**Supplementary material**

# Compound intense warming and precipitation events in the Patagonian Icefields and the Antarctic Peninsula Ice Sheet – Part 1: Event frequency, atmospheric circulation and impacts on glacier surface

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**1. Figures**

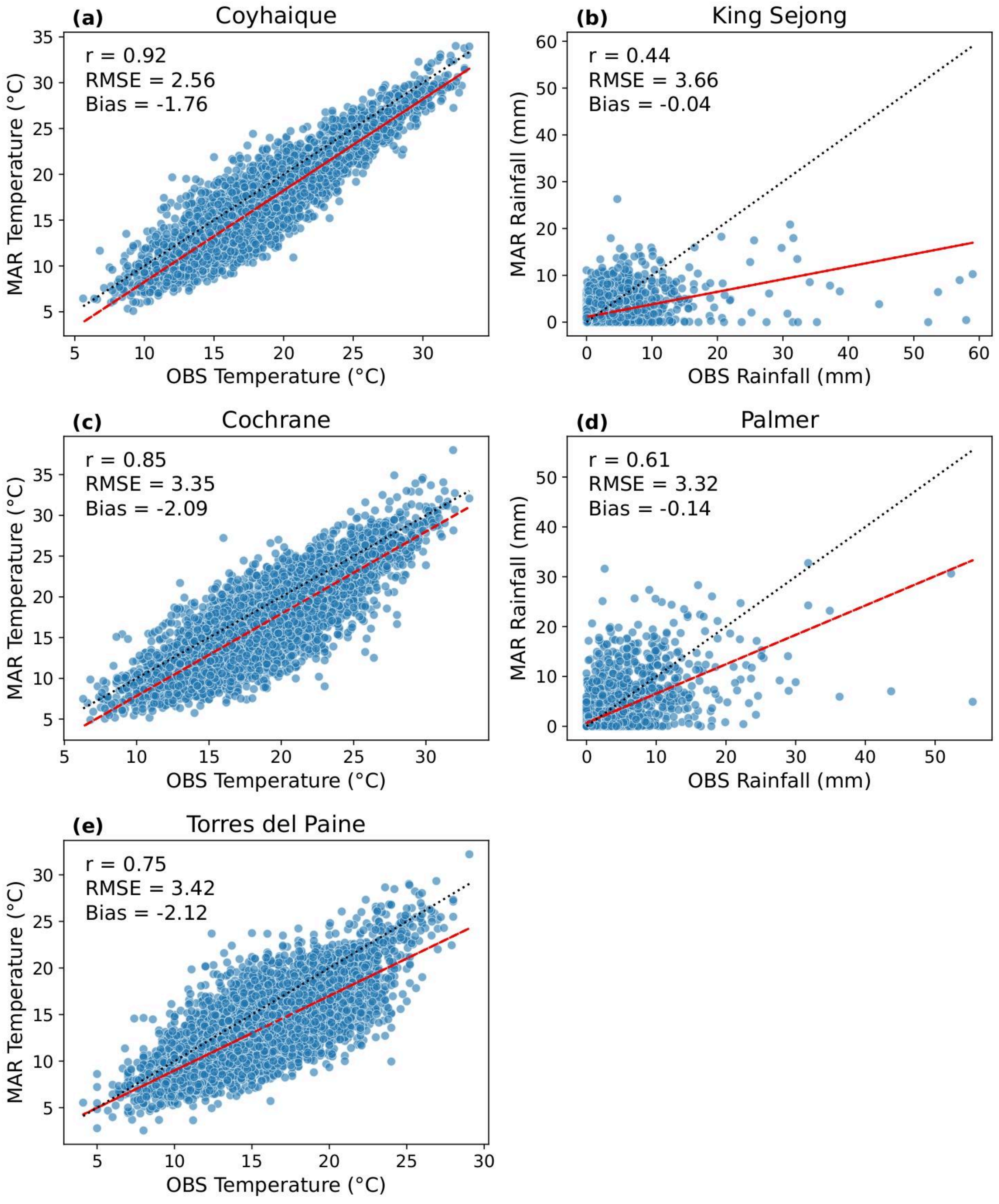



Figure S1. Correlation between observations and MAR output of daily maximum temperature (a, c, e) over Patagonia and daily accumulated rainfall (b and d) over the Antarctic Peninsula.

