived from the DATED-1 compilation

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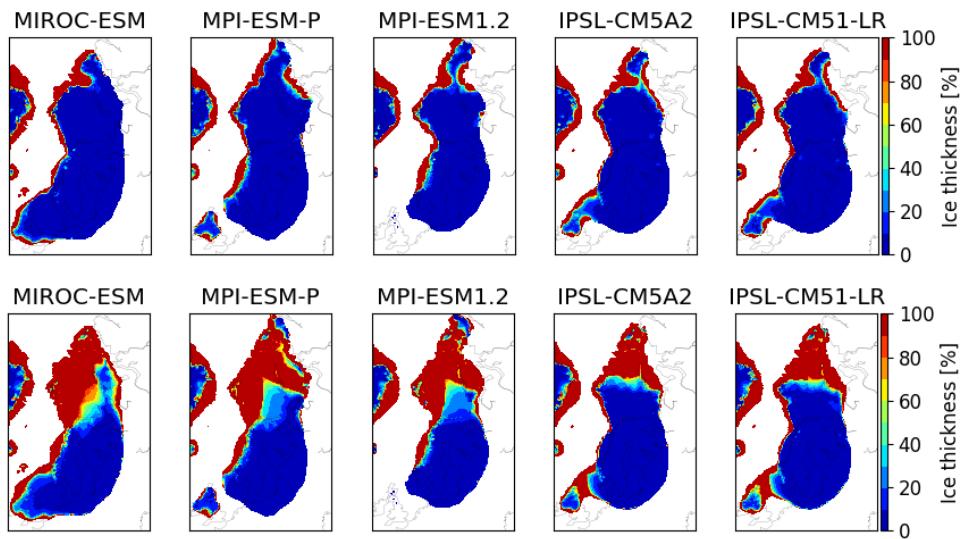
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57 **Figure SP8:** Ice thickness lost after 1000 (top) and 10000 (bottom) model years compared to the initial LGM ice

58 sheet for an oceanic temperature perturbation of 10°C for each GCM forcing. (Red: 100% lost).

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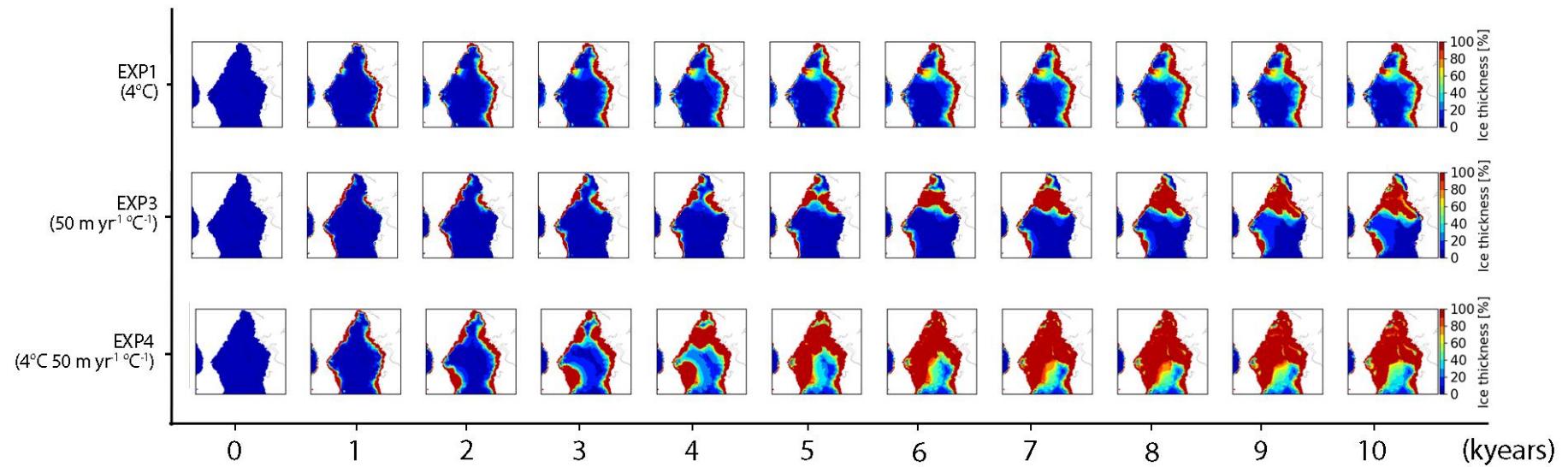
Figure SP9: top/ Ice thickness lost for simulation forced by MPI-ESM-P from 1000 to 10000 years with respect to the ice thickness of the LGM ice-sheet in the EXP1 (4°C) experiment Middle/ same as top/ for EXP3 (50 m °C^{-1} yr^{-1}). Bottom/ same as top for EXP4 (4°C and 50 m °C^{-1} yr^{-1}).
