# Supplementary Information of "Climate warming amplified the 2020 record-breaking heatwave in the Antarctic Peninsula"

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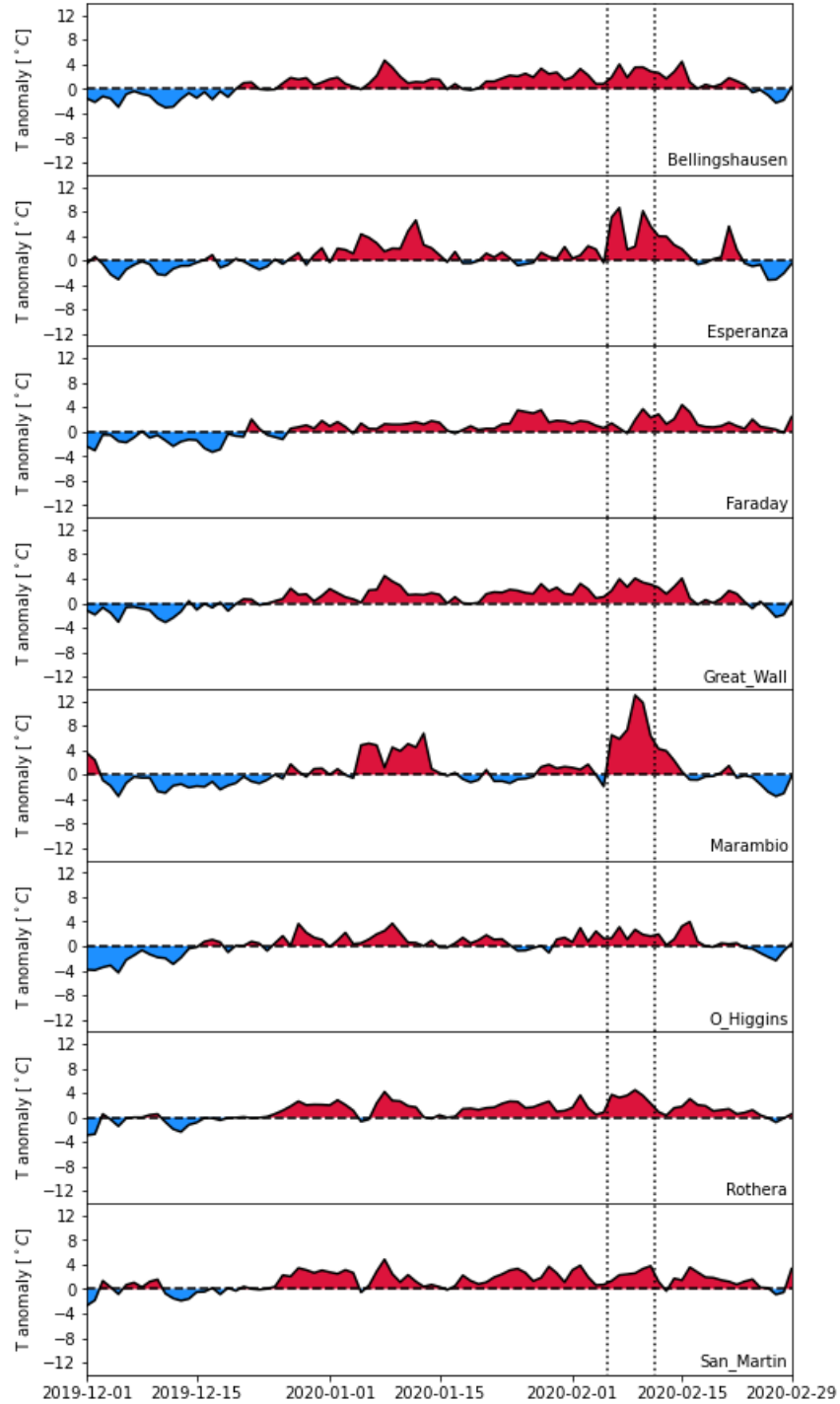
**Figure S1.** Time series of daily mean T2m anomalies (ºC, wrt. 1950-2019) for the 2020 summer at different stations of the AP region. Positive (negative) anomalies are shaded in red (blue). Vertical dotted lines delimit the period 6-11 February 2020. Data source: SCAR MET-READER dataset
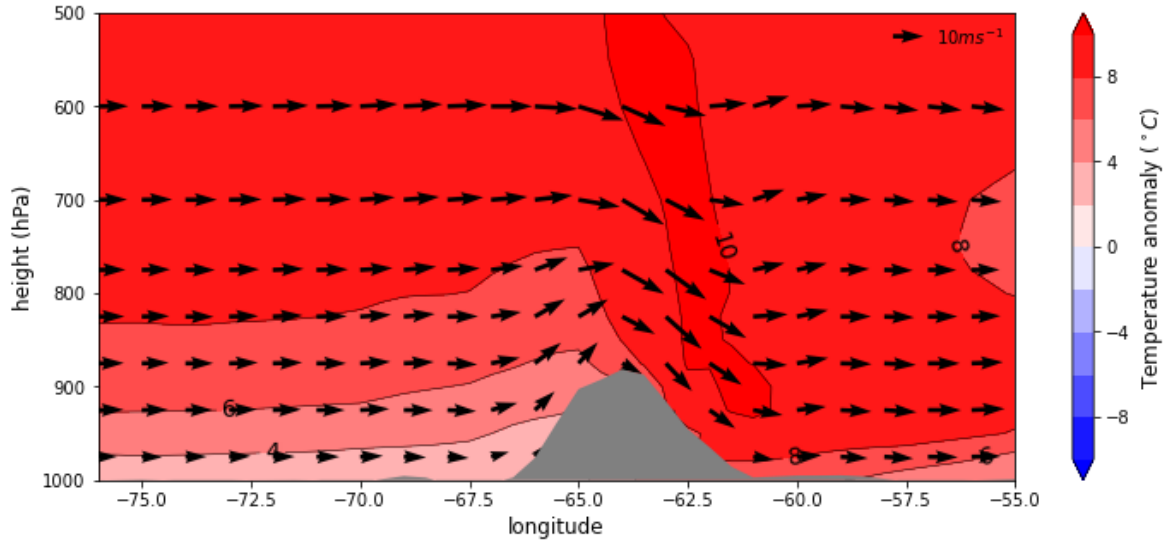
