

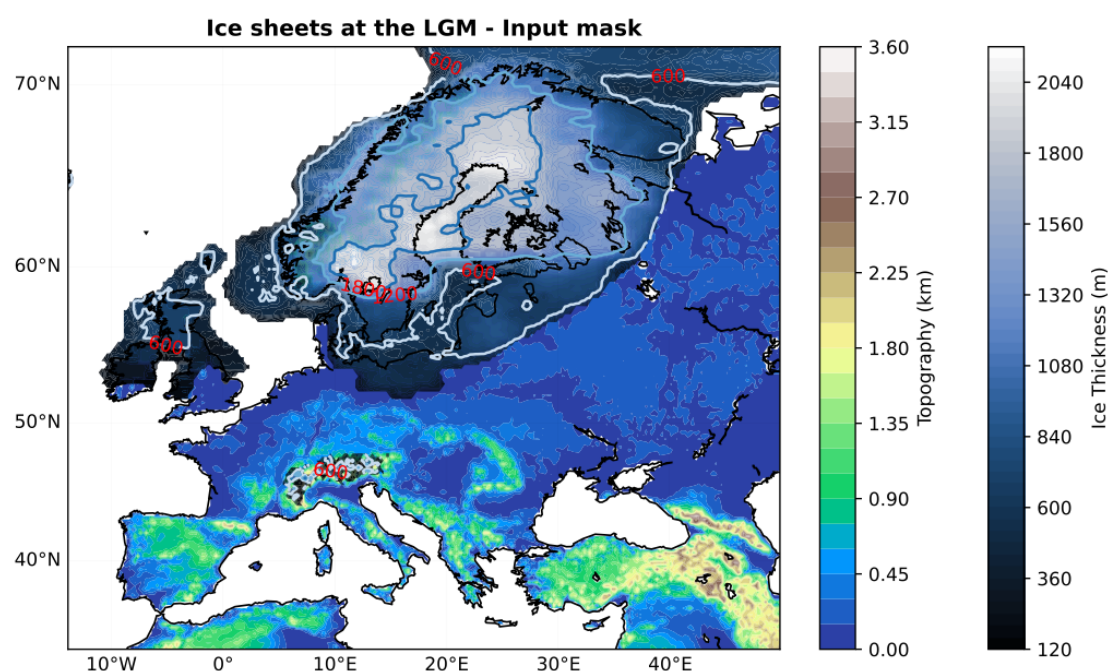


Figure S1. LGM ice mask (described in **Sec. 2.1**) and ice thickness (from [Tarasov et al., 2012](#), [Harmand et al., 2015](#) and [Seguinot et al., 2021](#)) plotted over the PI topography. This data is used as boundary conditions for the downscaling embedded in iLOVECLIM. GCM model outputs and non-downscaled iLOVECLIM outputs are interpolated onto this 0.25°x0.25° grid using a near-neighbour algorithm for inter-model comparison.