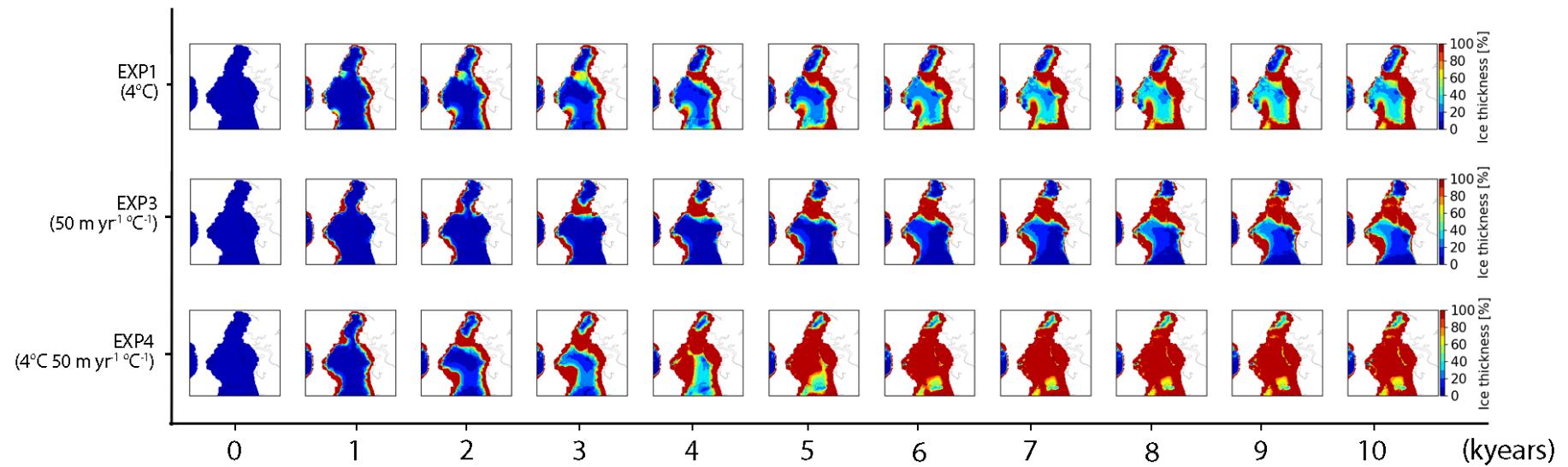
Figure SP10: Same as Figure SP9 for the simulation forced by MPI-ESM1.2
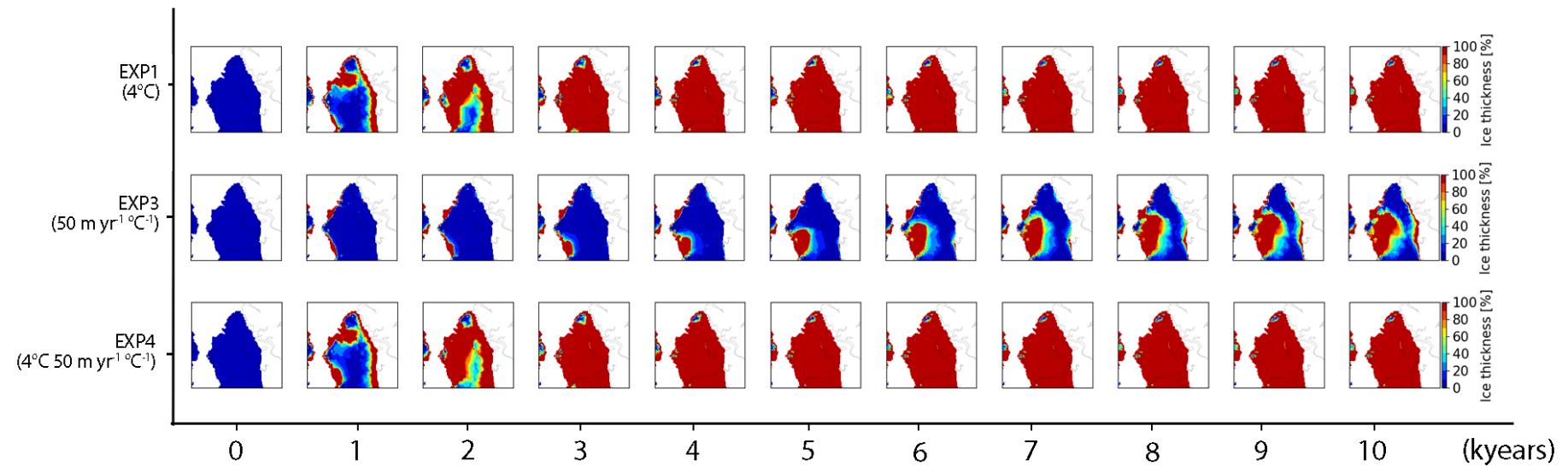
Figure SP11: Same as Figure SP9 for the simulation forced by MIROC-ESM.
