

FIGURE S1. Climate conditions for the spin-up: **(a)** mean summer surface temperature and annual mean precipitation over the whole domain, **(b)** insolation S_{TOA} on top of the atmosphere at 67° N.

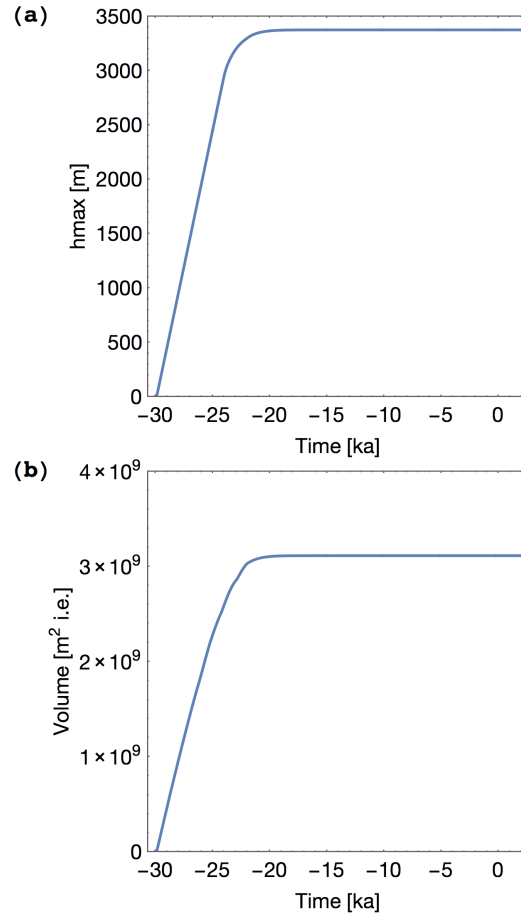


FIGURE S2. Spin-up: **(a)** evolution of the maximum ice thickness, **(b)** evolution of the ice volume. Equilibrium is reached after approximately 10 ka.

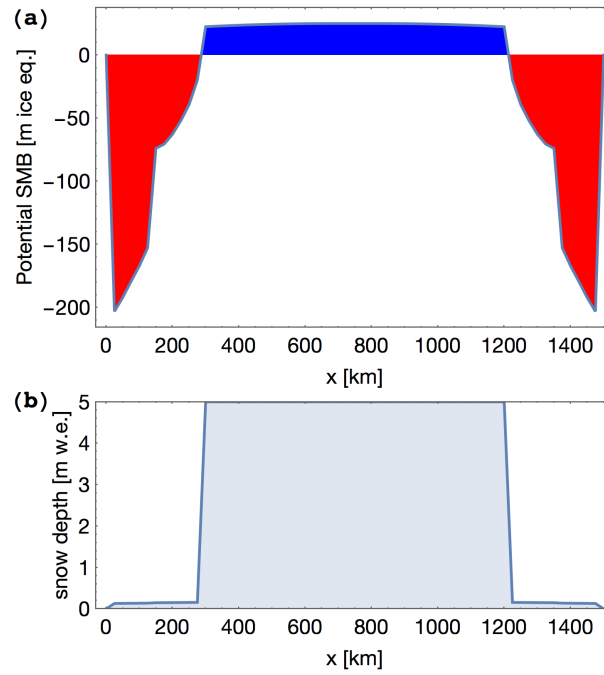


FIGURE S3. End of the spin-up: **(a)** potential surface mass balance for the 50 year time step, **(b)** snow thickness on 1 January. The SMB and snow depth are not calculated at the outermost points, which are never reached by the ice sheet.

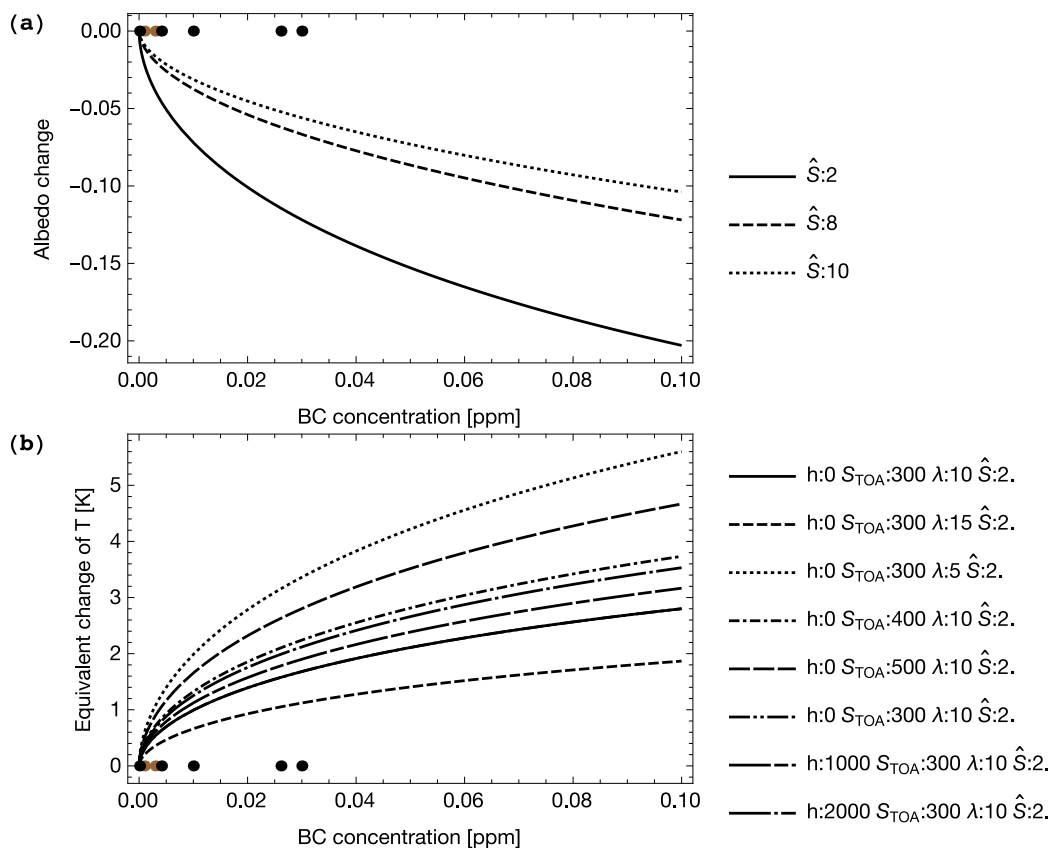


FIGURE S4. Black carbon (BC) influence on albedo: **(a)** for different specific surface areas of ice in $\text{cm}^2 \text{g}^{-1}$ (Gardner and Sharp 2010), **(b)** melt-equivalent temperature change for different parameters of the SMB model. The dots indicate measured BC (black) and dust concentrations both from ice cores and from converted surface values as a reference. The influence of additional BC is strongest when the initial BC concentration is close to zero. See also the interactive CDF (Computable Document Format) file S4.cdf (included in the Supplement) for further details.