**Figure S2.** Longitude-pressure cross-section at 66 ºS showing temperature (contours and color shading; in ºC) and zonal wind (arrows; in ms$^{-1}$) anomalies (wrt. 1950-2019) for 6-11 February 2020. Topography is masked with grey shading. Data source: ERA5 reanalysis.
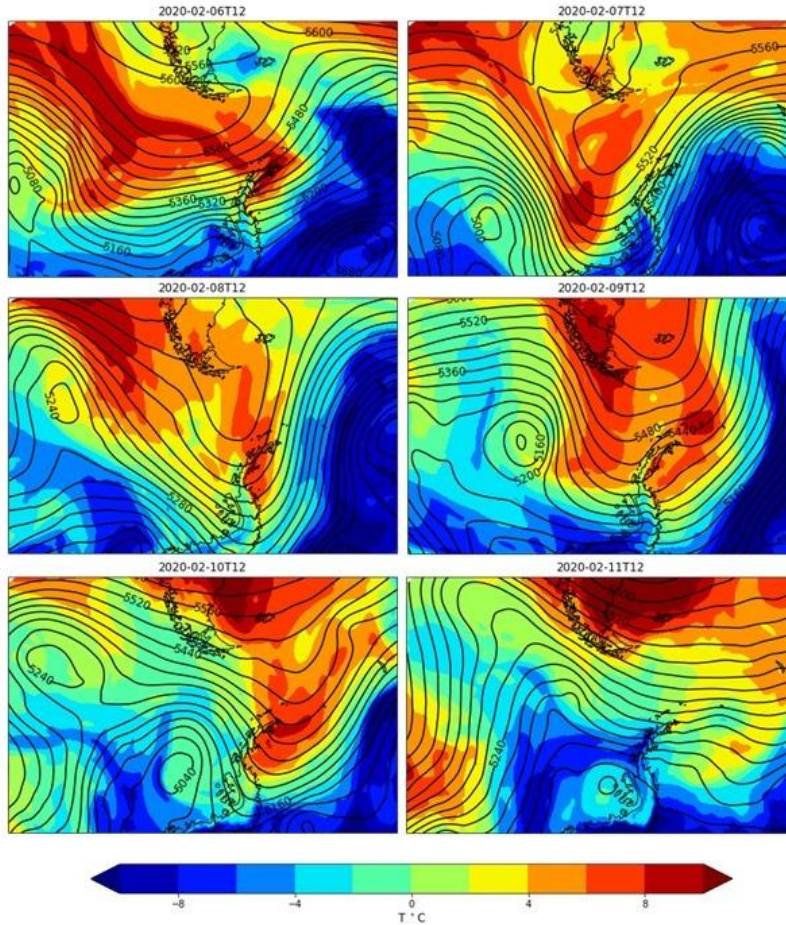
**Figure S3.** Daily synoptic weather maps showing Z500 fields (contours; in gpm) and T850 (shading; in ºC) for each day of the 6-11 February 2020 period. Data source: ERA5 reanalysis.
