

Supplementary Material

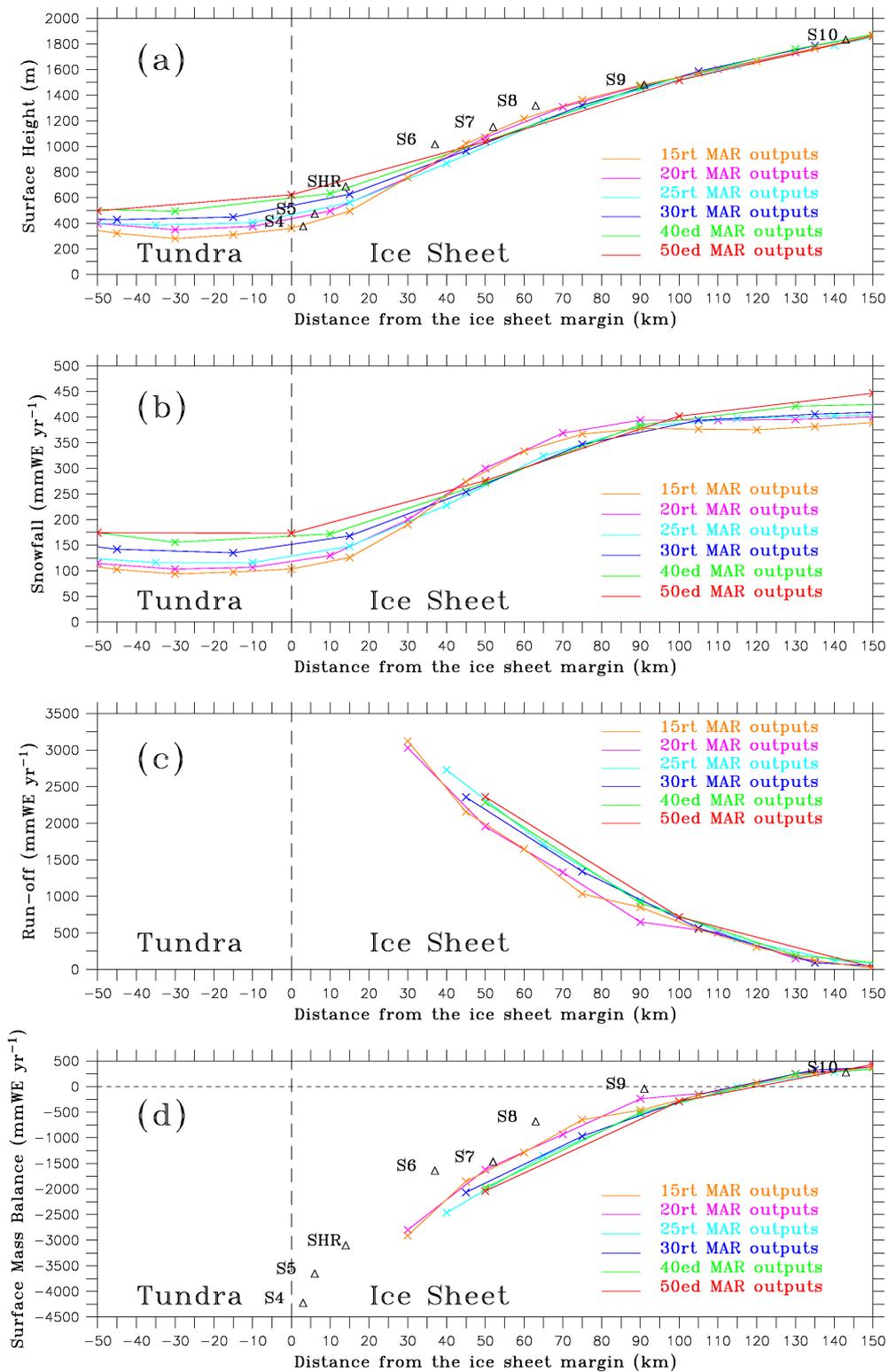


Fig. S1. (a) Cross section of the surface height (m) through the GrIS along the K-transect (67°N, west Greenland) for the 15-50 km resolution MAR runs, with station data drawn in black symbols. The relative grid points location were matched according to the elevation of S9 and S10. (b) The same as (a), but for the annual snowfall (mmWE yr⁻¹) over the 1990-2010 period. (c) The same as (b), but for the annual run-off of meltwater (mmWE yr⁻¹) over the 1990-2010 period. (d) The same as (b), but for the annual SMB (mmWE yr⁻¹).

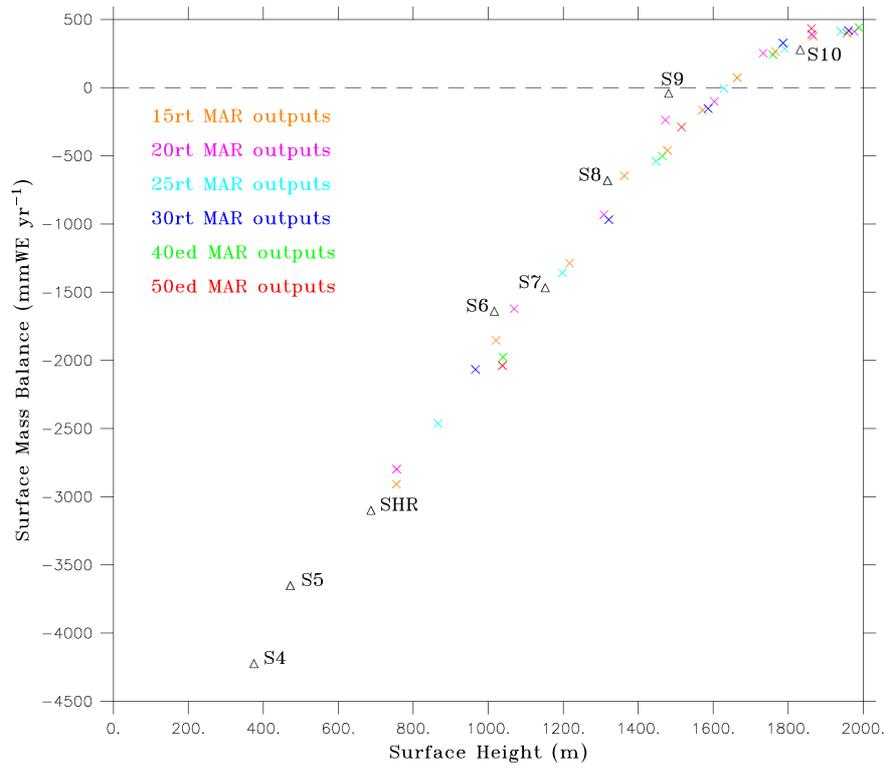


Fig. S2. Scatter plot of the annual SMB (mmWE yr⁻¹) along the K-transect (67°N, west Greenland) according to the surface height (m) for the 15-50 km MAR runs, with station data drawn in black symbols.