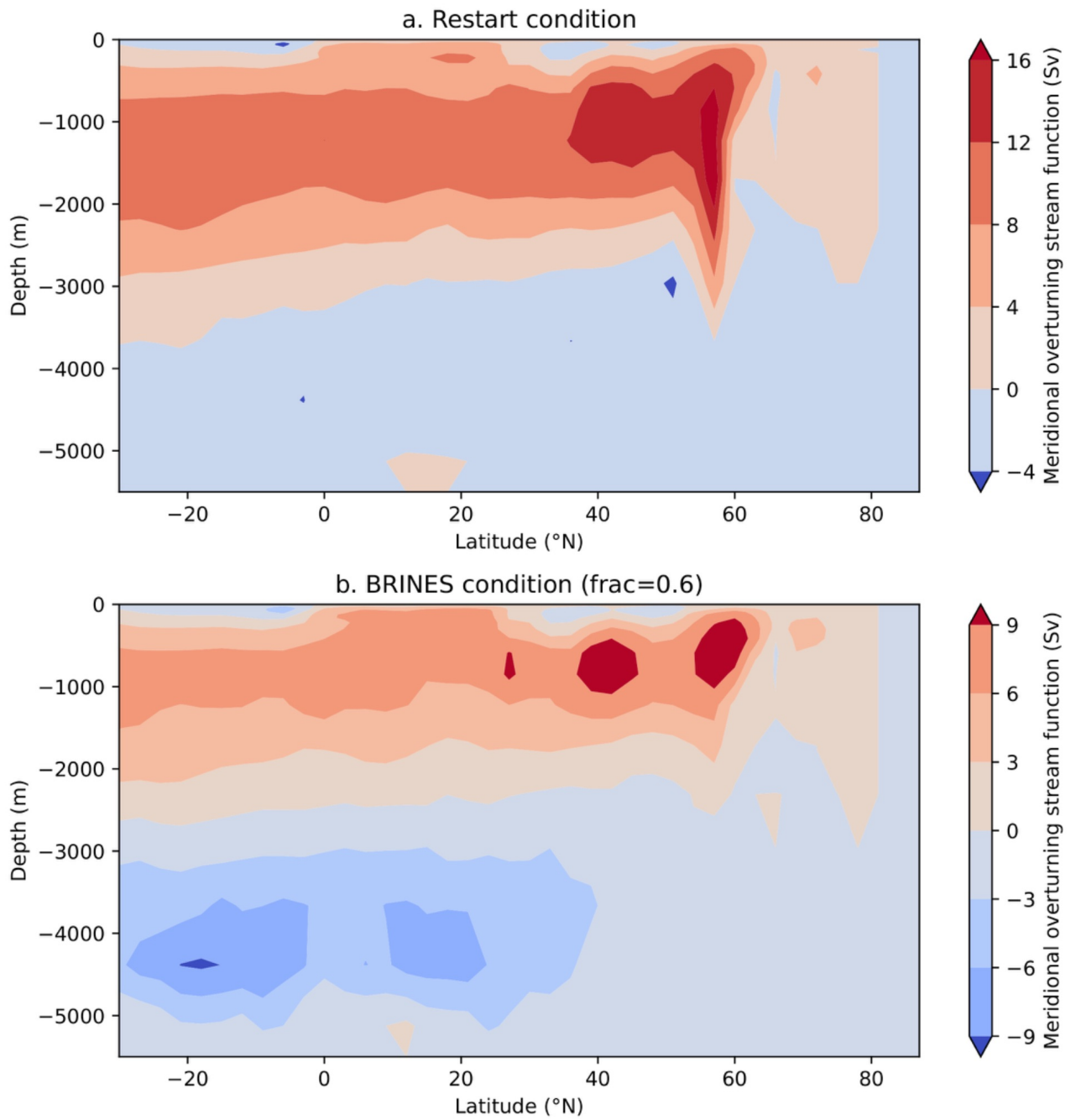


Figure S2. Latitudinal profile of the Atlantic meridional overturning stream function from two configurations: **(a)** restart and **(b)** brines test, using the global annual iLOVECLIM model at the LGM. The original grid resolution of the global outputs is $1.25^{\circ} \times 0.9^{\circ}$.

