Supplementary material of

Future projections of the Greenland ice sheet surface mass balance based on the regional climate model MAR forced by CMIP5 global models

Fettweis et al., 2012

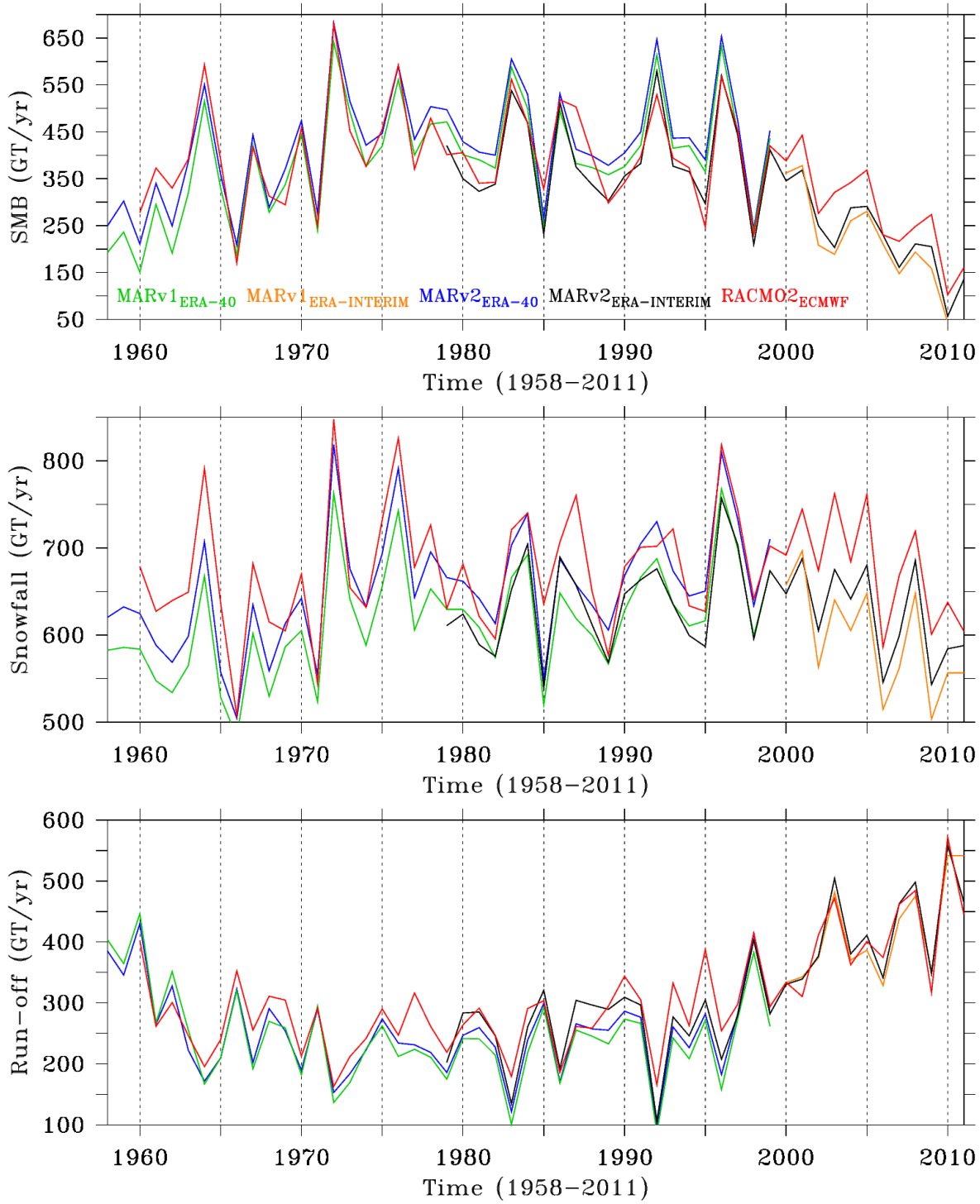

Fig. S1: Time series of the annual total ice sheet SMB, snowfall and run-off (in GT/yr) simulated by MAR and RACMO2 forced by the ECMWF reanalyses. RACMO2 is forced by ERA-40 over 1960-1988 and by ERA-INTERIM over 1989-2011.