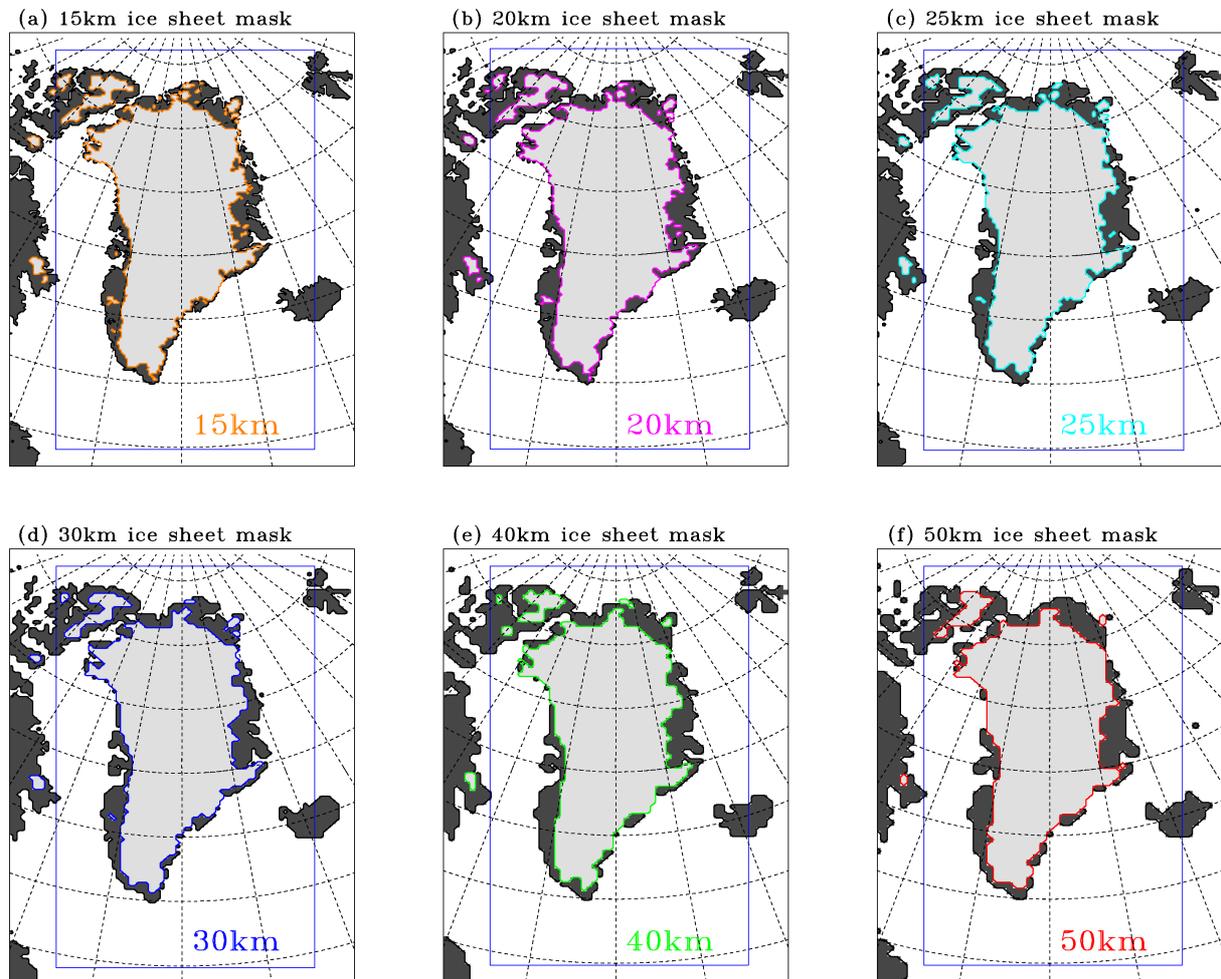


Fig. S3. Ice sheet mask from the 15-50 km resolution MAR simulations, over the extended integration domain. The original integration domain is embedded in blue.