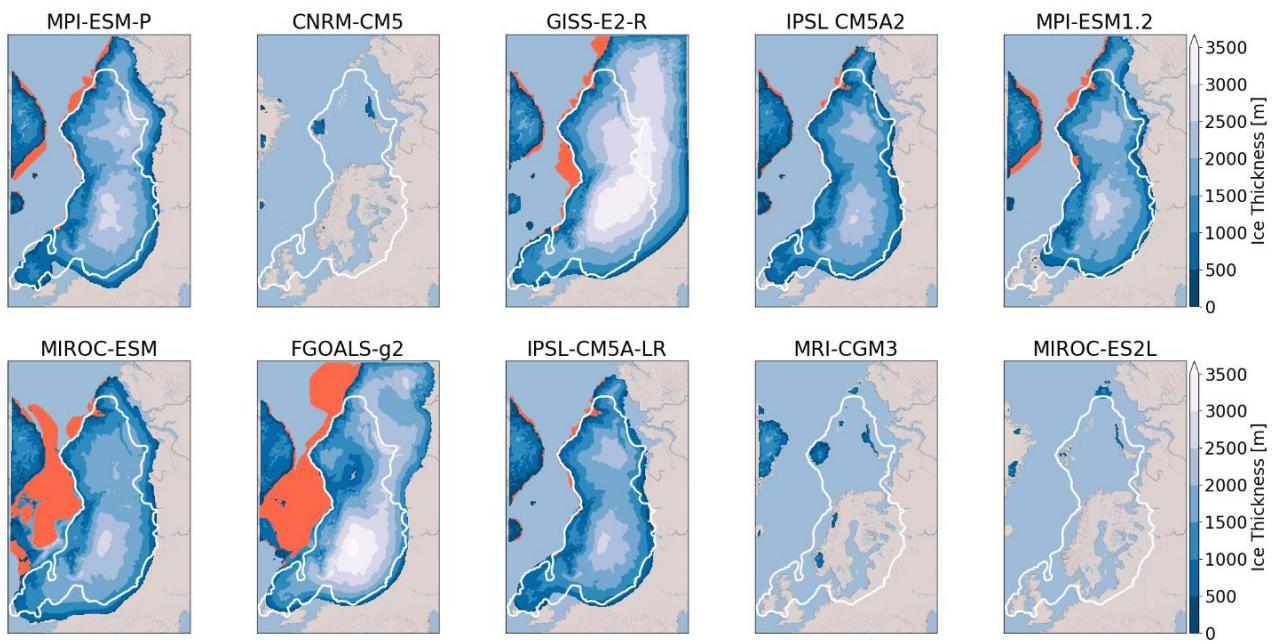
Figure SP12: Ice thickness at the end of the 100,000-year LGM simulation (spin-up) for the different GCMs used as inputs to GRISLI. Basal melting is set to 0.1 m yr^{-1}as in Petrini et al., (2020). The white line is the most credible extent derived from the DATED-1 compilation and the orange areas are the simulated ice shelves.