	SMB		Snowfall		Run-off	
	corr.	rmse	corr.	rmse	corr.	rmse
MARv1 vs MARv2 ERA-40 (1980-1999) – ERA-INTERM (2000-2010)	1.00	25	0.98	36	1.00	16
RACMO2 vs MARv2 ERA-40 (1980-1988) – ERA-INTERM (1989-2011)	0.94	49	0.92	51	0.95	32
MARv2 (ERA-40) vs MARv2 (ERA-INTERIM) 1980-1999	0.98	62	0.95	39	0.98	23

Table S1: Statistics (coefficient of correlation and RMSE in GT/yr) comparing time series plotted in Fig. S1. The ECMWF reanalyses used as forcing and the period over which the statistics are computed are listed in the table.

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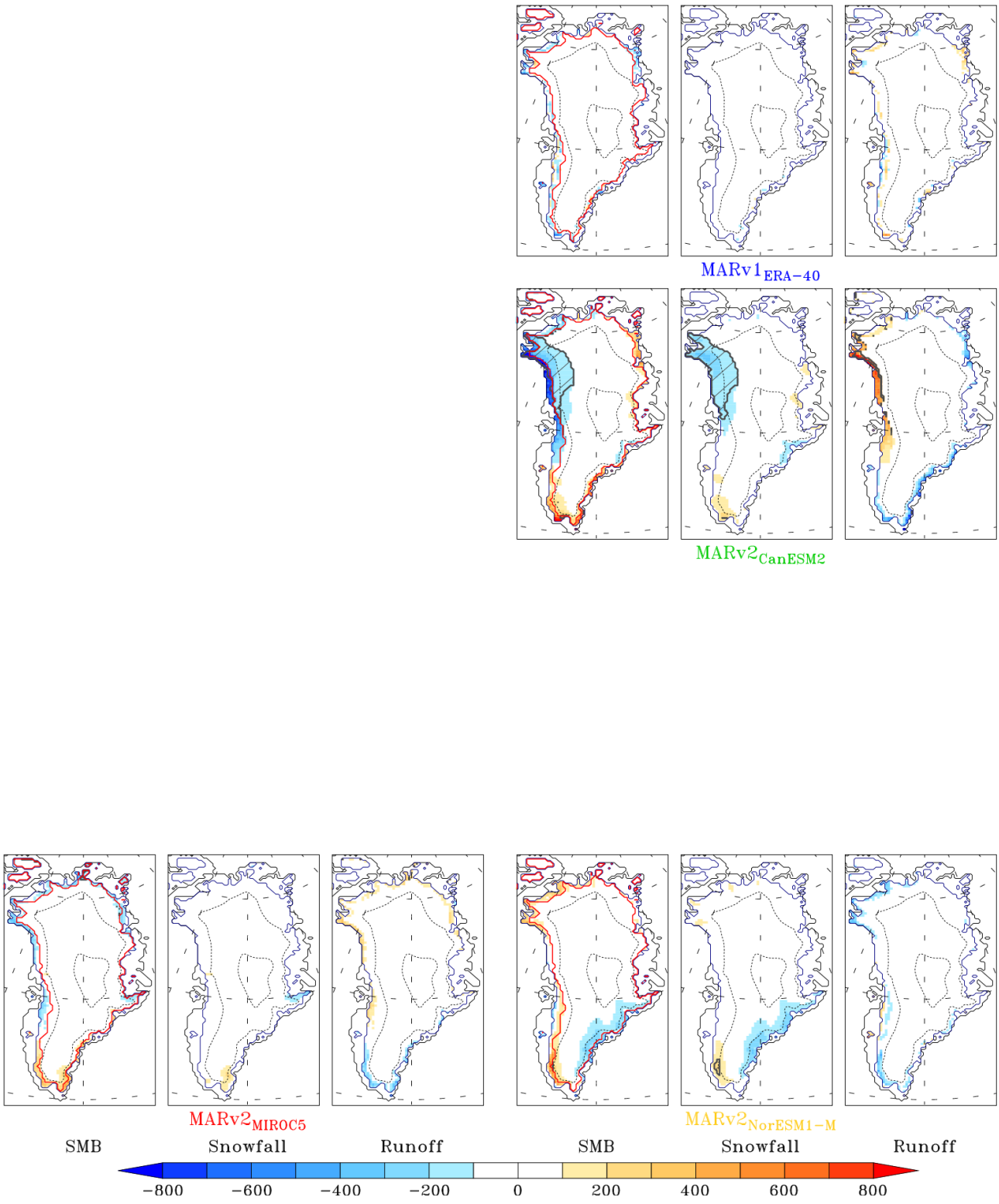

