Supplement - Role of precipitation and extreme precipitation events in the surface mass balance variability observed in three ice cores from coastal Dronning Maud Land

Sarah Wauthy[1,2] and Quentin Dalaiden[3,4,5]

[1]Laboratoire de Glaciologie, Département Géosciences, Environnement et Société (DGES), Université libre de Bruxelles (ULB), Brussels, Belgium
[2]Laboratoire G-Time, Département Géosciences, Environnement et Société (DGES), Université Libre de Bruxelles (ULB), Brussels, Belgium
[3]Lemaître Centre for Earth and Climate Research (TECLIM), Earth and Life Institute (ELI), Université catholique de Louvain (UCL), Louvain-la-Neuve, Belgium
[4]Bjerknes Center for Climate Research, Bergen, Norway
[5]Nansen Environmental and Remote Sensing Center (NERSC), Bergen, Norway

Correspondence to: Sarah Wauthy (sarah.wauthy@ulb.be)

Supplementary materials

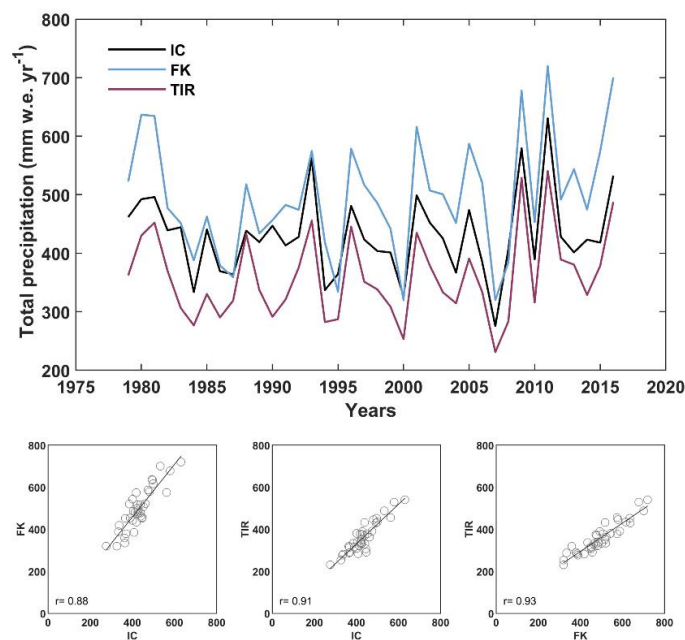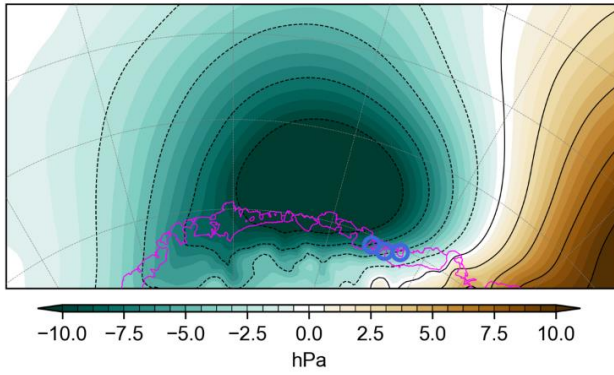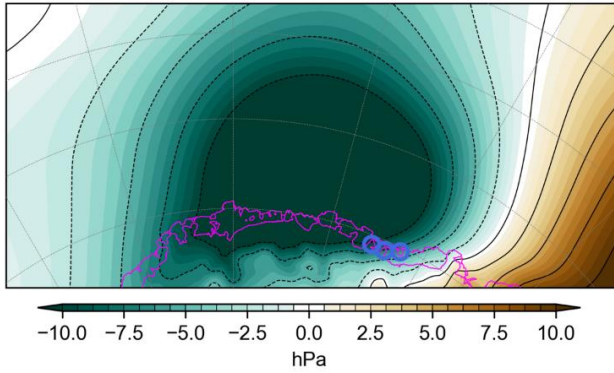**Supplement S1: Annual precipitation time series from RACMO2.3**

Figure S1: Total annual precipitation time series at our three sites (upper panel) and correlation between the sites (down panel) according to RACMO2.3.