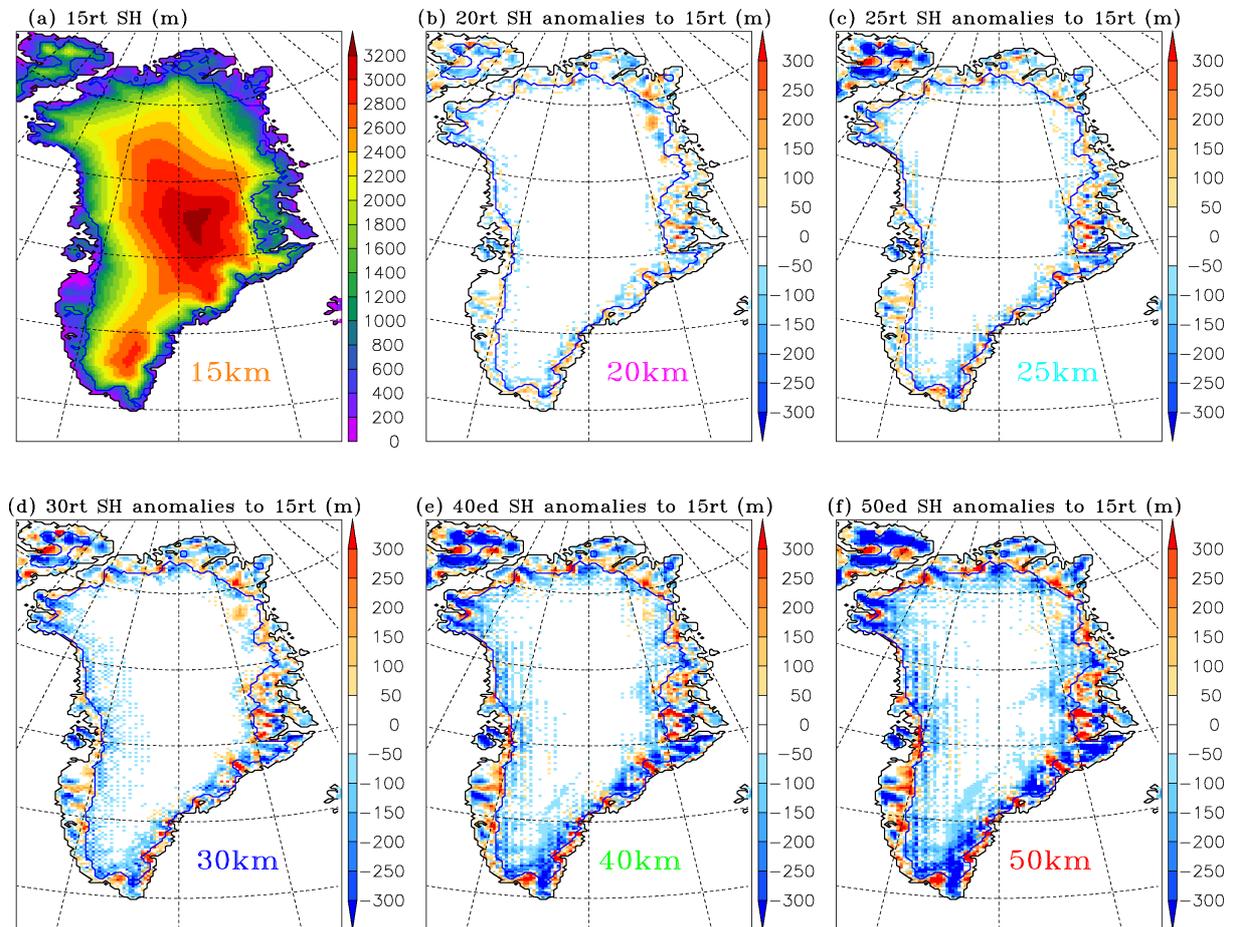


Fig. S4. (a) Surface height (m) of the MAR model at 15 km resolution (15rt), with the 15 km ice sheet mask drawn in solid blue line. (b-c) Surface height anomalies (m) of the 20-50 km resolution MAR outputs interpolated onto the 15 km MAR grid, compared to (a), with the ice sheet mask common to all the spatial resolutions drawn in solid blue line.