Fig. S2: Same as Fig. 1 but with respect to $MARv2_{ERA\text{-}40}$ over 1970-1999.

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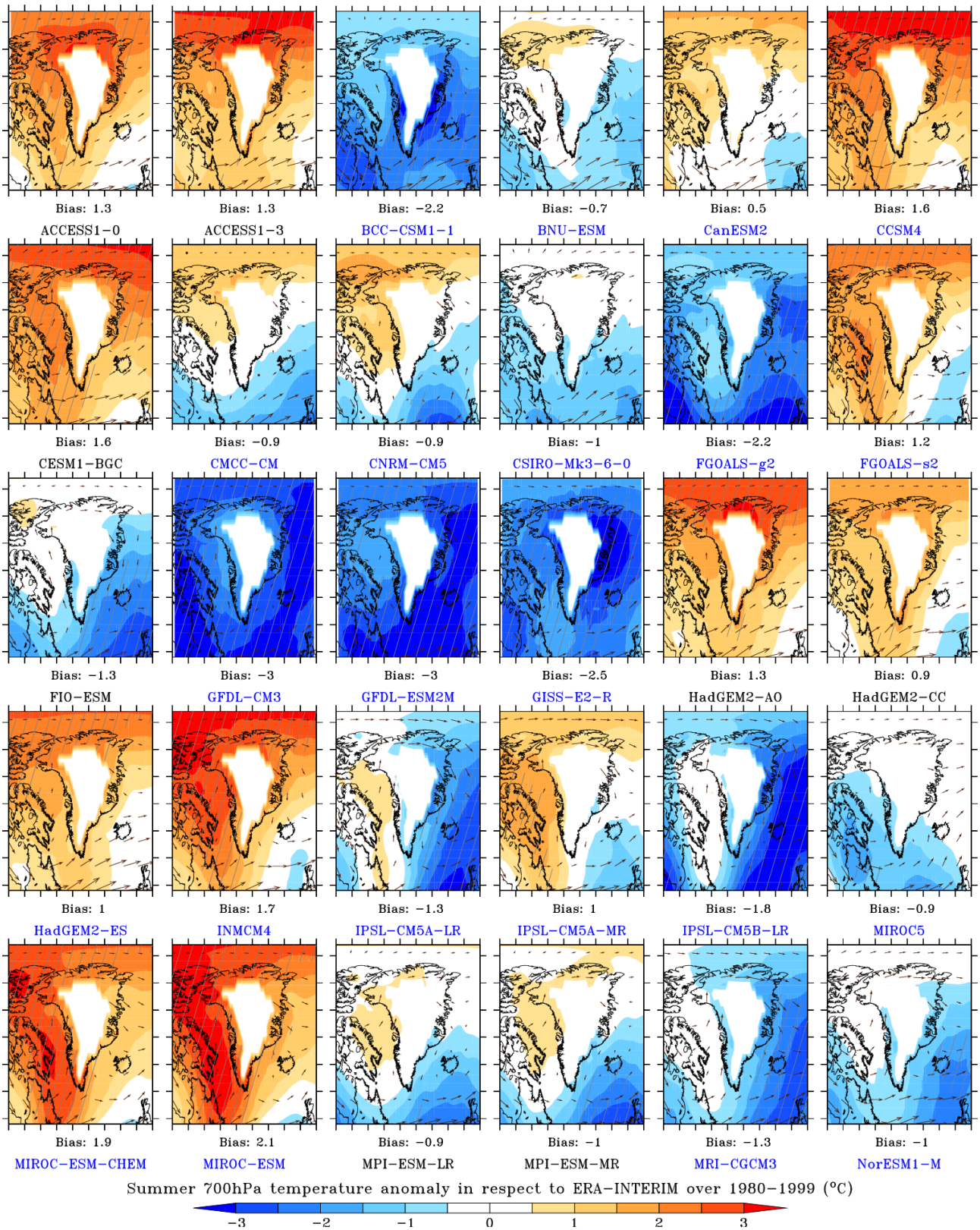

Fig. S3a: Same as Fig 2 but for the 30 CMIP5 GCMs used in the CMIP5 ensemble mean. In blue, the GCMs for which 6 hourly outputs are available in the CMIP5 database.