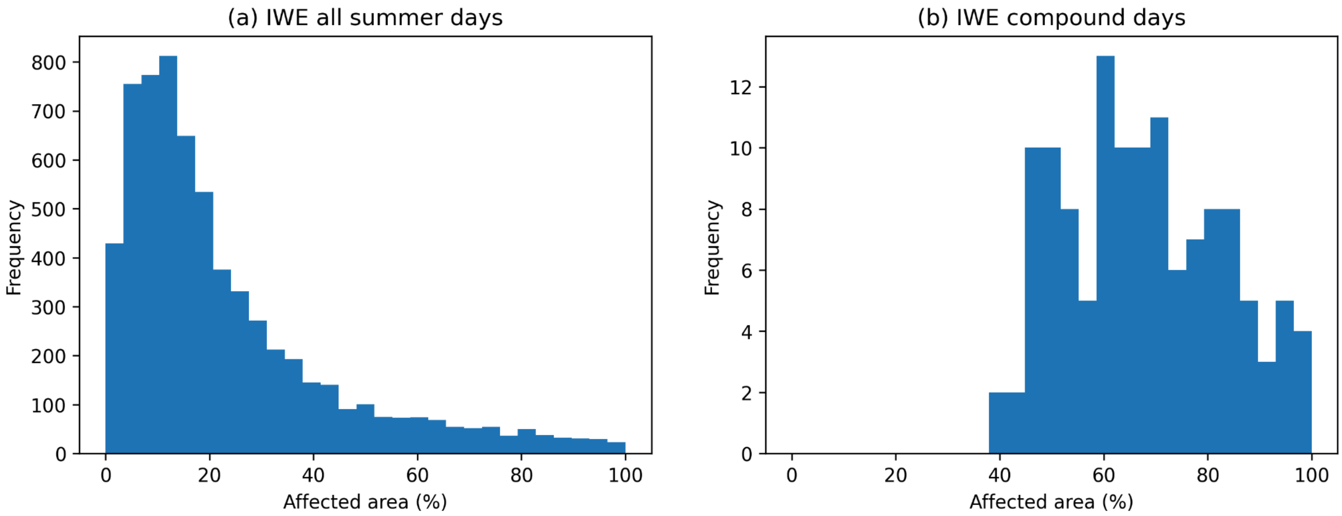



Figure S2. Frequency of the affected area during intense warming events (IWE) over the Patagonian Icefields during the extended summer (November–March) (a) and for compound-day events only (b) for the 1980–2022 period.