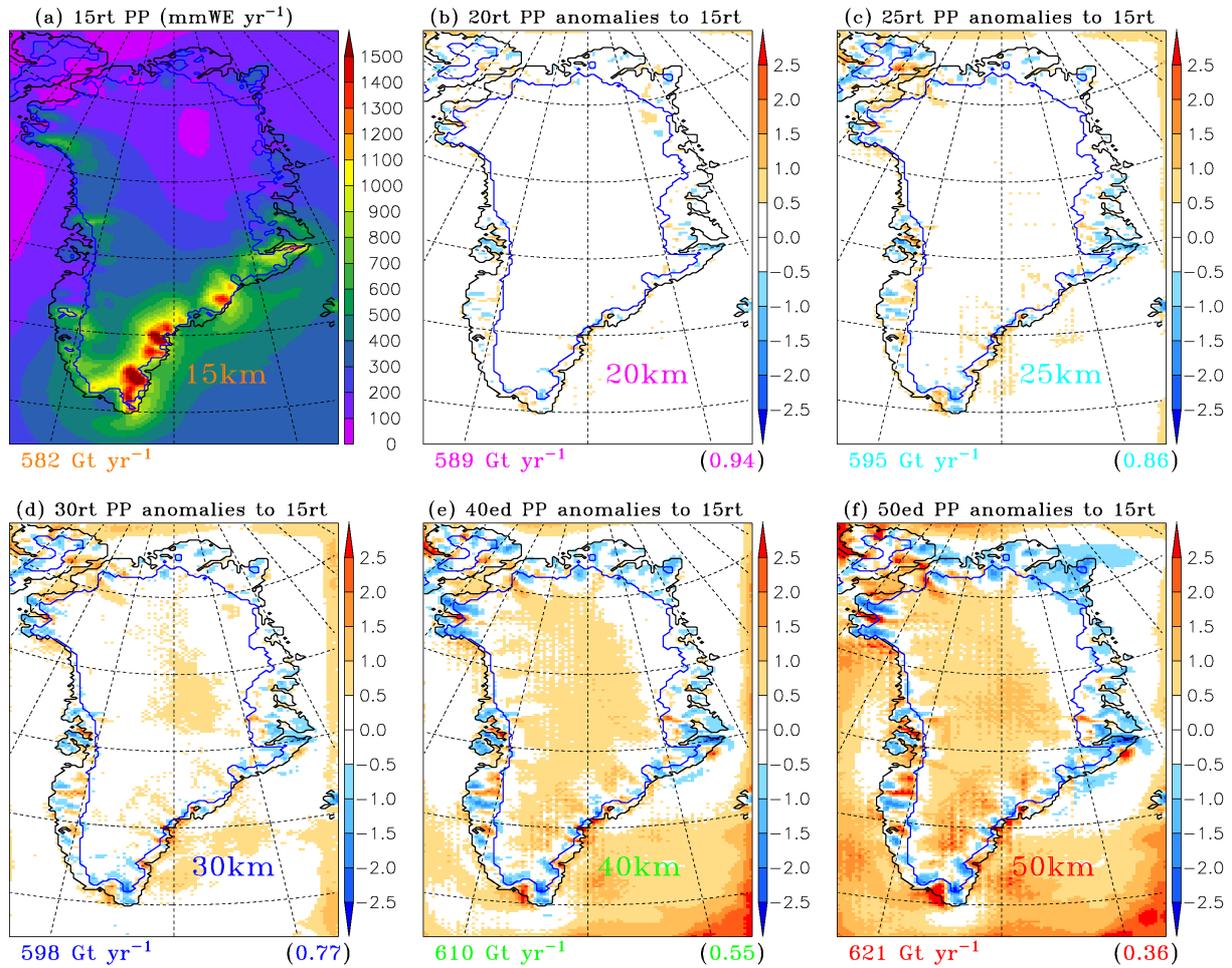


Fig. S5. (a) Annual precipitation (mmWE yr⁻¹) simulated by the MAR model at 15 km resolution (15rt) over the 1990-2010 period. (b-f) Annual precipitation anomalies (in standard deviation) of the 20-50 km-resolution MAR outputs interpolated onto the 15 km MAR grid, compared to (a). On the bottom left side of each view is the annual amount of precipitation (Gt yr⁻¹) on the ice sheet mask common to all the spatial resolutions, drawn in solid blue line. On the bottom right side of each view, in brackets, is the skill score of the 20-50 km field compared to the 15rt outputs, on the common GRIS mask.

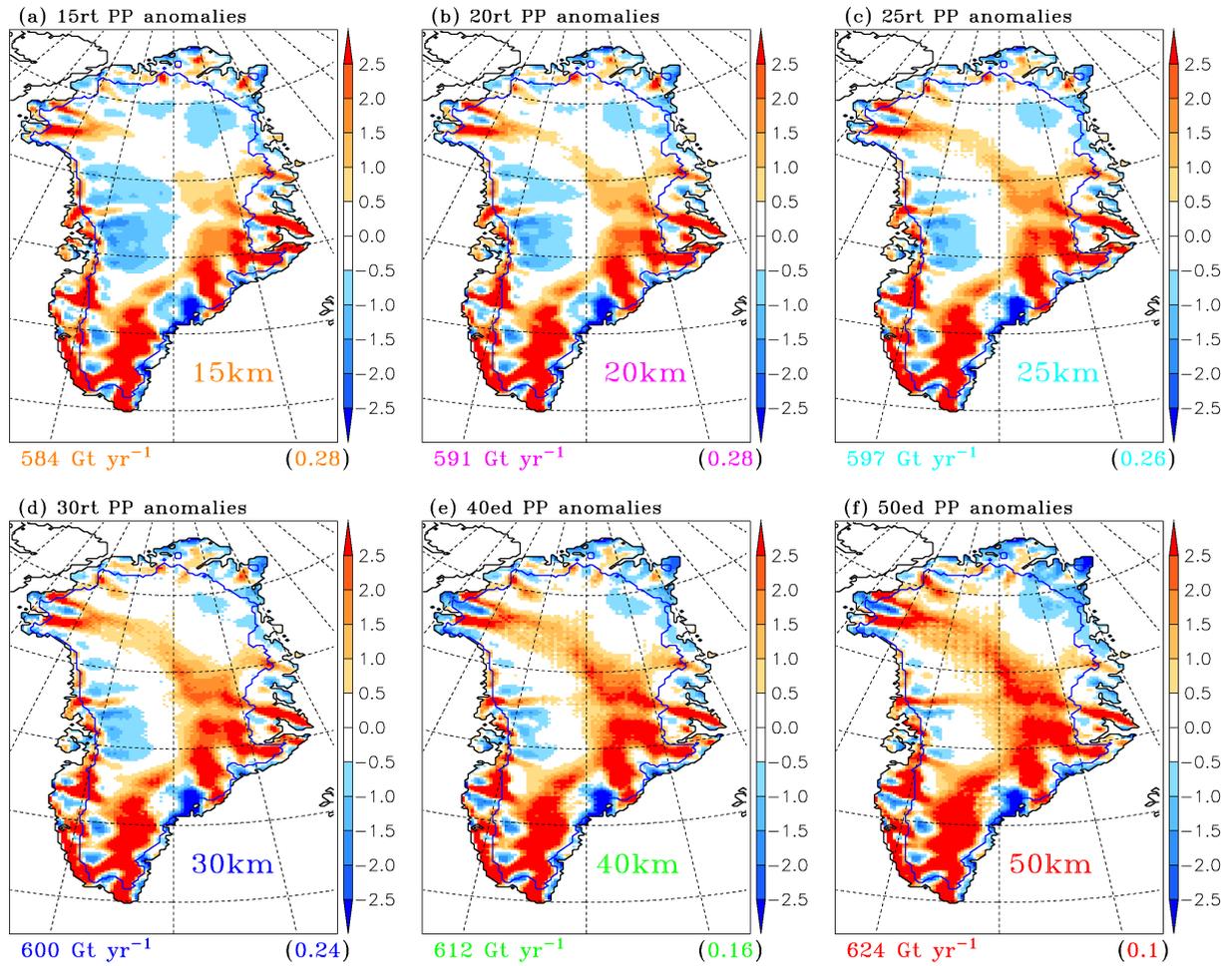


Fig. S6. Annual precipitation anomalies (in standard deviation) of the 15-50 km resolution MAR outputs interpolated onto the 15 km MAR grid, compared to the Jason Box's GrIS snow accumulation grid over the 1990-2008 period. On the bottom left side of each view is the annual amount of precipitation (Gt yr⁻¹) on the ice sheet mask common to all the spatial resolutions, drawn in solid blue line. On the bottom right side of each view, in brackets, is the skill score of the 15-50 km resolution field compared to the snow accumulation grid, on the common GrIS mask.