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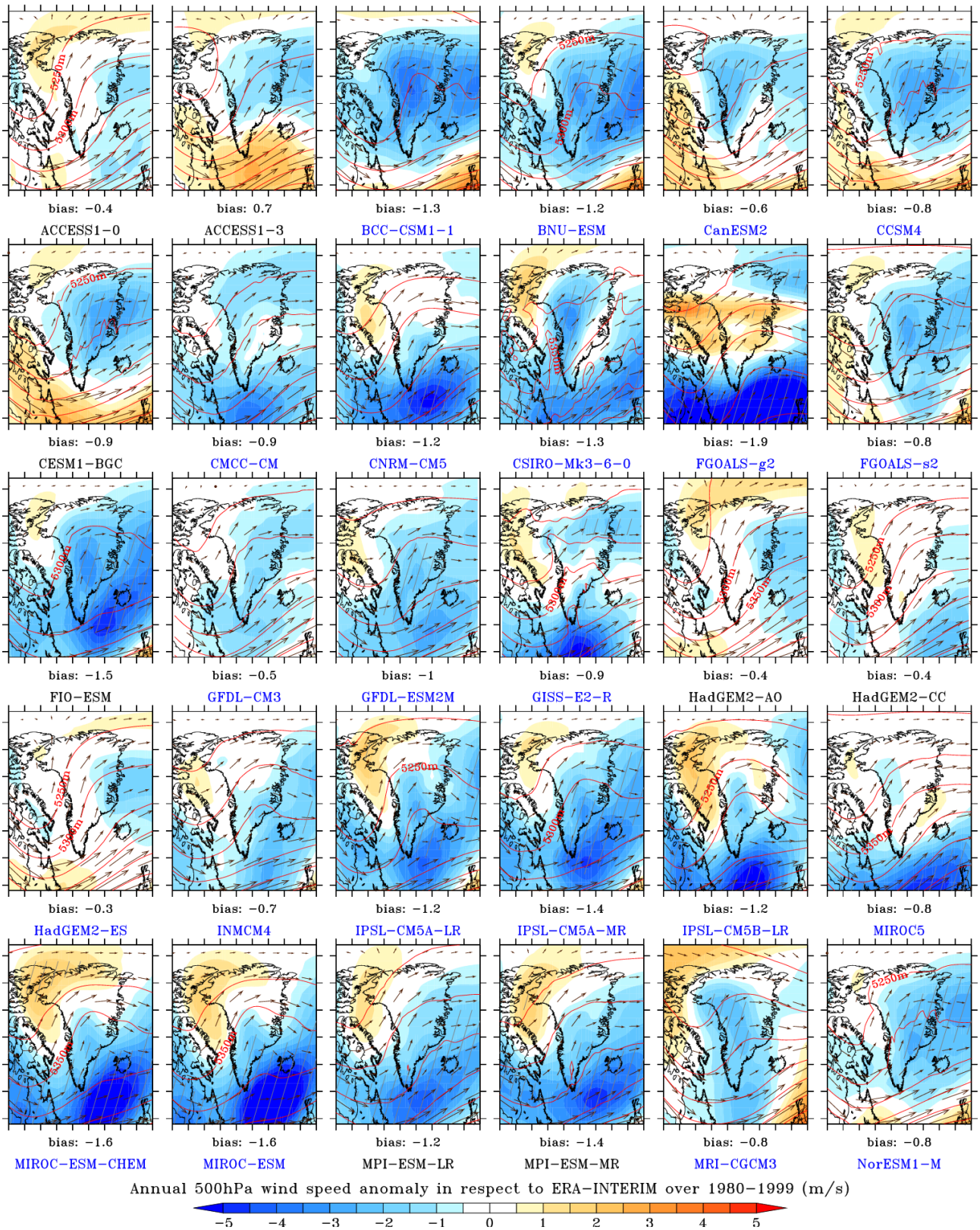

Fig. S3b: Same as Fig 2 but for the 30 CMIP5 GCMs used in the CMIP5 ensemble mean. In blue, the GCMs for which 6 hourly outputs are available in the CMIP5 database.