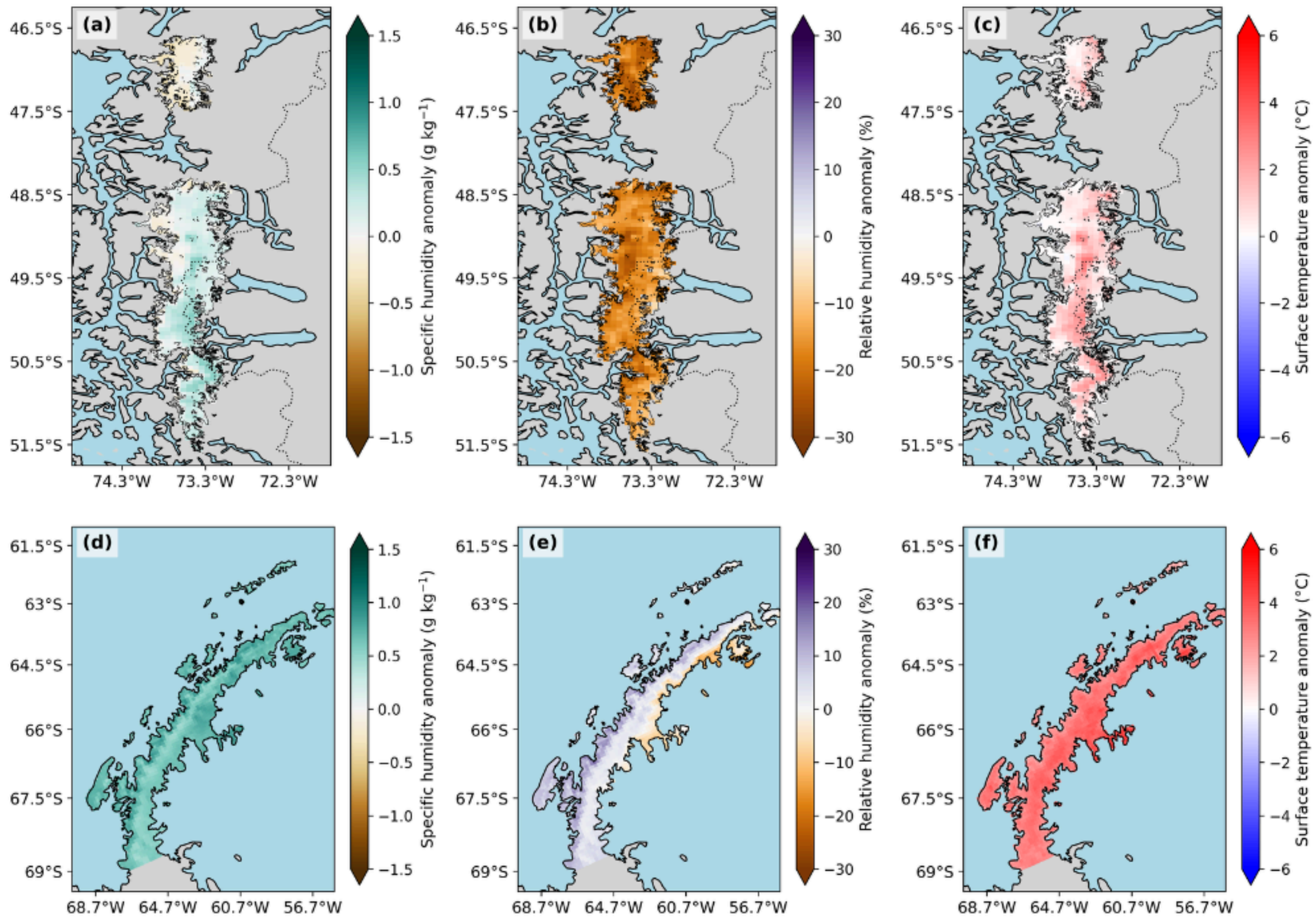



Figure S3. Mean daily anomaly fields of (a, d) specific humidity; (b, e) relative humidity; and (c, f) surface temperature for the 127 days identified between November and March over the 1980–2022 period; derived from MAR simulations. Panels (a–c) correspond to the Patagonian Icefields, and panels (d–f) to the Antarctic Peninsula Ice Sheet.

