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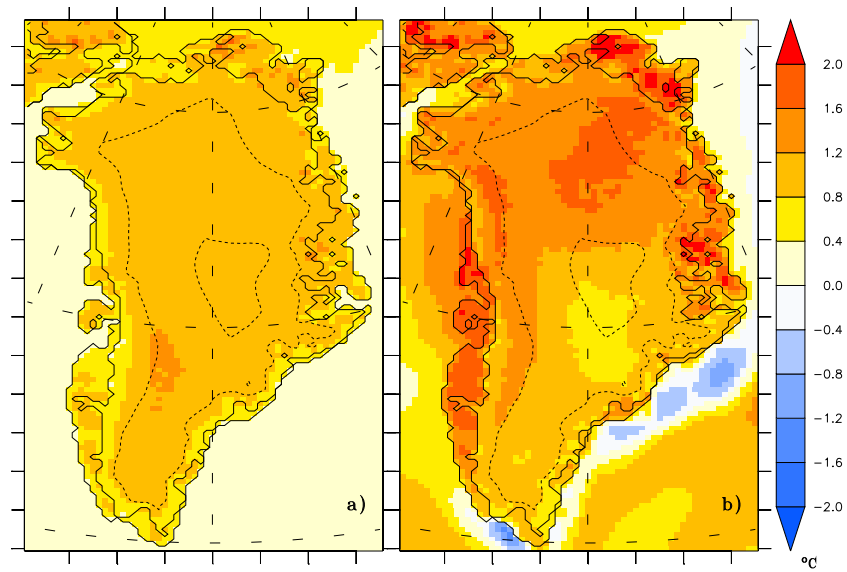
*Supplement of*

## **Brief communication: Impact of the recent atmospheric circulation change in summer on the future surface mass balance of the Greenland Ice Sheet**