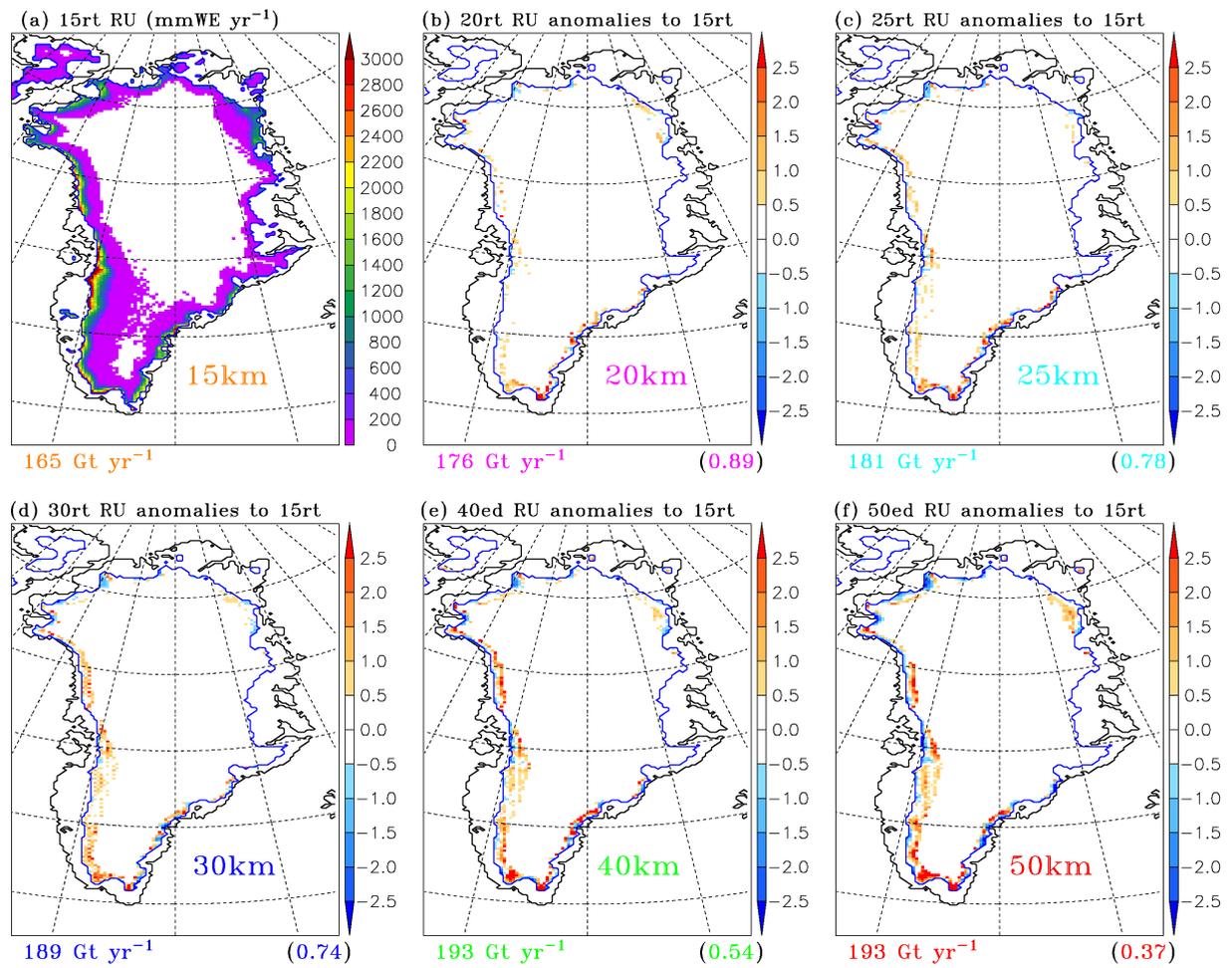


Fig. S7. The same as Fig. S5, but for the annual run-off (mmWE yr⁻¹).