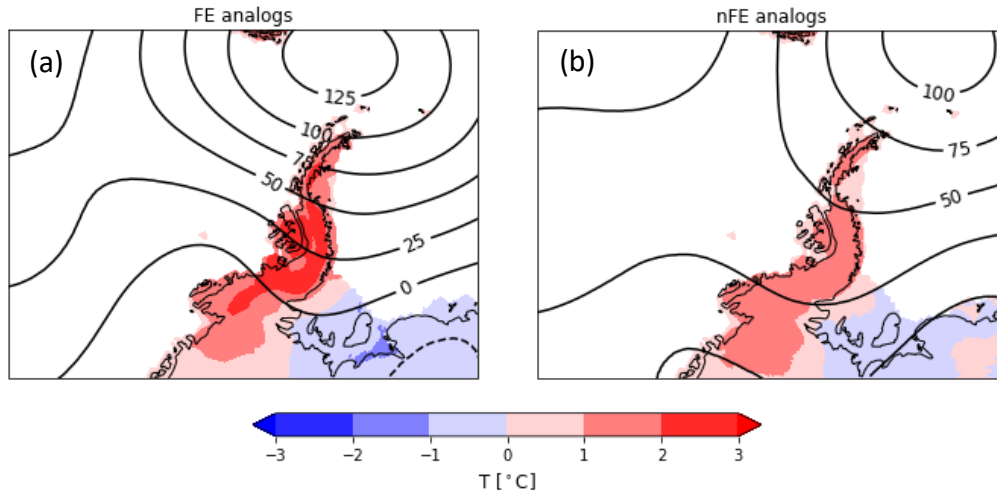
**Figure S4**. Composites of Z500 (contours; in gpm) and T2m (shading; in ºC) anomalies (wrt. 1950-2019) for analog days of the 2020 AP heatwave (6-11 February 2020) with (a; FE) and without (b; nFE) Foehn effect.
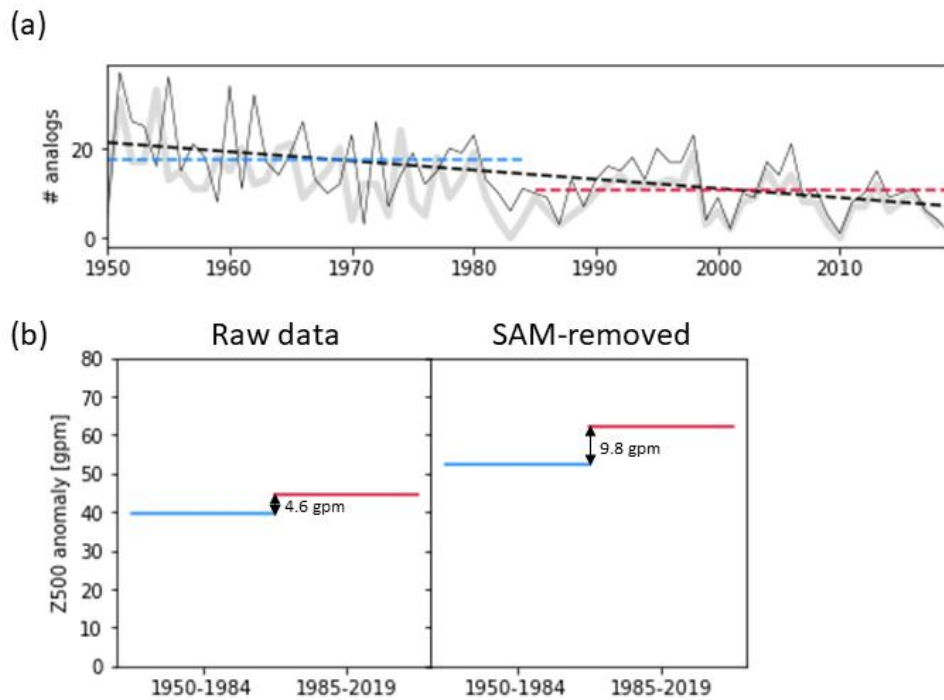
**Figure S5.** (a) Time series (1950-2019) of the summer frequency of analog days (RMSD < 0.9 SD). Black thin line shows the raw series and grey thick line denotes the SAM-removed series. Black dashed line shows the linear trend. Colored dashed lines indicate the averaged values for the 1950-1984 (blue) and 1985-2019 (red) sub-periods. (b) Mean AN Z500 anomalies (gpm) for past (1950-1984) and recent (1985-2019) flow analogs of the 2020 AP heatwave. Left and right insets show the results for the raw and SAM-detrended data, respectively. Data source: ERA5 reanalysis.