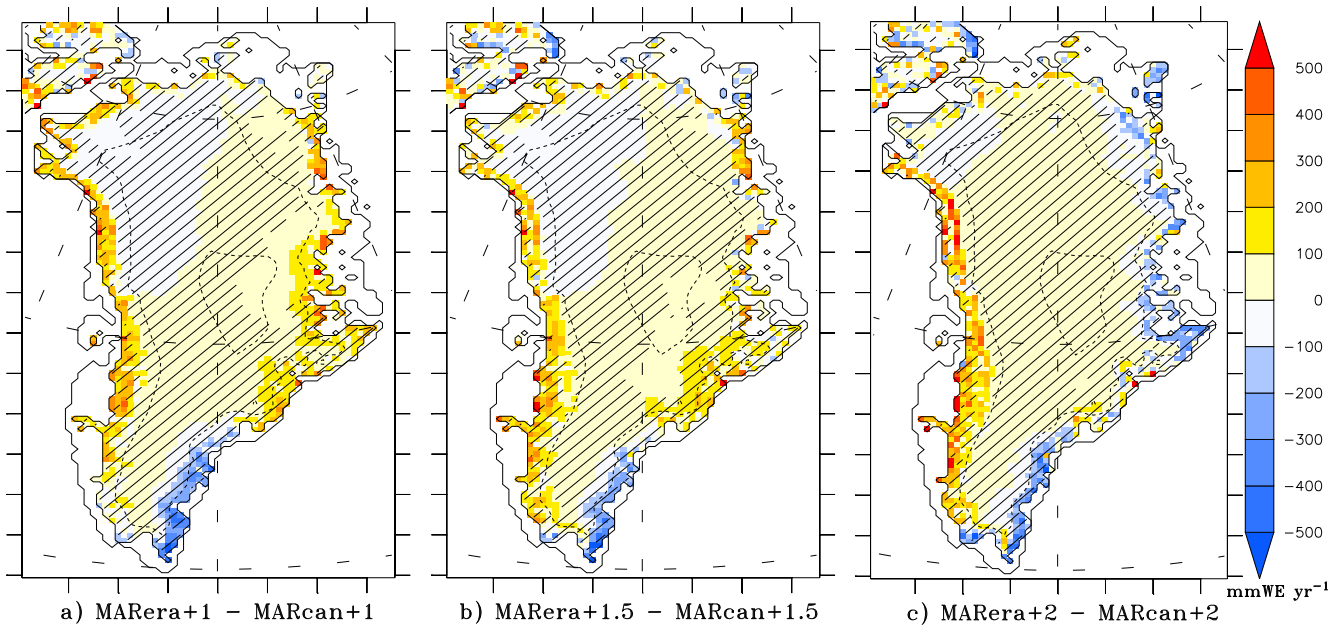
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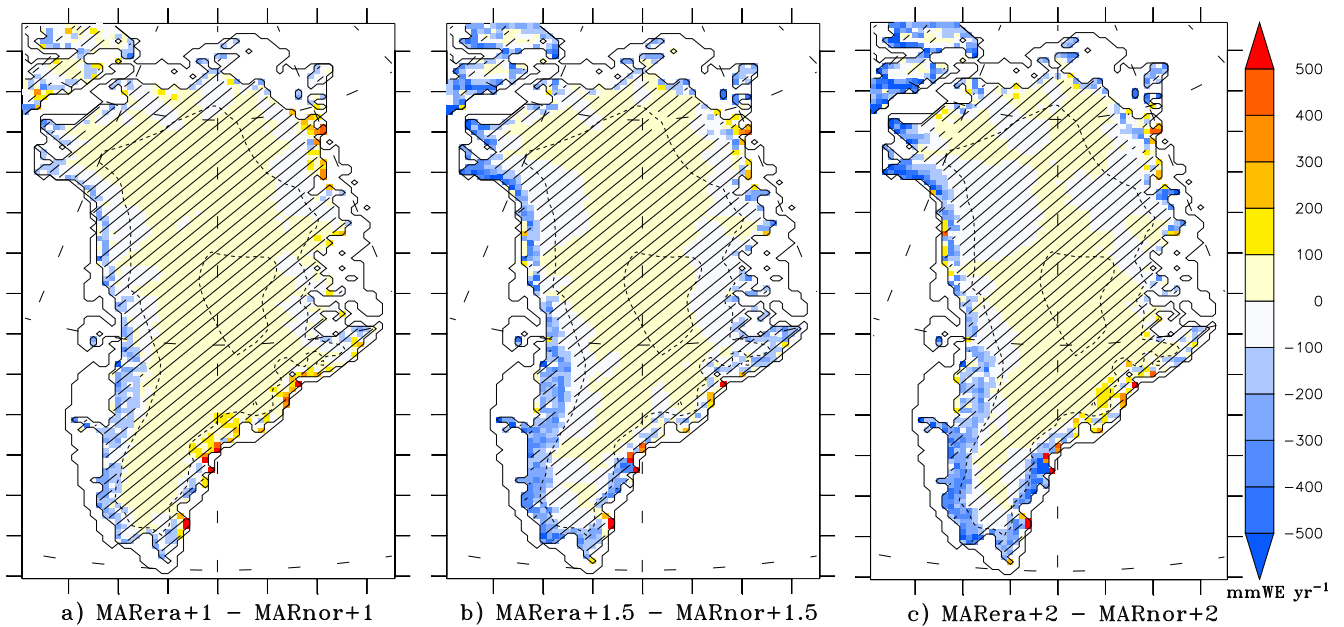
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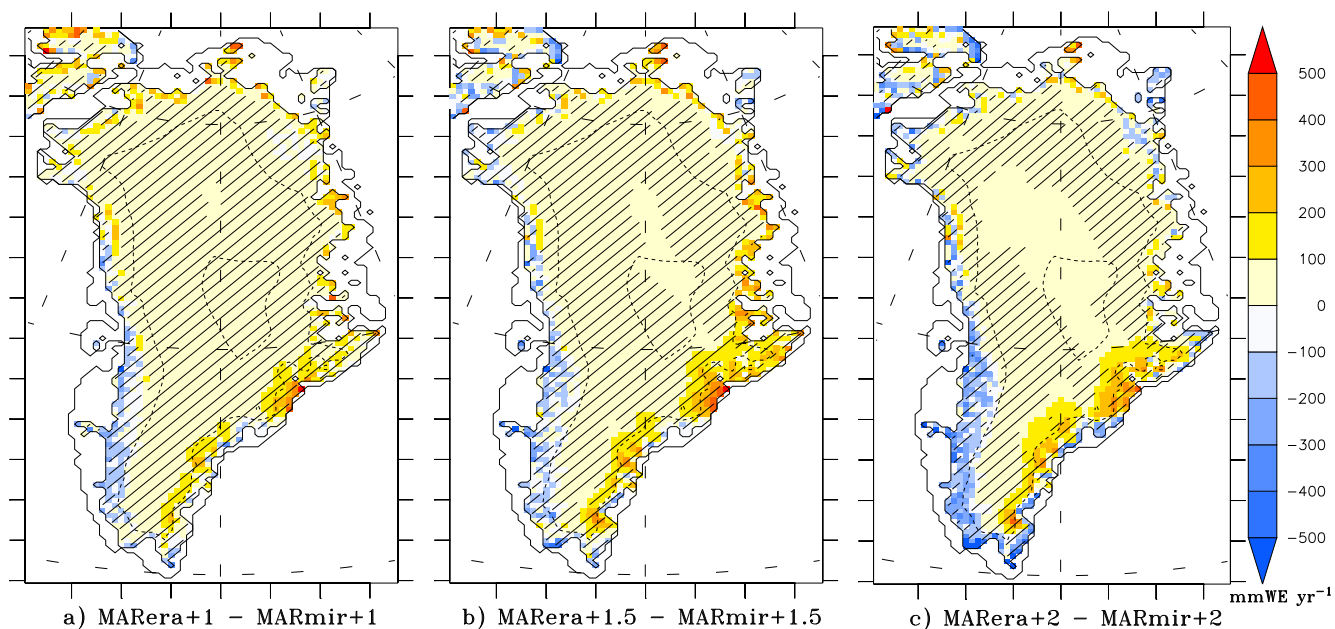
**Figure S1.** Mean anomalies of JJA near-surface temperature ( $^{\circ}\text{C}$ ) of MAR forced by ERA-Interim warmer of  $+1^{\circ}\text{C}$  over a) 1980 – 1999 and b) 2000 – 2016 compared to MAR forced by unaltered ERA-Interim over 1980 – 1999. Dashed lines are equal altitude lines of 2000 m and 3000 m.