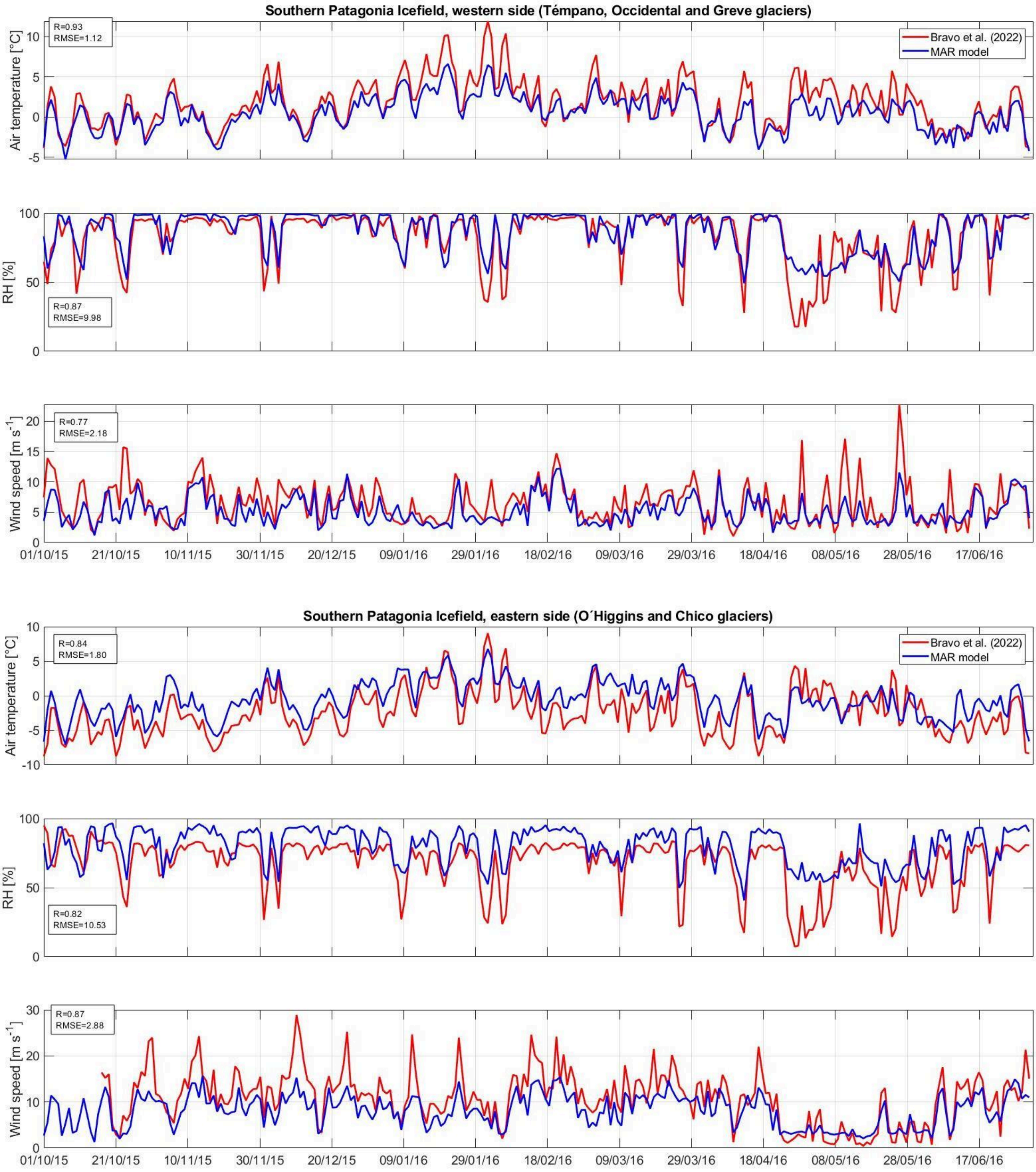
