Supplementary materials
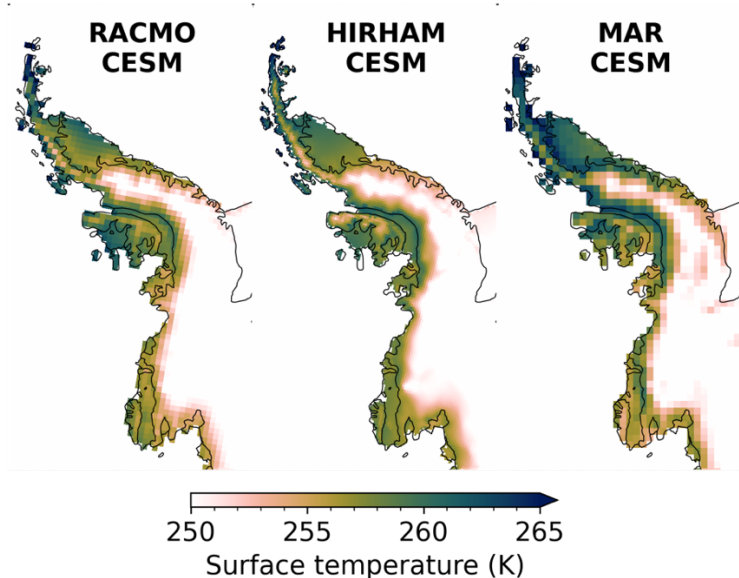
Figure S1. Annual average surface temperature over the historical period (1980-2014) for RACMO-CESM, HIRHAM-CESM and MAR-CESM over the Antarctic Peninsula and Ellsworth Land.
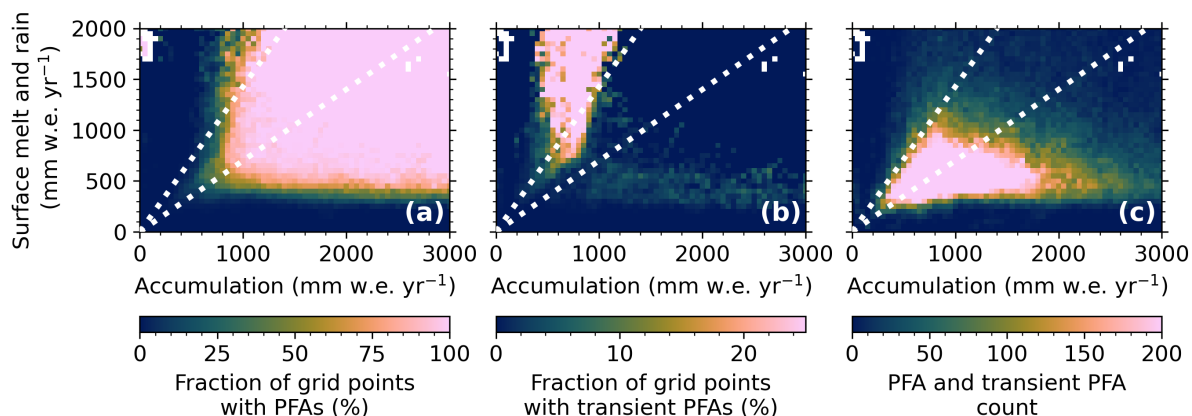
Figure S2. Percentage of **(a)** perennial firn aquifer (PFA) occurrence and **(b)** transient PFA occurrence, and **(c)** total amount of PFA and transient PFA occurrence from all HIRHAM simulations, as a function of annual surface melt and rainfall (y-axis) and snow accumulation (x-axis). The grid cells are grouped in melt and accumulation bins of 50 mm mm w.e. yr^{-1}. The dotted lines indicate the 0.7 and 1.7 melt-over-accumulation (MoA) thresholds.
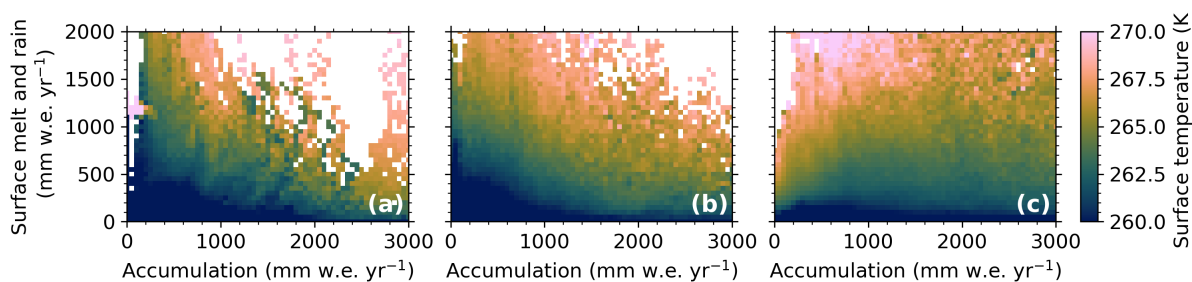
Figure S3. Annual average surface temperature as a function of annual surface melt and rainfall (y-axis) and snow accumulation (x-axis) for all **(a)** RACMO, **(b)** MAR and **(c)** HIRHAM simulations.
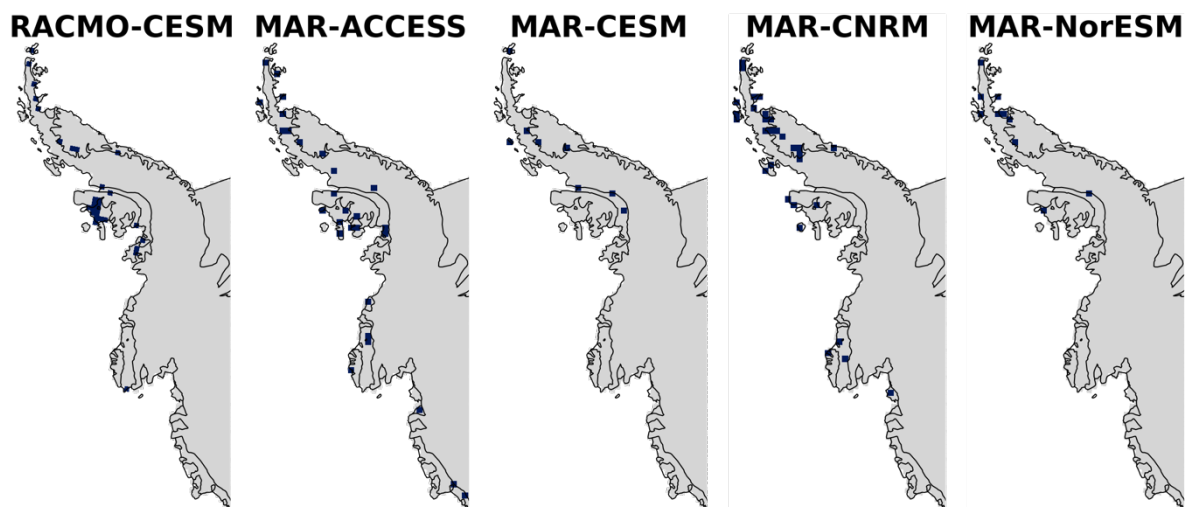
Figure S4. Locations with transient PFAs under SSP5-8.5 for RACMO and MAR are found in the Antarctic Peninsula, Ellsworth Land and Marie Byrd Land only and are indicates in blue.