1

20   **Supplement S2: Synoptic conditions during 98th percentile EPEs**
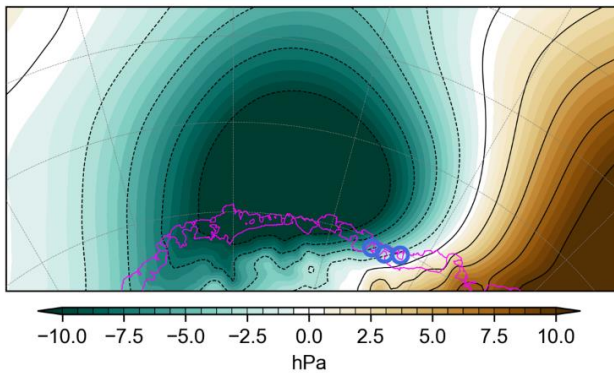
(a)   EPEs at IC – SLP anomaly (n=171)

(b)   EPEs at FK – SLP anomaly (n=149)

(c)   EPEs at TIR – SLP anomaly (n=148)

Figure S2: Maps of the sea level pressure anomaly (SLP) during 98th percentile EPEs at the three sites: (a) IC, (b) FK, and (c) TIR. The number in parentheses corresponds to the number of EPE days. Blue colors indicate negative anomaly (i.e., low pressure) and brown colors indicate positive anomaly (i.e., high pressure).

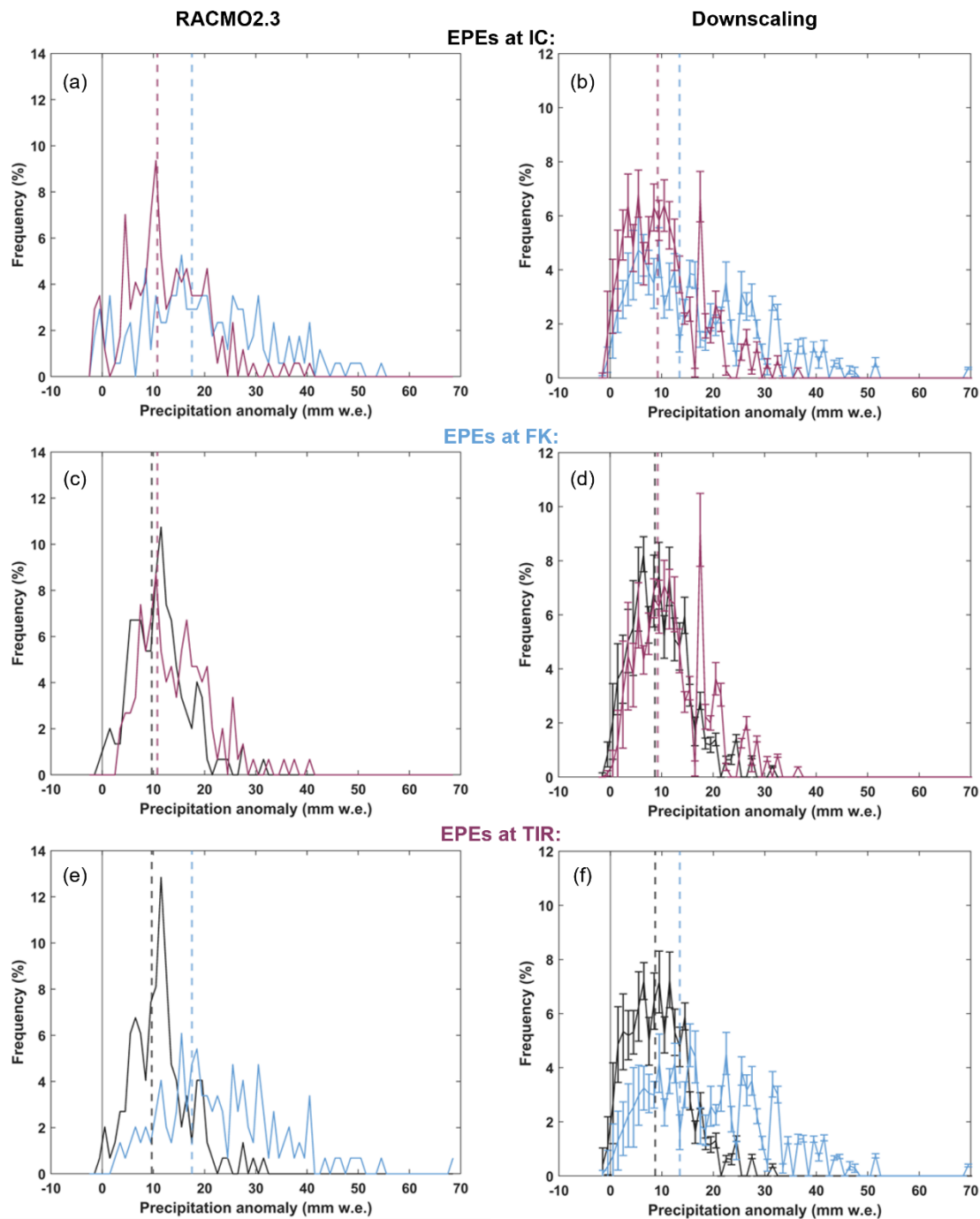**Supplement S3: 98th percentile EPEs anomalies**