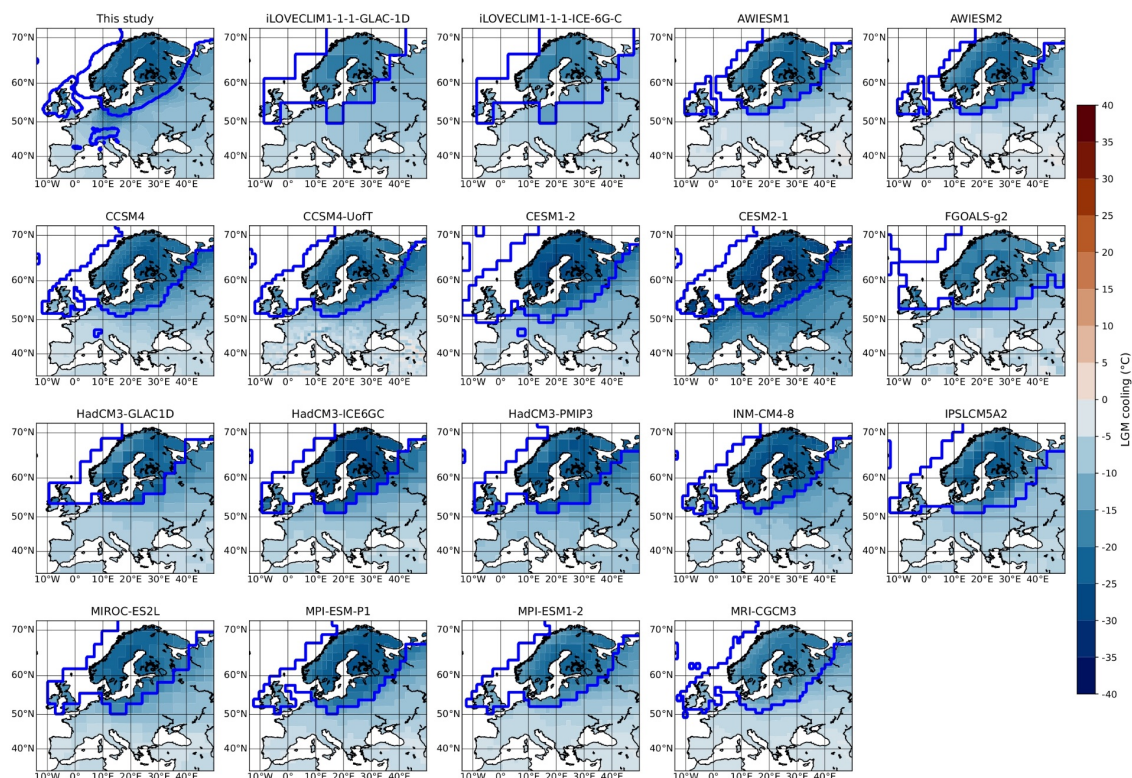
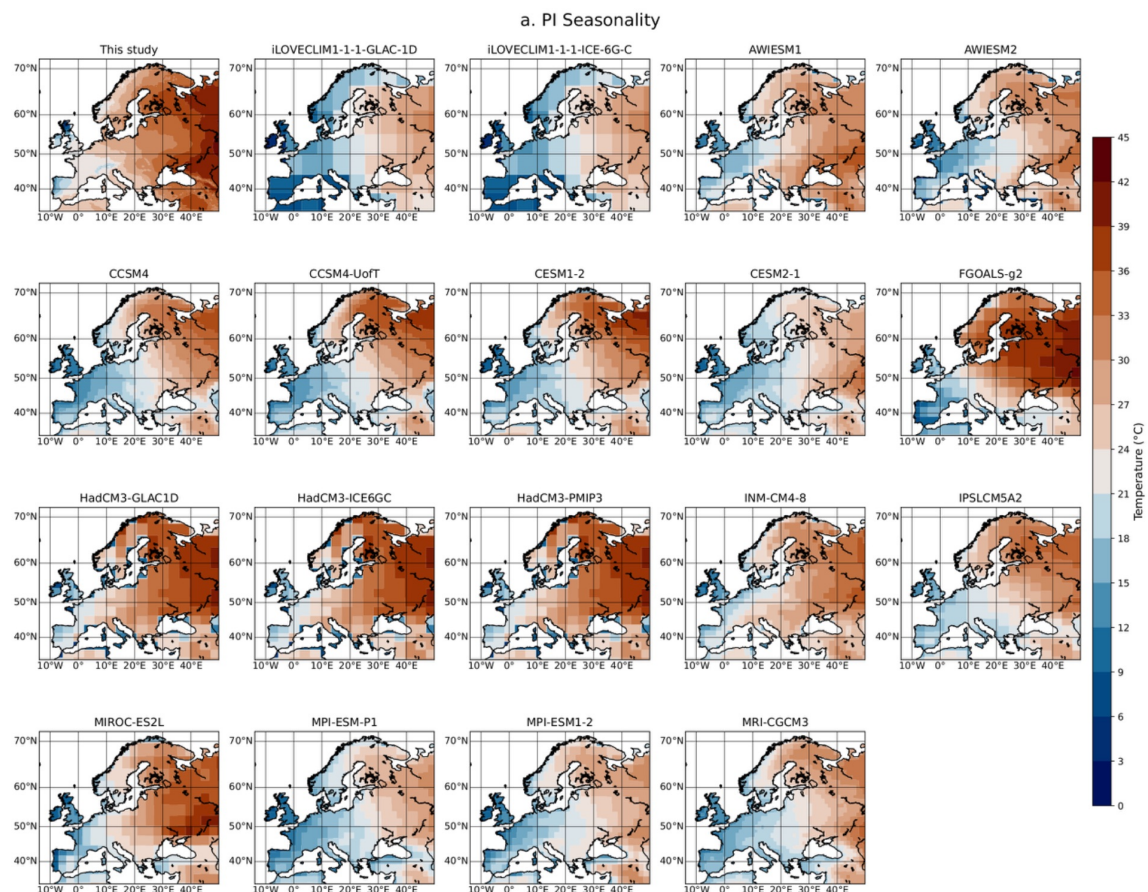


Figure S3. Simulated LGM cooling for the individual models. The blue contour represents their respective ice mask. Color bars have a common range (-40°C to 40°C for LGM cooling).