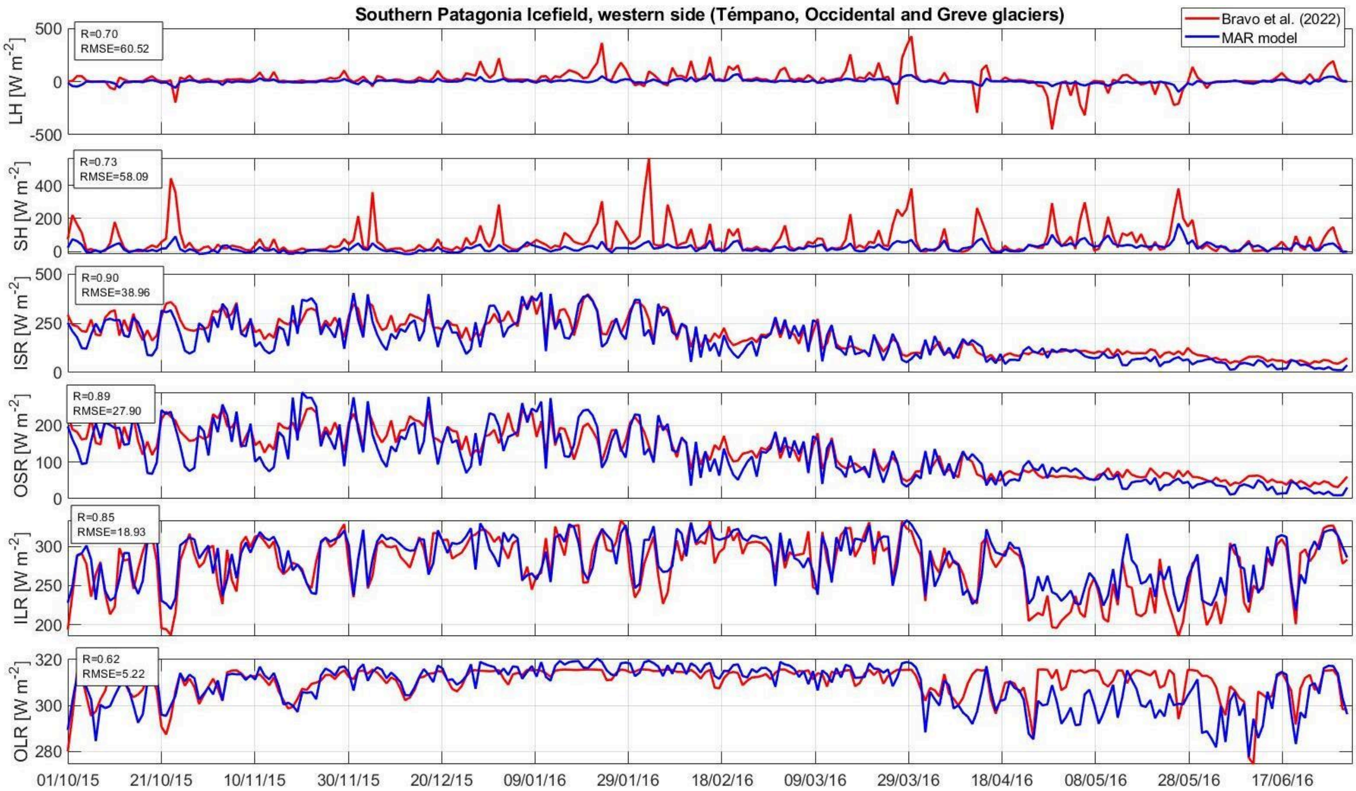