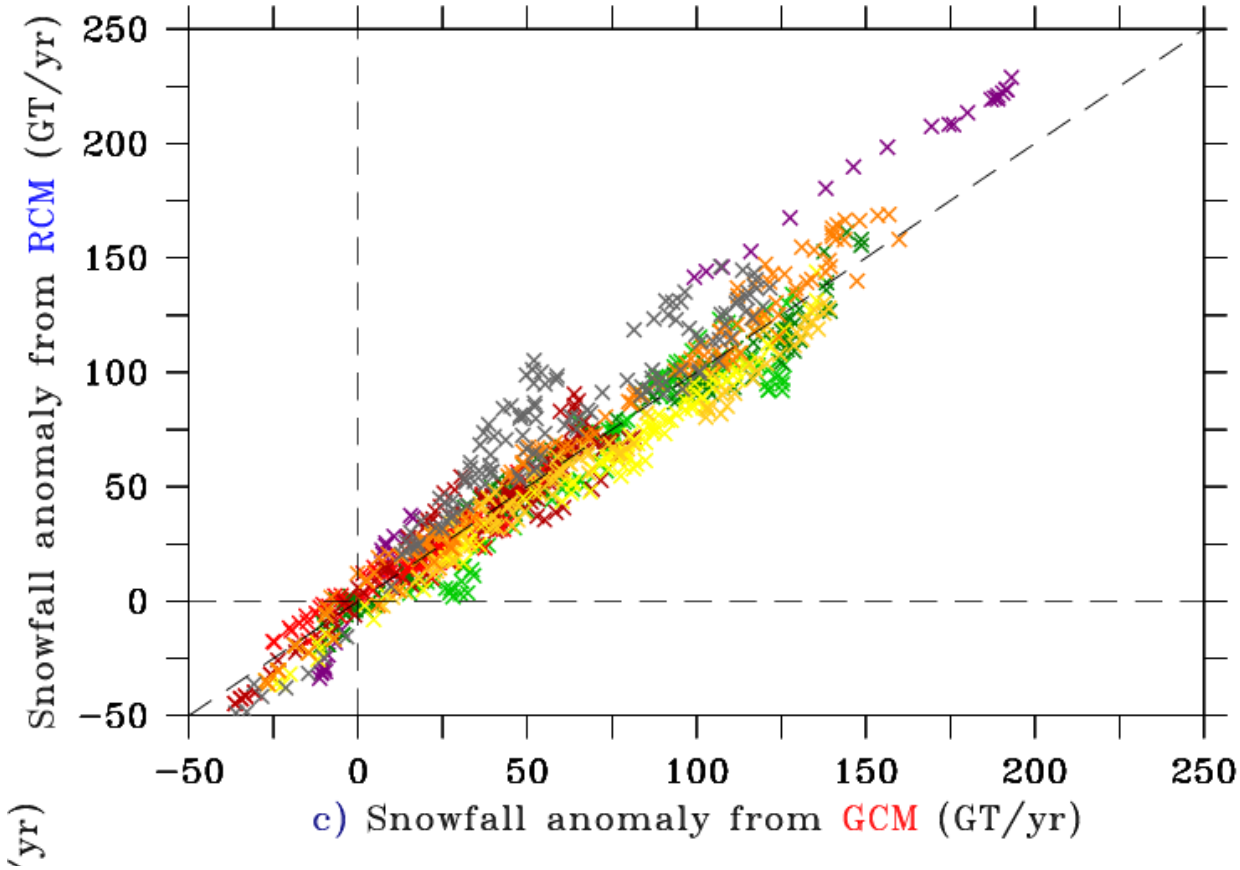

Fig. S4: Same as Fig 7a) but for annual total snowfall from RCMs vs annual total snowfall from GCMs.