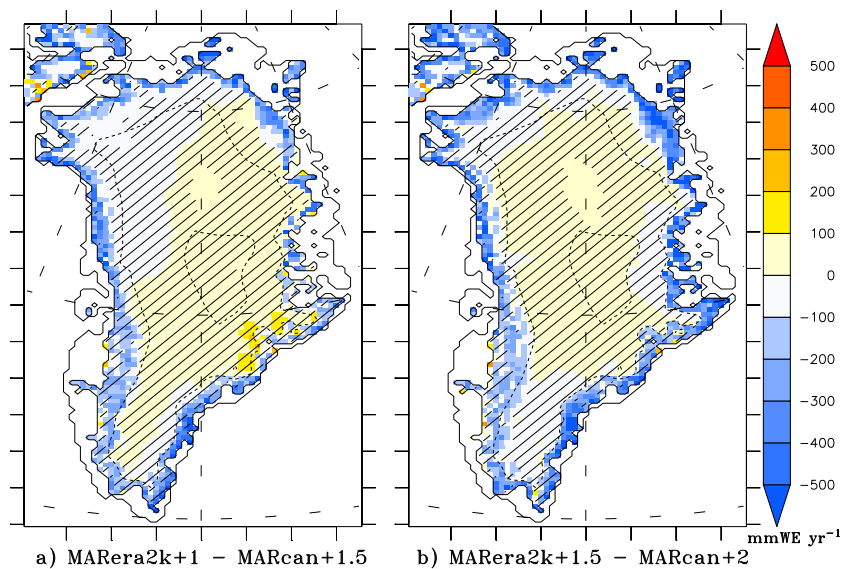
**Figure S2.** Differences of mean anomalies of annual SMB (in mmWE y<sup>-1</sup>) between a) MARera+1 and MARcan+1, b) MARera+1.5 and MARcan+1.5 and c) MARera+2 and MARcan+2. Areas where anomaly differences are smaller than the inter-annual variability (i.e. the standard deviation) of the simulation of MAR forced by unaltered ERA-Interim over 1980 – 1999 are hatched. Dashed lines are equal altitude lines of 2000 m and 3000 m. See Table S1 and Table S2 for abbreviations.