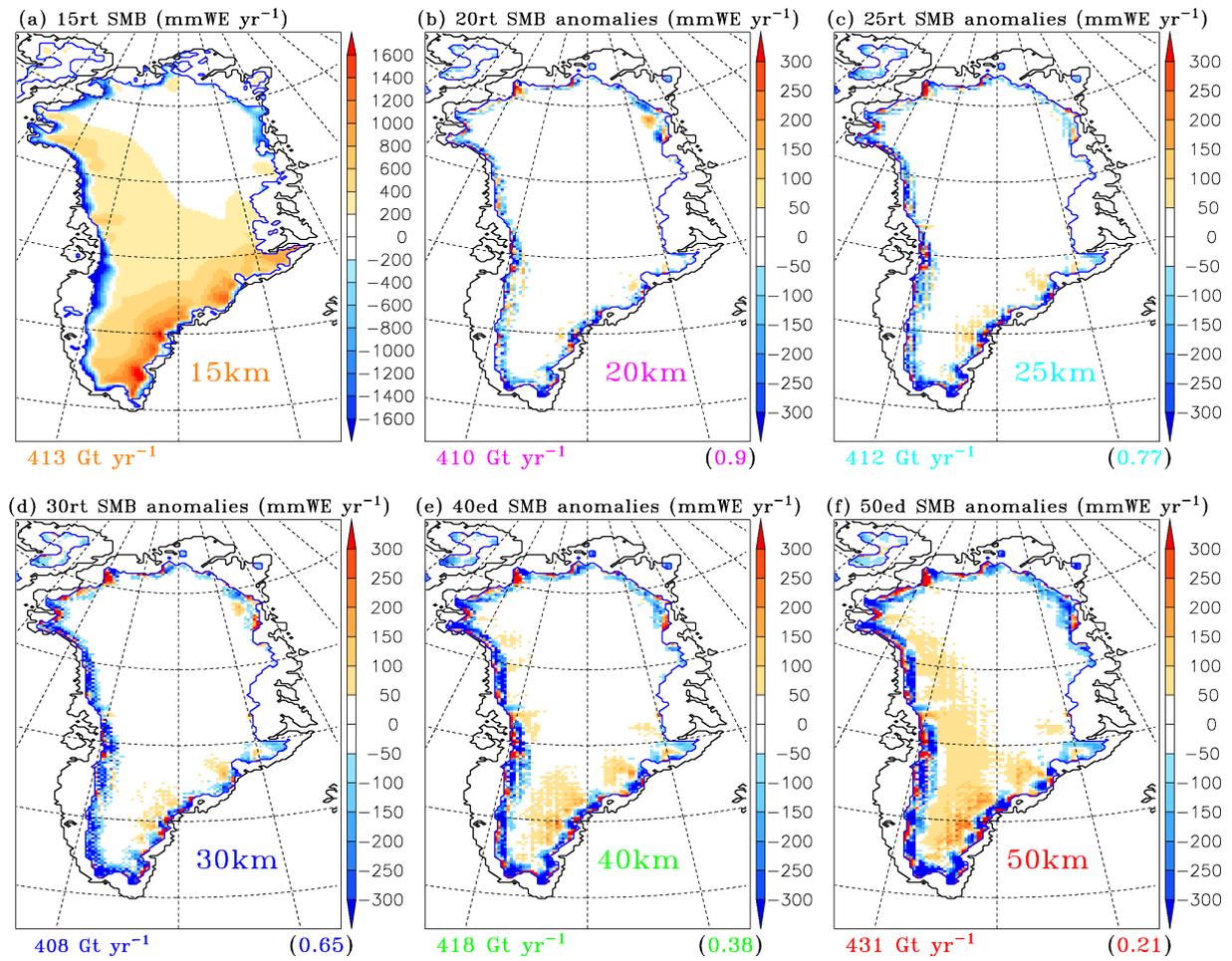


Fig. S8. The same as Fig. S5, but for the annual SMB (mmWE yr^{-1}).

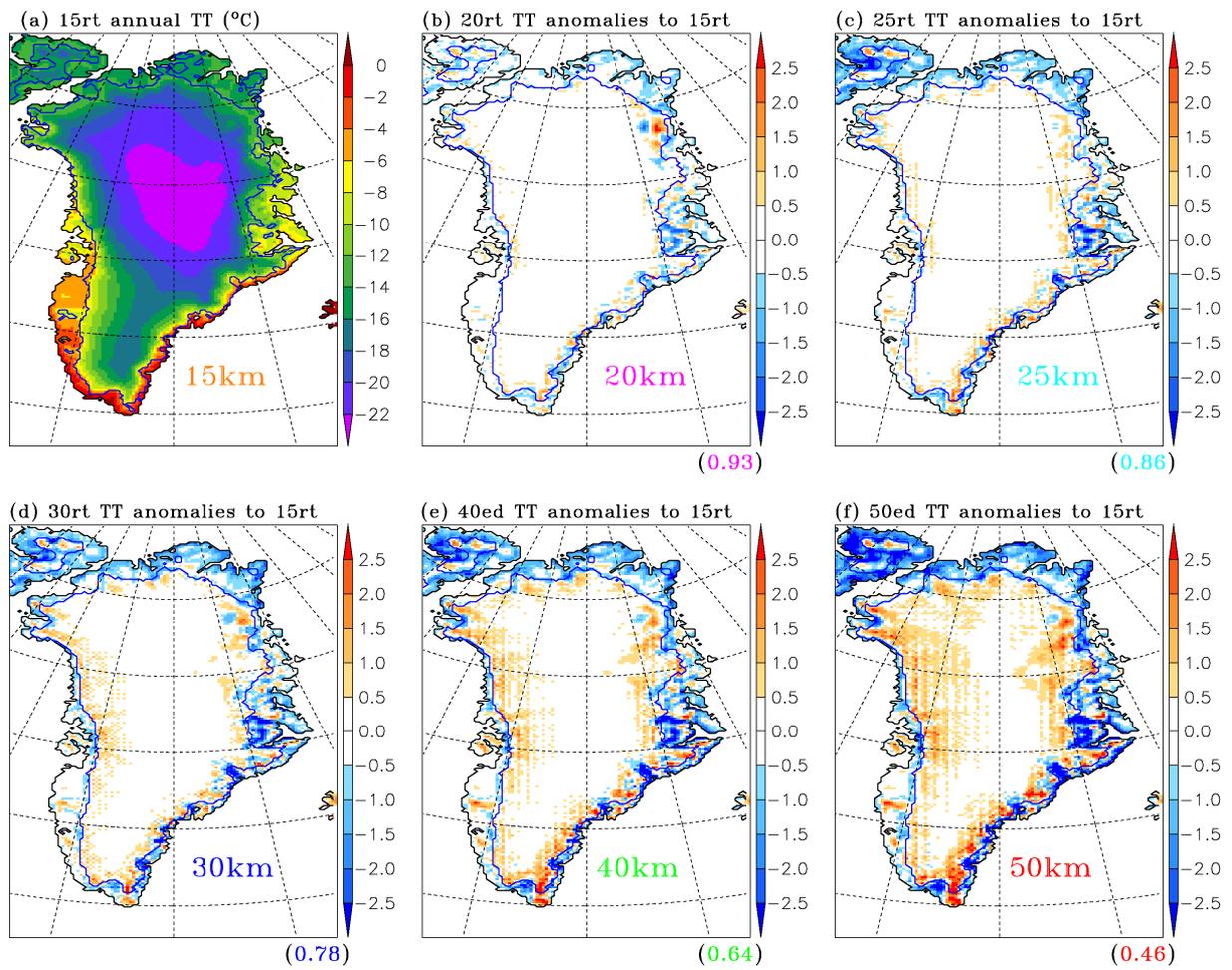


Fig. S9. The same as Fig. S5, but for the annual near-surface temperature (°C).