Figure S4. Daily comparison of air temperature, wind speed, and relative humidity over the eastern and western sectors of the Southern Patagonian Icefield, from Bravo et al. (2022) and MAR model.



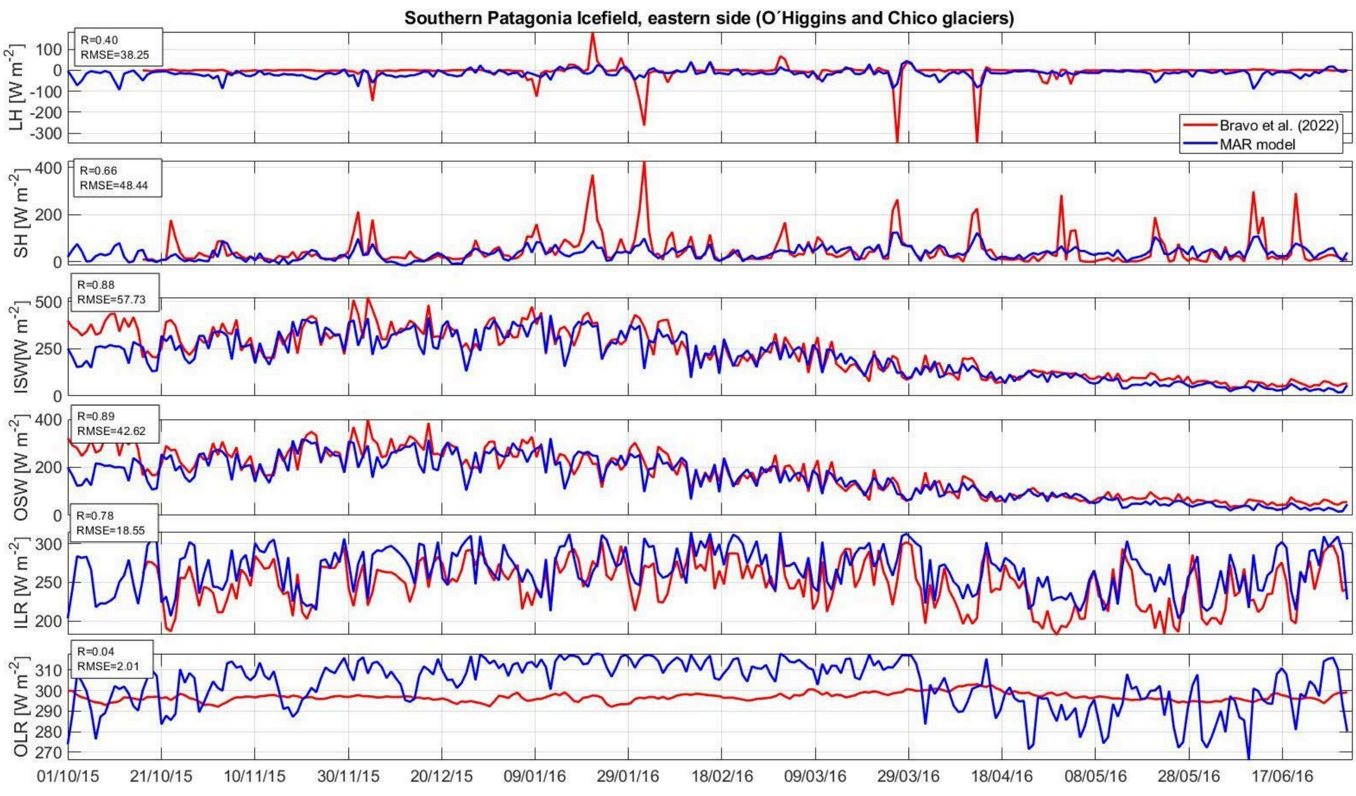




Figure S5. Daily comparison of surface energy balance components (latent and sensible heat fluxes, and incoming and outgoing shortwave and longwave radiation) over the eastern and western sectors of the Southern Patagonian Icefield, from Bravo et al. (2022) and MAR model.

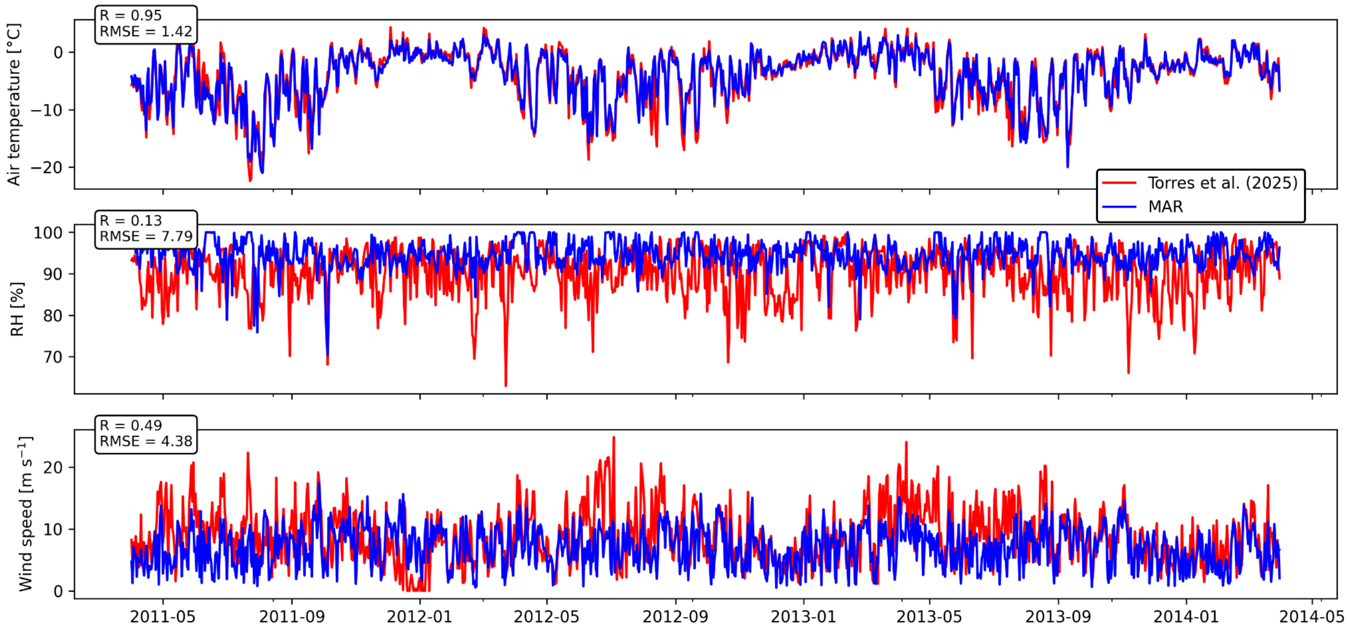



Figure. S6. Daily comparison of air temperature, wind speed, and relative humidity at Fourcade and Polar Club Glacier located King George Island, from Torres et al. (2025) and MAR model.

