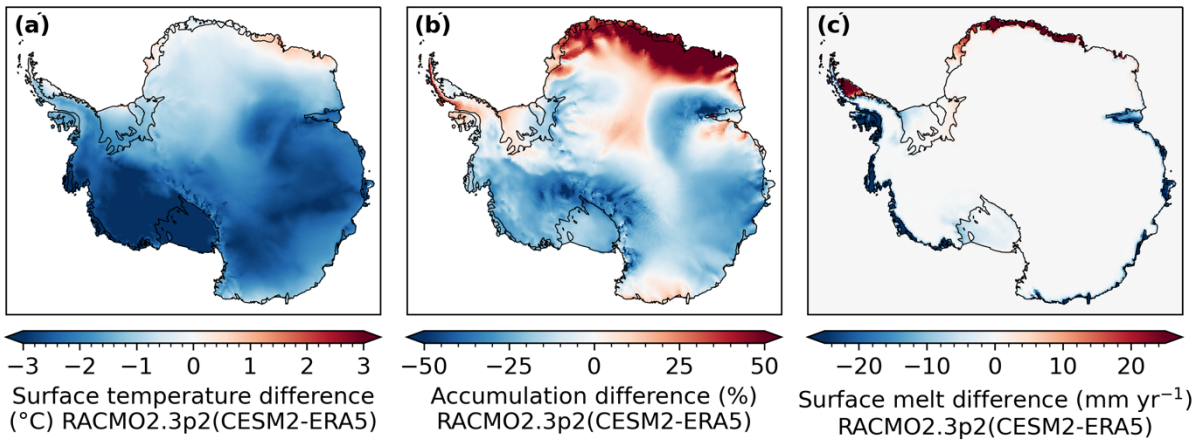

Figure S1. Difference in mean annual **(a)** surface temperature, **(b)** accumulation and **(c)** surface melt, over the period 1979-2014 between RACMO2.3p2-CESM2 and RACMO2.3p2-ERA5.