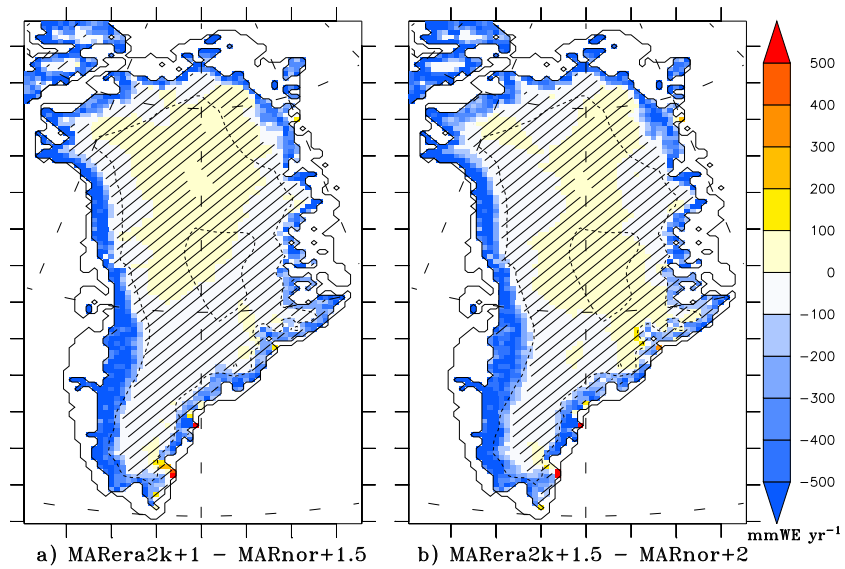
**Figure S3.** Same as Fig. S2 but for MARnor+x where x equals 1,1.5 or 2.



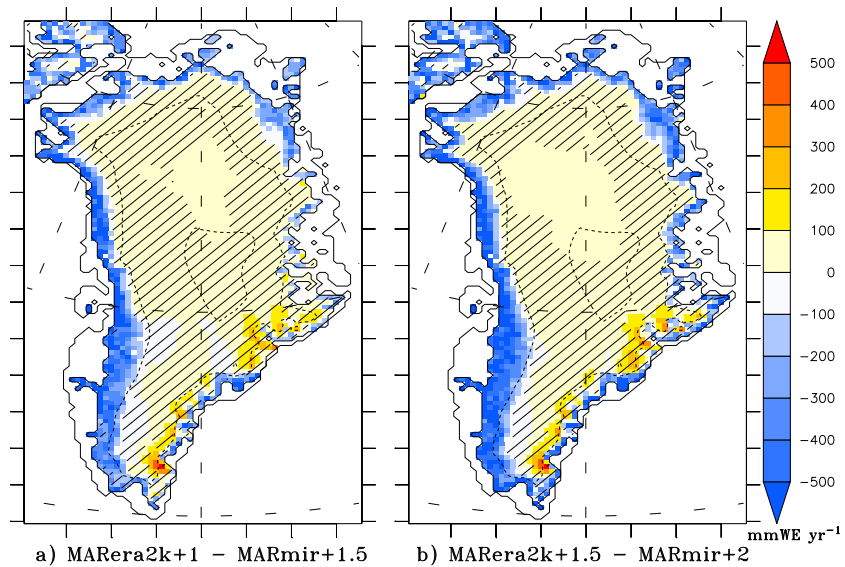
**Figure S4.** Same as Fig. S2 but for  $\text{MARmir}+x$  where  $x$  equals 1, 1.5 or 2.