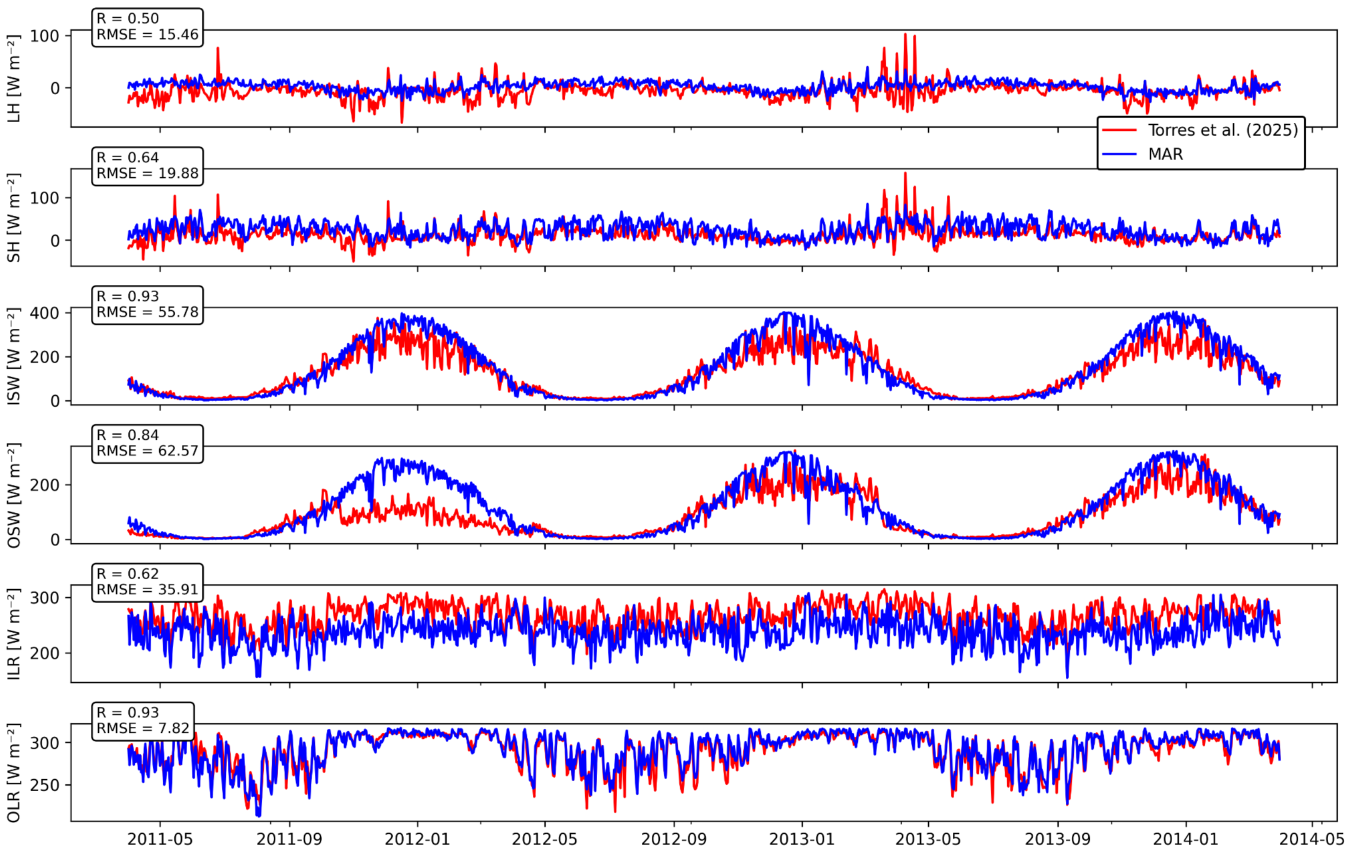



Figure S7. Daily comparison of surface energy balance components (latent and sensible heat fluxes, and incoming and outgoing shortwave and longwave radiation) at Fourcade and Polar Club Glacier located King George Island, from Torres et al. (2025) and MAR model.