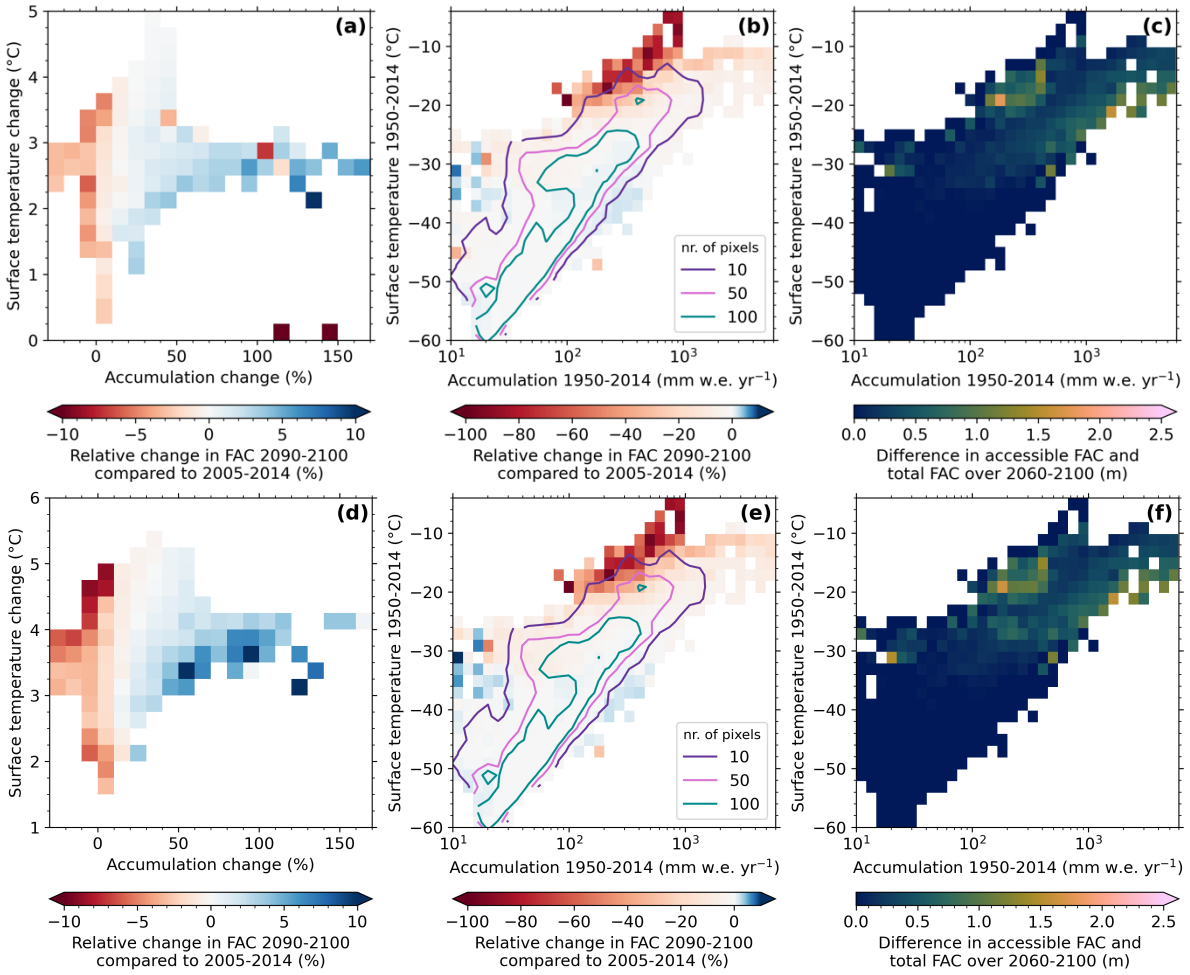

Figure S2. Relative change in total FAC by 2090-2100 for SSP1.2-6 **(a,b)** and SSP2-4.5 **(d,e)** compared to 2005-2014 **(a,d)** as a function of temperature change and accumulation change by 2090-2100 compared to 1950-2014 for locations that do not experience melt by the end of the century in SSP5-8.5 and **(b,e)** as a function of annual average accumulation and temperature (1950-2014) for the entire AIS. Difference between accessible firn air content and total firn air content in 2060-2100 for the entire AIS for SSP1-2.6 **(c)** and SSP2-4.5 **(f)** as a function of annual average accumulation and temperature (1950-2014). Contour lines in **(b,e)** indicate the number of pixels per accumulation/temperature bin. Please note the different scales for decreasing and increasing FAC in panel **(b,e)**.