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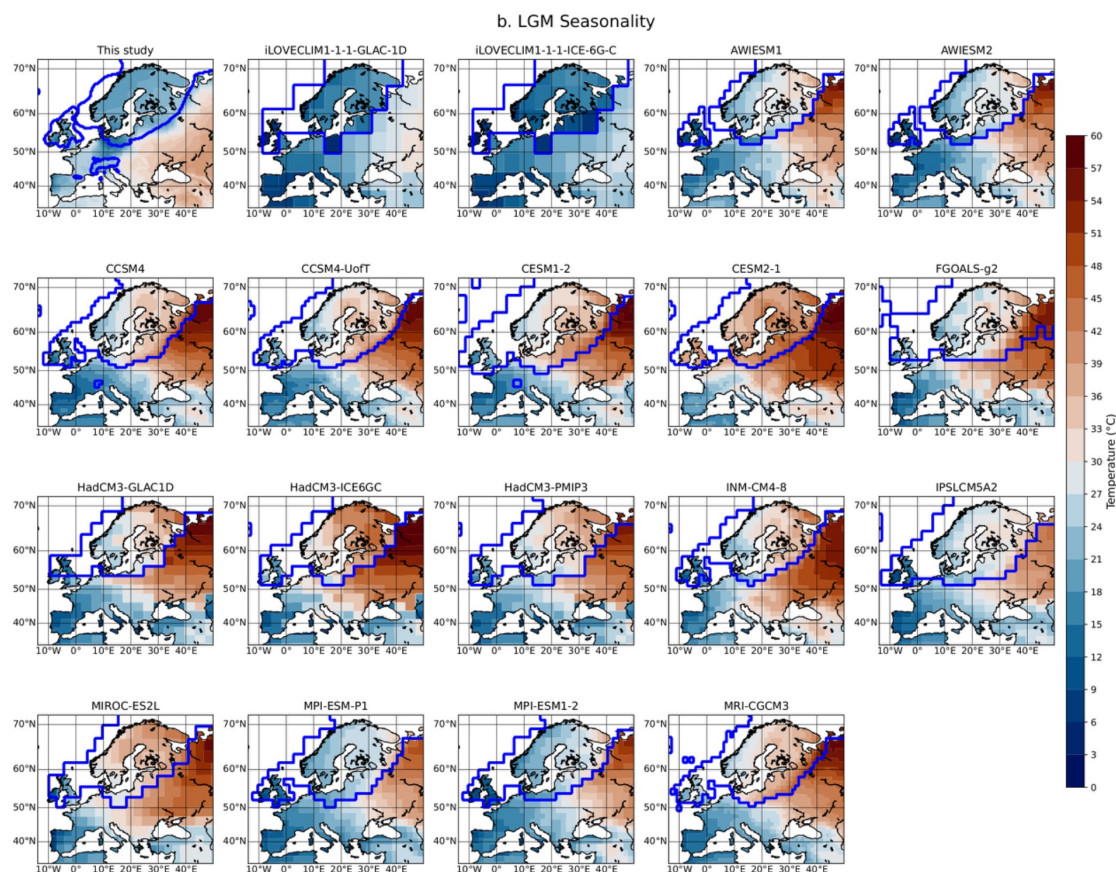
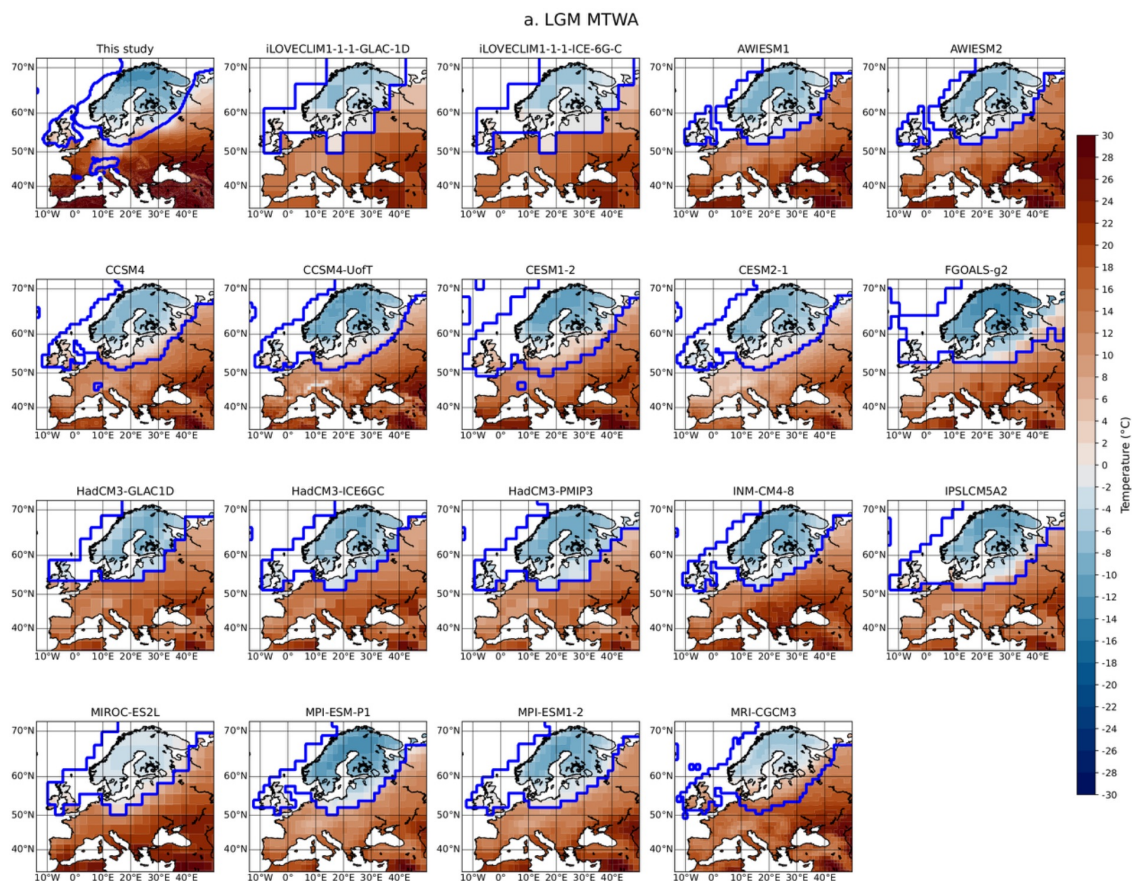


Figure S4. Continental seasonal (S from [Equ.1](#)) maps at the PI (a) and LGM (b) conditions from each climate model and their respective ice mask in the European areas (blue). Color bars have a common range (0°C to 45°C and 0°C to 60°C for PI and LGM seasonality, respectively).