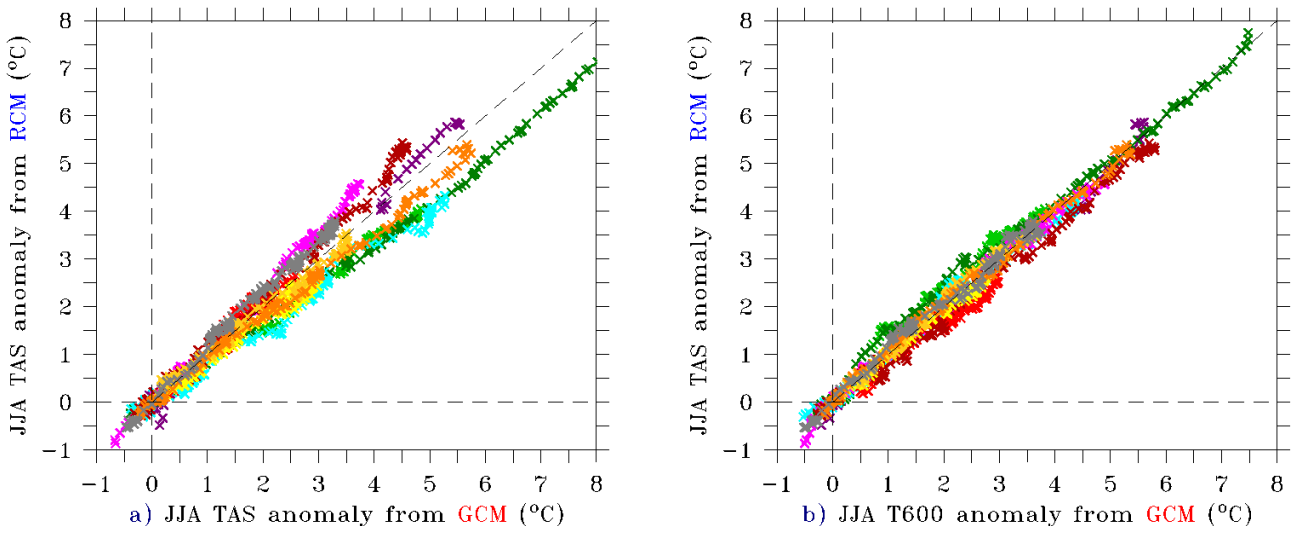

Fig. S5: Left) JJA TAS anomaly from RCM vs the one from GCM with respect to 1980-1999. In lack of an ice sheet mask in the GCMs, the pixels located in the area described above and at an altitude higher than 1000 meters a.s.l are used for computing the JJA TAS over GrIS. The topography (OROG) of each model is used for selecting the pixels higher than 1000 m a.s.l. Right) The same as left but for T600 computed over the area (70°W-20°W and 60°N-85°N). Finally, a 10-year running mean has been applied for smoothing the curves.

	Corr.	RMSE (GT/yr)
MARv2 $_{CanESM2}$ vs CanESM2 (RCP45)	0.84	89
MARv2 $_{CanESM2}$ vs CanESM2 (RCP85)	0.97	104
MARv2 $_{MIROC5}$ vs MIROC5 (RCP45)	0.84	84
MARv2 $_{MIROC5}$ vs MIROC5 (RCP85)	0.96	92
MARv2 $_{NorESM1-M}$ vs NorESM1-M (RCP45)	0.86	69
MARv2 $_{NorESM1-M}$ vs NorESM1-M (RCP60)	0.85	84
MARv2 $_{NorESM1-M}$ vs NorESM1-M (RCP85)	0.94	77

Table S2: Statistics (coefficient of correlation and RMSE in GT/yr) comparing time series plotted in Fig. 8c and Fig. 8d i.e. the GrIS SMB simulated by MARv2 vs the GrIS SMB derived with Eq. 1 from the forcing outputs over 2000-2100 (without having applied a 10-yr running mean).