**Figure S5.** Differences of mean anomalies of annual SMB (in  $\text{mmWE y}^{-1}$ ) between a)  $\text{MARera}2K+1$  and  $\text{MARcan}+1.5$  and b)  $\text{MARera}2K+1.5$  and  $\text{MARcan}+2$ . Areas where anomaly differences are smaller than the inter-annual variability (i.e. the standard deviation) of the simulation of MAR forced by unaltered ERA-Interim over 1980 – 1999 are hatched. Dashed lines are equal altitude lines of 2000 m and 3000 m. See Table S1 and Table S2 for abbreviations.



**Figure S6.** Same as Fig. S5 but for  $\text{MARnor}+x$  where  $x$  equals 1.5 or 2.



**Figure S7.** Same as Fig. S5 but for  $\text{MARmir}+x$  where  $x$  equals 1.5 or 2.

**Table S1.** Abbreviation description of reanalysis sensitivity experiments

MARera+1	Anomalies between MAR forced by the ERA-Interim reanalysis warmer of +1 °C over 1980 – 1999 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999
MARera+1.5	Anomalies between MAR forced by the ERA-Interim reanalysis warmer of +1.5 °C over 1980 – 1999 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999
MARera+2	Anomalies between MAR forced by the ERA-Interim reanalysis warmer of +2 °C over 1980 – 1999 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999
MARera2k	Anomalies between MAR forced by the ERA-Interim over 2000 – 2016 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999
MARera2k+1	Anomalies between MAR forced by the ERA-Interim reanalysis warmer of +1 °C over 2000 – 2016 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999
MARera2k+1.5	Anomalies between MAR forced by the ERA-Interim reanalysis warmer of +1.5 °C over 2000 – 2016 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999
MARera2k+2	Anomalies between MAR forced by the ERA-Interim reanalysis warmer of +2 °C over 2000 – 2016 and MAR forced by the unaltered ERA-Interim reanalysis over 1980 – 1999

**Table S2.** Abbreviation description of GCM sensitivity experiments

MARmir+1	Anomalies between MAR forced by MIROC5 over a warmer 20-yr period of +1 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARmir+1.5	Anomalies between MAR forced by MIROC5 over a warmer 20-yr period of +1.5 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARmir+2	Anomalies between MAR forced by MIROC5 over a warmer 20-yr period of +2 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARnor+1	Anomalies between MAR forced by NorESM1 over a warmer 20-yr period of +1 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARnor+1.5	Anomalies between MAR forced by NorESM1 over a warmer 20-yr period of +1.5 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARnor+2	Anomalies between MAR forced by NorESM1 over a warmer 20-yr period of +2 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARcan+1	Anomalies between MAR forced by CanESM2 over a warmer 20-yr period of +1 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARcan+1.5	Anomalies between MAR forced by CanESM2 over a warmer 20-yr period of +1.5 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period
MARcan+2	Anomalies between MAR forced by CanESM2 over a warmer 20-yr period of +2 °C relative to the reference period 1980 – 1999 and MAR forced by MIROC5 over the reference period