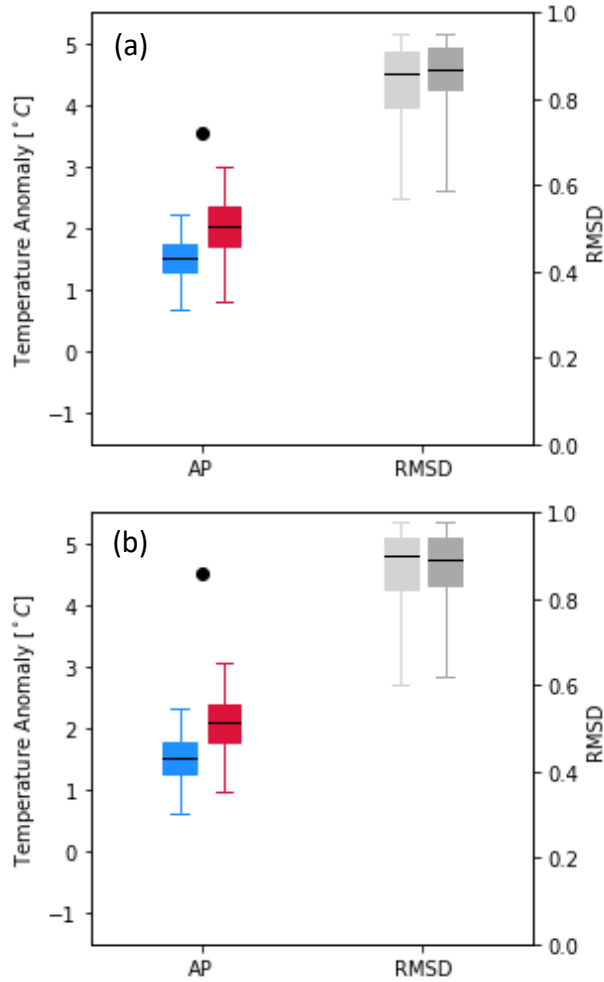
**Figure S6.** Flow-conditioned distributions of 6-day mean AP T2m anomaly (colored whiskers; ºC wrt. 1950-2019 in left y-axis) and AN Z500 RMSD (grey whiskers; m in right y-axis) as reconstructed from analogs of the 2020 AP heatwave (6-11 February 2020) using: a) Z500/SLP detrended data; b) FE analogs only. Boxers and whiskers follow the same layout convention as in Figure 4. Data source: ERA5 reanalysis
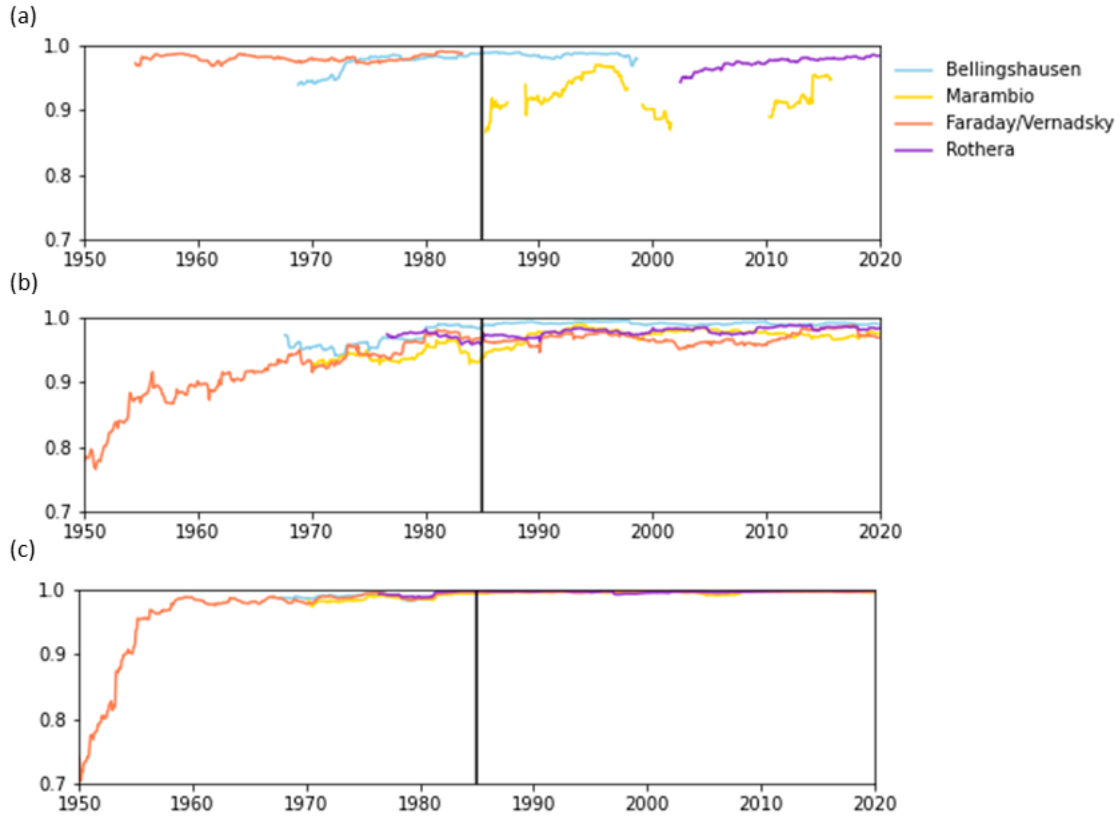
**Figure S7.** Time series (1950-2020) of the Pearson's correlation coefficient between observations from the SCAR MET-READER dataset at selected locations (colored lines) and ERA5 data at the closest grid point. Correlations are computed for 5-year centered running windows and monthly mean series of (a) Z500 (gpm), (b) T2m (ºC) and (c) MSLP (hPa). The vertical black line denotes the 1985 year delimiting the 1950-1984 and 1985-2019 sub-periods.

| | | 1950-1984 | | | | | | 1985-2019 | | | | | |
| | | Z500 | | | T2m | | | Z500 | | | T2m | | |
