

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.

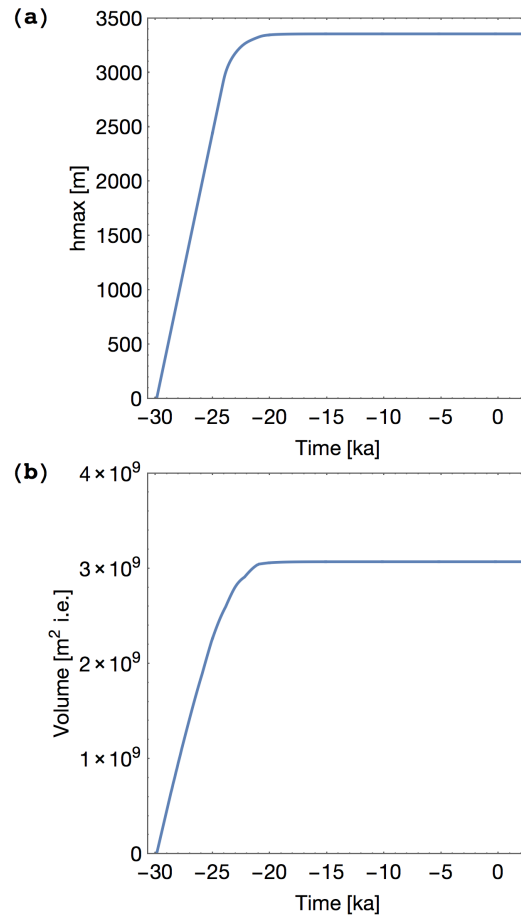


FIGURE S2. The spin-up reaches equilibrium after approximately 10 ka as can be seen in **(a)** evolution of the maximum ice thickness and **(b)** evolution of the ice volume.

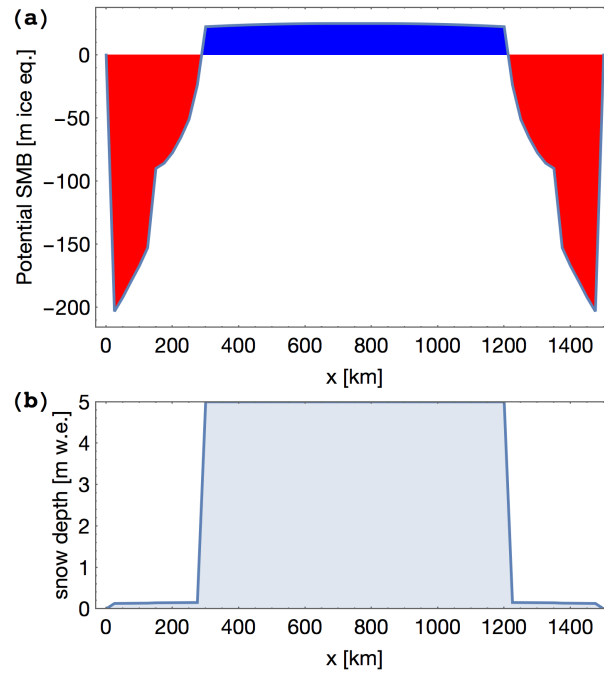


FIGURE S3. End of the spin-up: **(a)** potential surface mass balance for the 50 year time step, **(b)** snow thickness on 1 January. The SMB and snow depth are not calculated at the outermost points, which are never reached by the ice sheet.

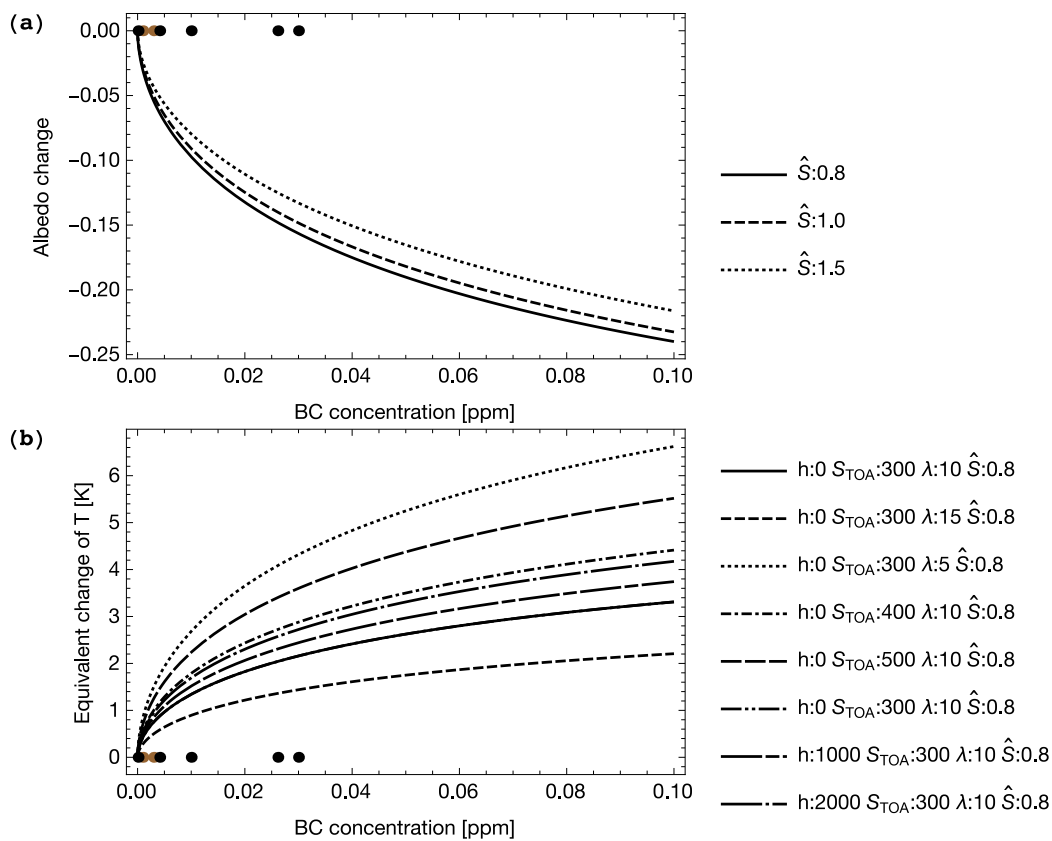


FIGURE S4. Black carbon (BC) influence on albedo **(a)** with different specific surface areas of ice (Gardner and Sharp 2010) and an melt-equivalent temperature change in **(b)** with different parameters for the SMB model. The dots indicate measured BC (black) and dust concentrations both from ice 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 *Computational Document Format S4.cdf* for further details, which is included in the supplements.