Figure S3: Frequency distributions of precipitation anomalies (calculated as the precipitation – the average value of precipitation series) at the two other sites corresponding to the dates of 98th percentile EPEs at (a-b) IC, (c-d) FK and (e-f) TIR, using the RACMO2.3 data series (left panels) and the downscaling data series (right panels).

30

These results are summarized in Table S1:

RACMO2.3 (%)	EPEs at IC		EPEs at FK		EPEs at TIR	
	FK	TIR	IC	TIR	IC	FK
EPEs	52.0	53.8	59.7	63.8	62.2	64.2
Neg. anom.	4.7	6.4	0.7	0	0.7	0
Downscaling (%)	EPEs at IC		EPEs at FK		EPEs at TIR	
	FK	TIR	IC	TIR	IC	FK
EPEs	52 ± 5	51 ± 4	53 ± 5	63 ± 7	52 ± 4	63 ± 7
Neg. anom.	0.7 ± 0.5	2 ± 2	0.9 ± 0.5	0.1 ± 0.1	1.5 ± 1.7	0.4 ± 0.7

Table S1: Distribution of the precipitation anomalies at two sites when there is a 98th percentile EPE at the third site, in %, for both the RACMO2.3 and downscaling datasets. For the downscaling, the average of the 10 members is shown, as well as the standard deviation to highlight the variability between members. See text for more explanations on the "EPEs" and "Neg. anom." (i.e.,
35 **negative anomalies) categories.**

Supplement S4: Comparison between the 5.5 km and 2 km SMB outputs from RACMO2.3
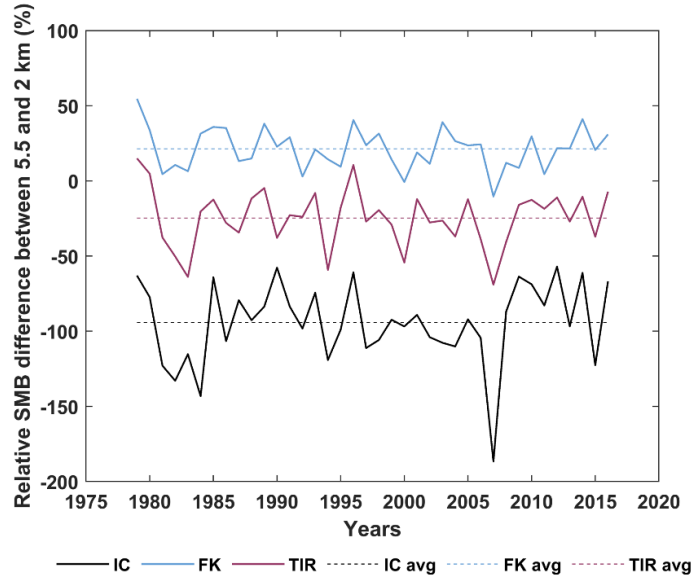

Figure S4: Relative difference in % between the SMB time series of RACMO2.3 at 5.5 km and 2 km resolutions (solid lines) and average values for the 1979-2016 period (dotted lines), for the three sites (IC in black, FK in blue, and TIR in burgundy).

4