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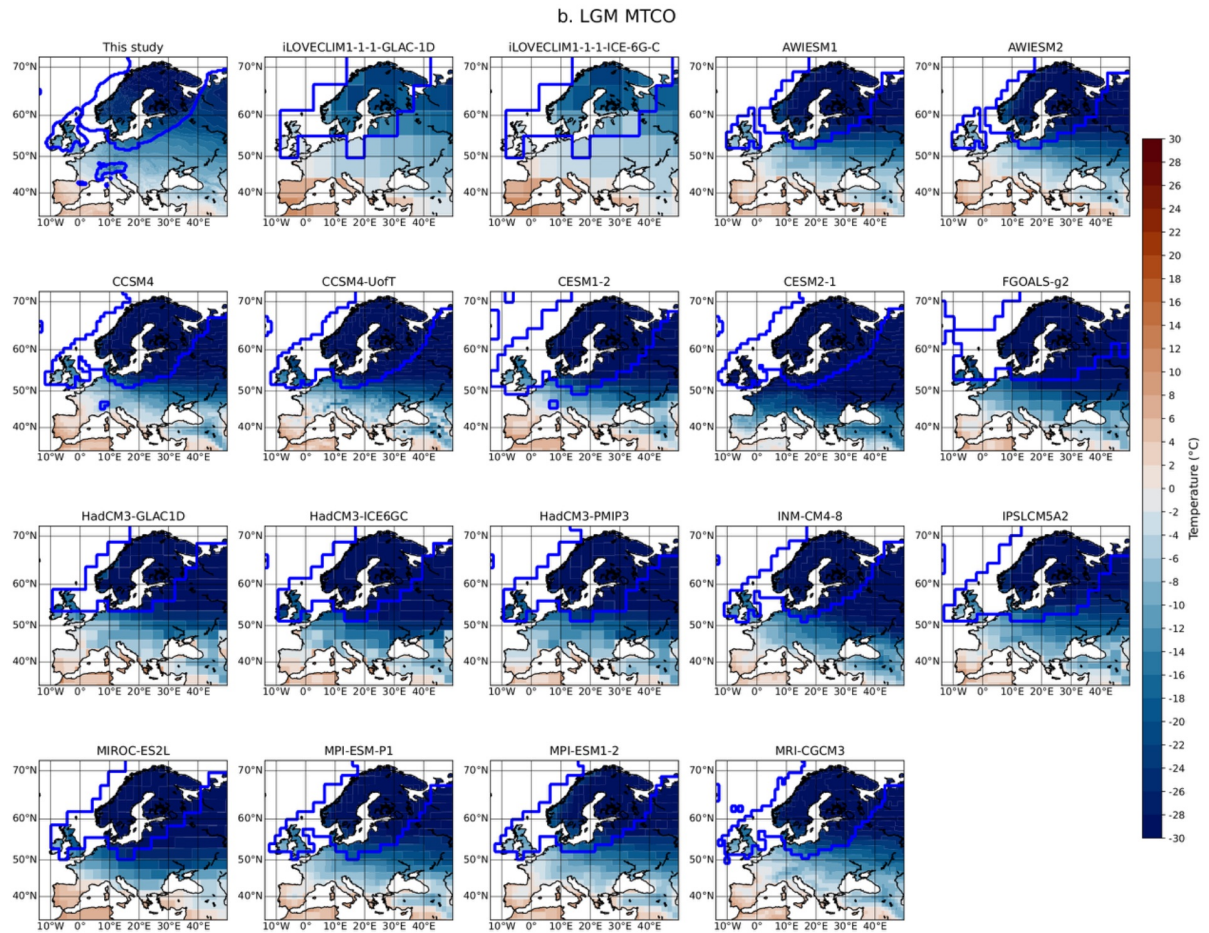


Figure S5. Continental MTWA (a) and MTCO (b) maps during the LGM condition from each climate model and their respective ice masks in the European areas (blue). Color bars have a common range (-30°C to 30°C).