| | Period | n | BIAS | MAE | n | BIAS | MAE | n | BIAS | MAE | n | BIAS | MAE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bellingshausen** | 1970 - 1999 | 45 | -3.7 | 17.5 | 49 | 0.2 | 0.5 | 38 | -15.5 | 18.9 | 108 | -0.2 | 0.4 |
| **Marambio** | 1982 - 2017 | 4 | -18.1 | 24.6 | 43 | 1.4 | 1.4 | 47 | -2.3 | 9.8 | 108 | 0.6 | 0.8 |
| **Faraday/Vernadsky** | 1954 - 1982 | 337 | 13.3 | 16.4 | 103 | -0.2 | 0.6 | 0 | - | - | 108 | -0.6 | 0.7 |
| **Rothera** | 2002 - 2021 | 0 | - | - | 23 | -2.0 | 2.0 | 52 | 6.1 | 11.9 | 108 | -2.1 | 2.1 |

**Table S1.** Summer diagnostics (mean bias and Mean Absolute Error, MAE) of ERA5 performance with respect to four selected sites (rows) over the 1950-1984 and 1985-2020 sub-periods (columns). The performance is tested using monthly mean values of the summer season from the closest ERA5 reanalysis grid point. The number of available observations is also indicated. Reference datasets are Z500 radiosonde data (gpm) and T2m station-based observations (ºC) from the SCAR MET-READER dataset.