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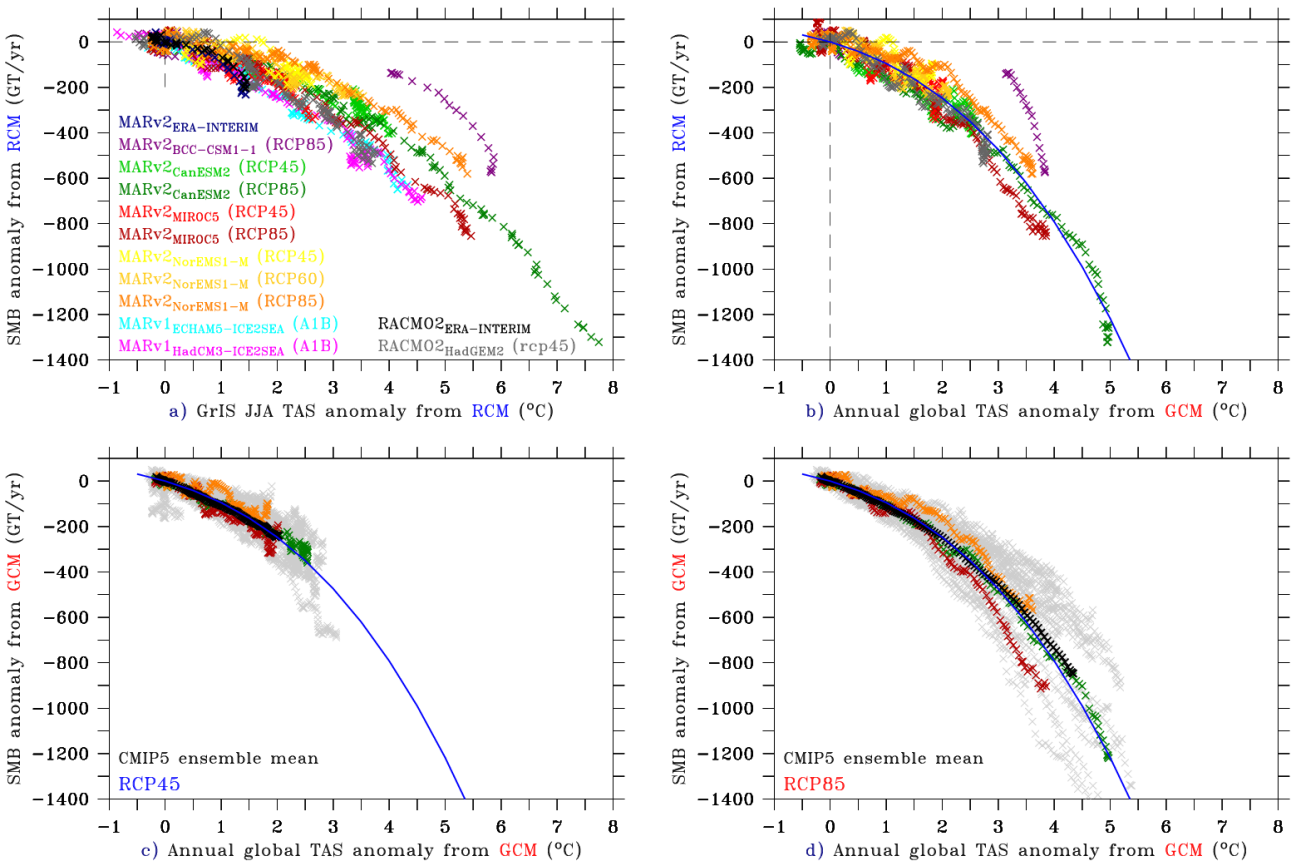

Fig. S6: a) GrIS SMB anomaly from RCM vs JJA TAS anomaly from RCM with respect to 1980-1999. b) GrIS SMB anomaly from RCM vs global annual TAS from GCM. c) GrIS SMB anomaly estimated from GCM outputs using Eq. 1 vs global annual TAS from GCM for the RCP45 scenario. d) Same as c) but for the RCP85 scenario. Finally, in blue, there is an approximation of the GrIS SMB anomalies (in GT/yr) following:

$$\Delta SMB = -2.8(\Delta TAS)^3 - 20.4(\Delta TAS)^2 - 71.5(\Delta TAS)$$

where ΔTAS (in °C) is the global annual TAS anomaly from GCM with respect to 1980-1999. A 10-year running mean has been applied for smoothing the curves of all time series.