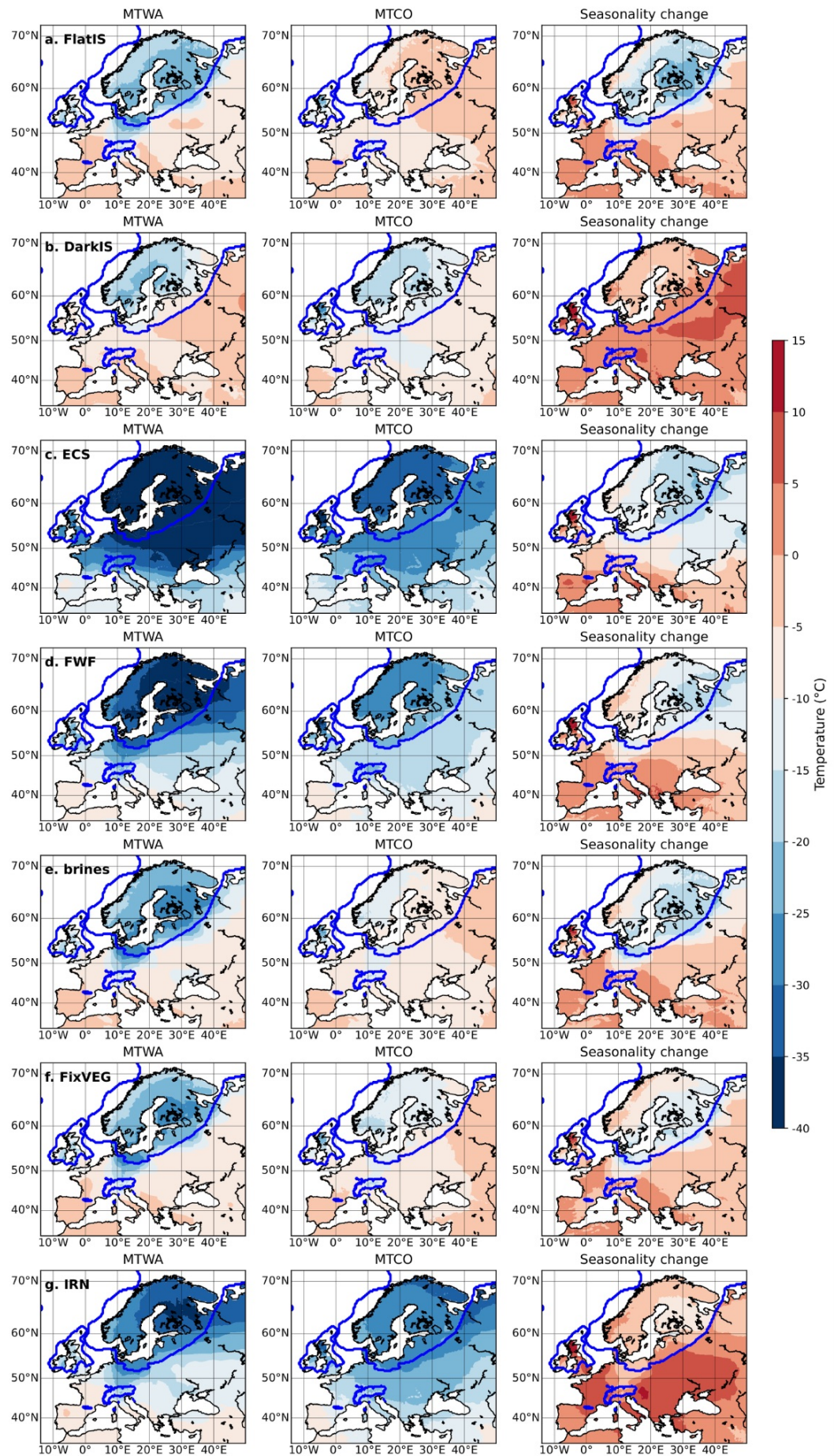


Figure S6. Individual maps of continental seasonal anomaly (LGM-PI, $\Delta S_{\text{LGM-PI}}$ from [Equ.2](#)) results from the iLOVECLIM experiment compared to the standard iLOVECLIM simulation. The names of experiments are reported in [Table 2](#). The ice mask in the European areas (blue). Color bars have a common range (-30°C to +30°C). Climate models were compared using the same downscaling grid (0.25°×0.25°) by the nearest interpolation method. The mean seasonal cycle of each climate model corresponds to the last 50 years of the simulations.