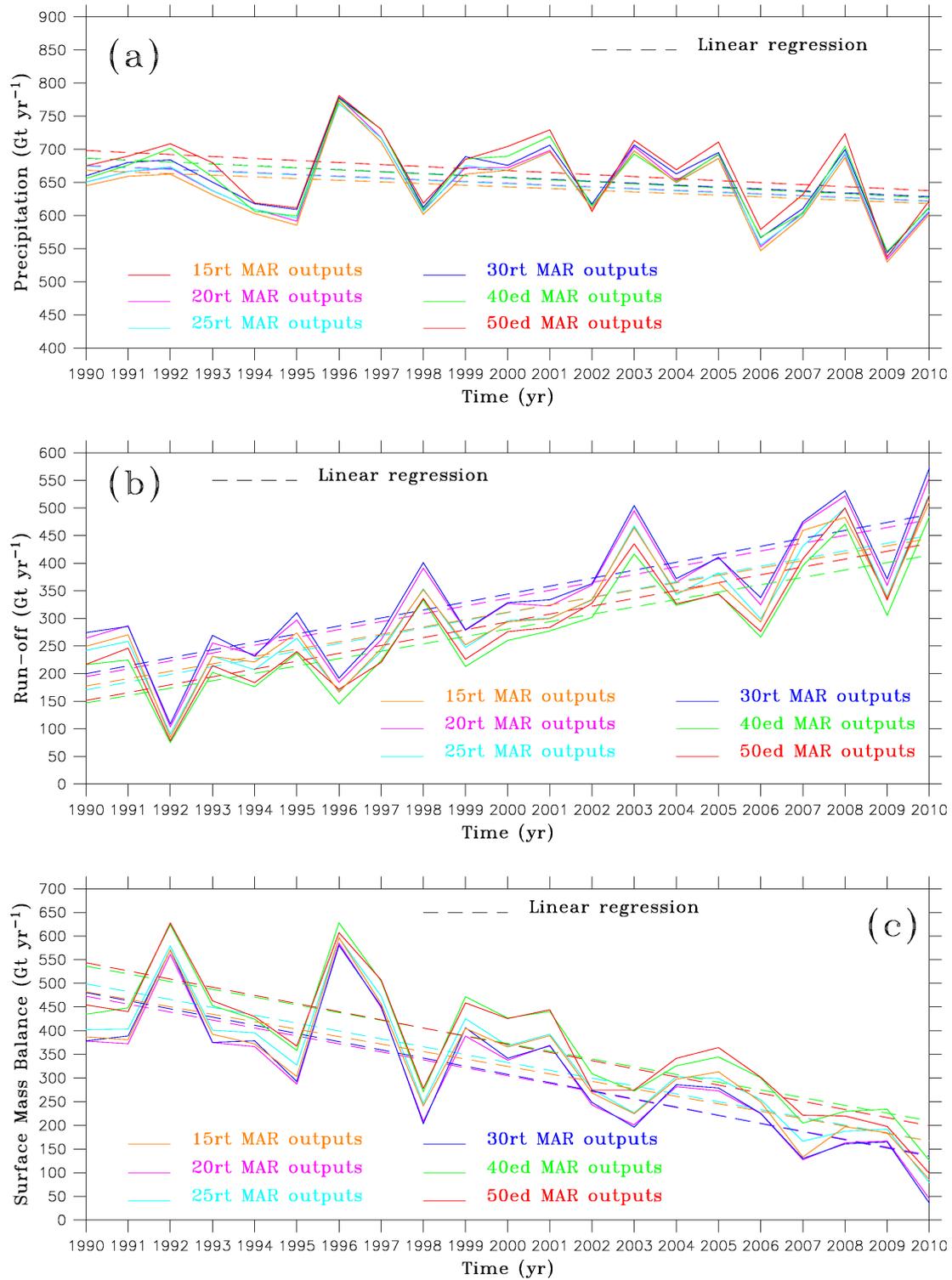


Fig. S10. (a) Annual precipitation (Gt yr⁻¹) on the GrIS simulated by the MAR model at 15-50 km resolution (in solid lines), on ice sheet mask specific to each simulation. The linear regressions throughout the 1990-2010 period are drawn in dashed lines. (b) The same as (a), but for the annual run-off of meltwater (Gt yr⁻¹) from the GrIS. (c) The same as (a), but for the annual GrIS SMB (Gt yr⁻¹).

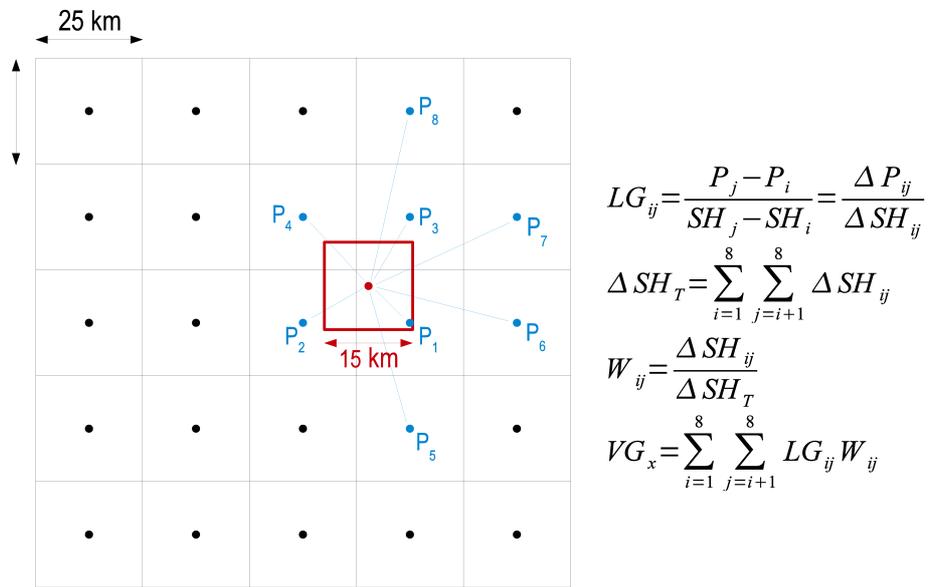


Fig. S11. Explanatory figure of the method of correction used in this study: e.g. for an interpolated 15 km point x , corrected from the eight closest 25 km points. P_i = value of the field in the 25 km point i . SH_i = surface height of the 25 km point i . LG_{ij} = local gradient of the field calculated between the 25 km points i and j . W_{ij} = weight of the local gradient between i and j . VG_x = vertical gradient of the field for the interpolated 15 km point x , used to correct this point x according to the difference of elevation between the real 15 km topography and the surface height at this point x .