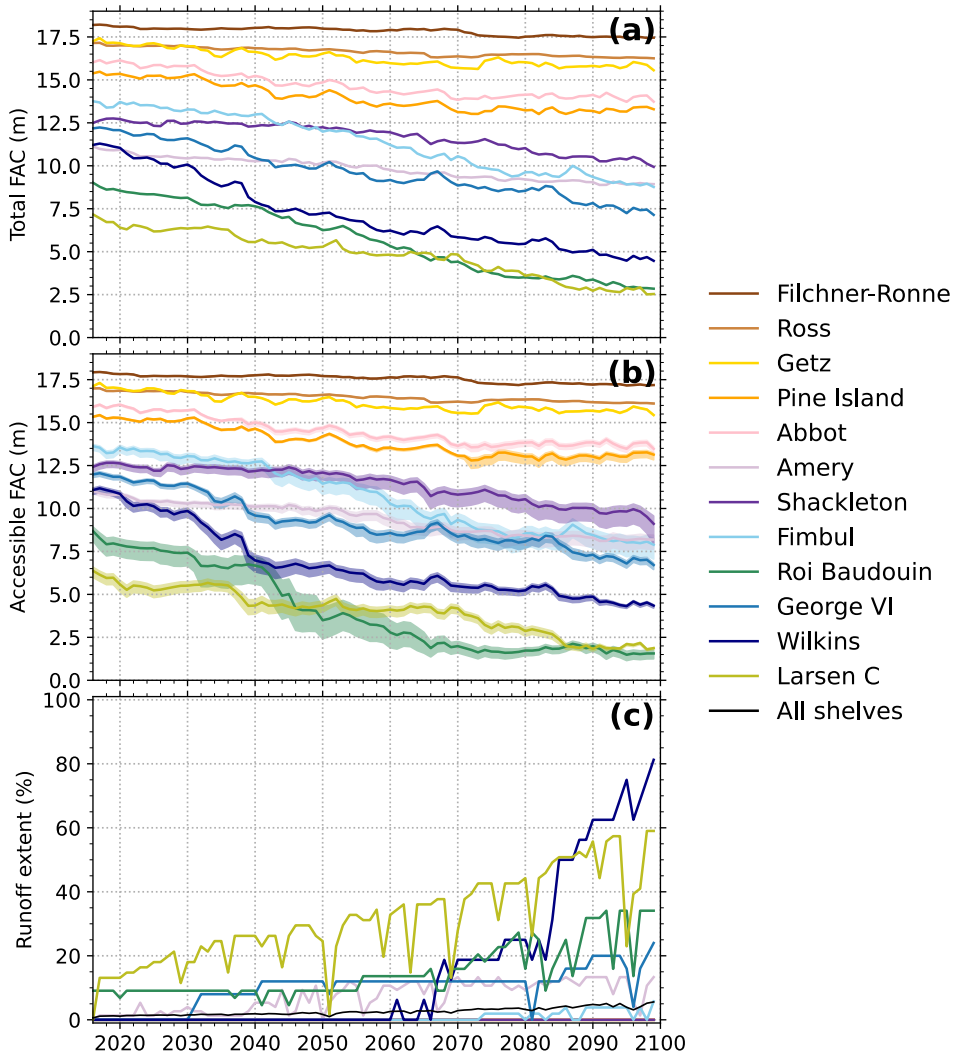

Figure S3. Timeseries of **(a)** total firn air content (FAC), **(b)** accessible FAC and **(c)** runoff extent of 12 ice shelves simulated with FDM v1.2AD-C for SSP1-2.6 for the period 2015-2100. The shaded areas indicate the sensitivity to the relation between ice layer thickness and permeability factor shown in Figure 3a.

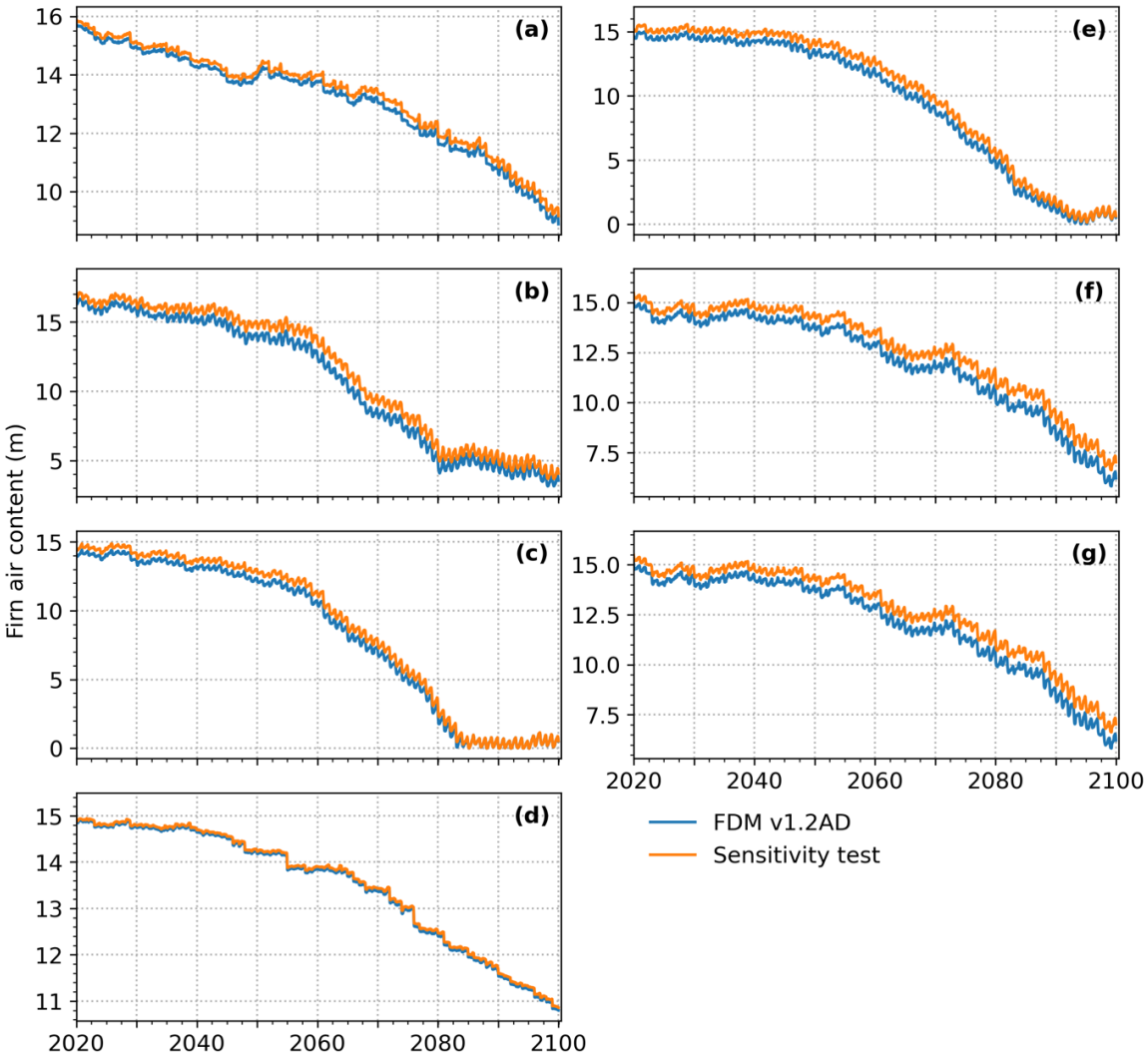

Figure S4. Test with different refreezing grain size (0.4 mm) for the locations in Figure 9.