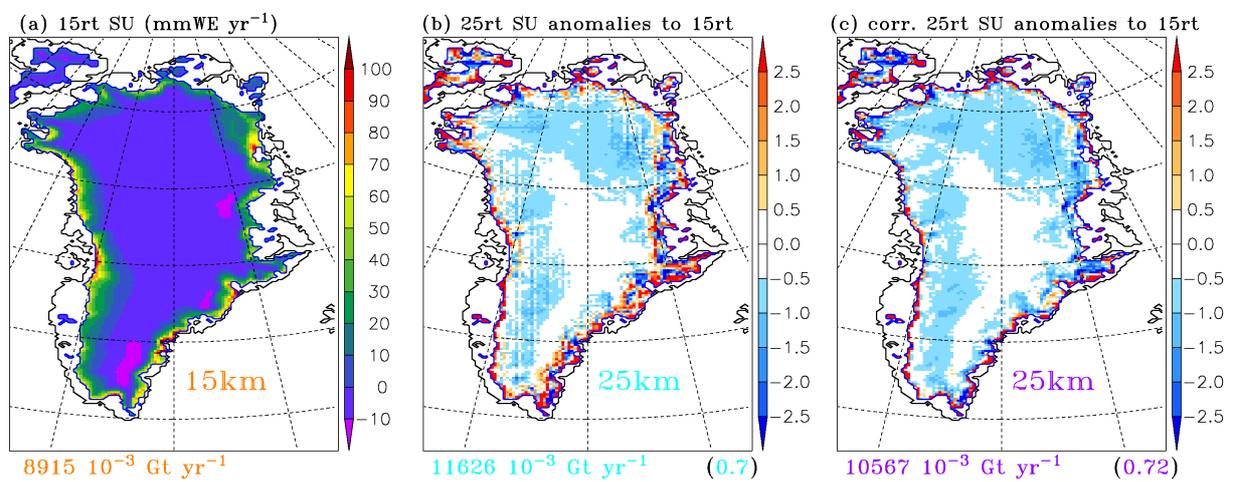


Fig. S12. (a) Annual sublimation and evaporation (mmWE yr⁻¹) simulated by the MAR model at 15 km resolution (15rt), over the 1990-2010 period. On the bottom left side of the view is the total sublimation and evaporation (10⁻³ Gt yr⁻¹) from the GrIS on the 15 km ice sheet mask. (b) Annual sublimation and evaporation anomalies (in standard deviation) of the 25 km resolution outputs (25rt) interpolated onto the 15 km ice sheet mask, compared to (a). On the bottom right side, in brackets, is the skill score of the interpolated field compared to the 15rt outputs. (c) The same as (b), but for the 25rt outputs interpolated onto the 15 km ice sheet mask and corrected with daily gradients.

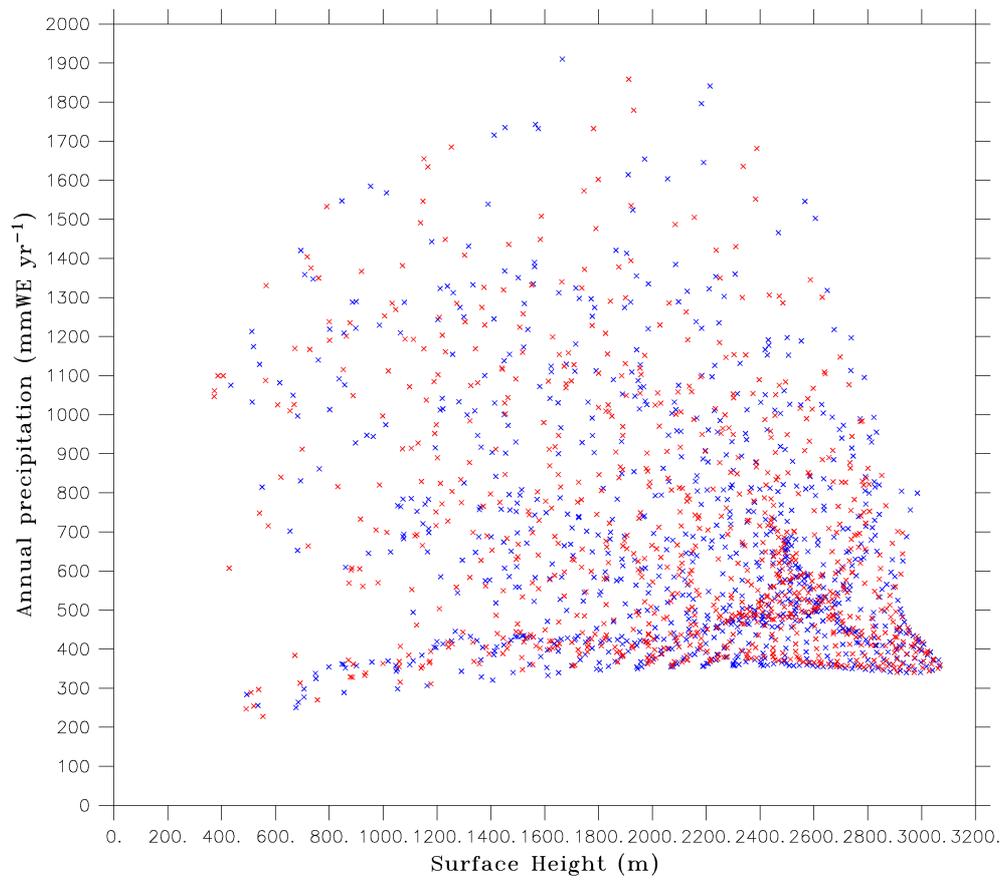


Fig. S13. Scatter plot of the annual precipitation (mmWE yr⁻¹) on the GrIS for latitudes lower than 70°N, according to the surface height (m), simulated by 25rt (in blue) and 25st (in red), over the 1990-2010 period.