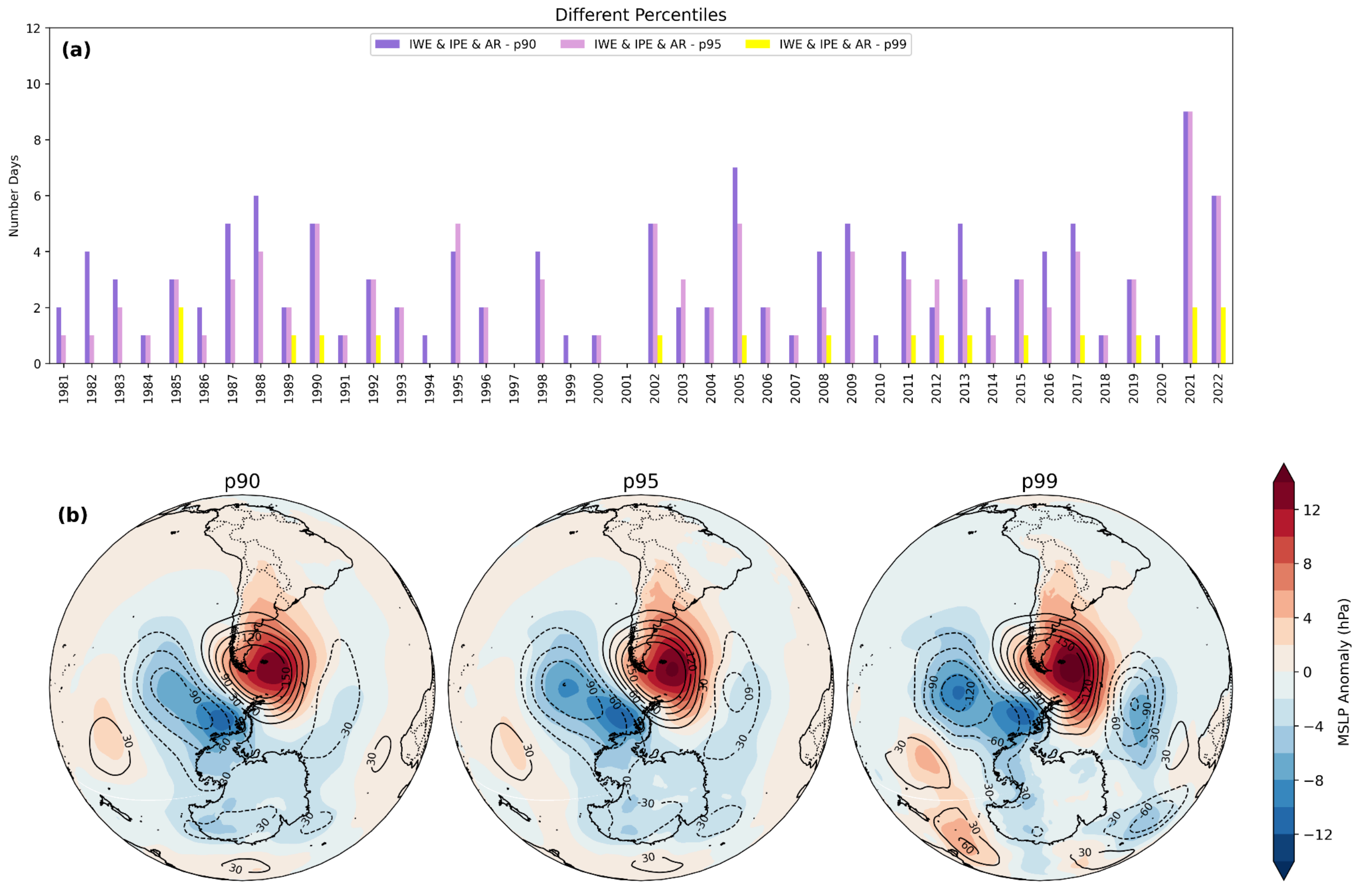



Figure S8. Intersummer comparison of (a) the number of simultaneous events obtained using different percentile thresholds and (b) composite MSLP anomalies (shading) and Z500 anomalies (contours; solid for positive and dashed for negative values, at 25-m intervals) for different percentile thresholds.

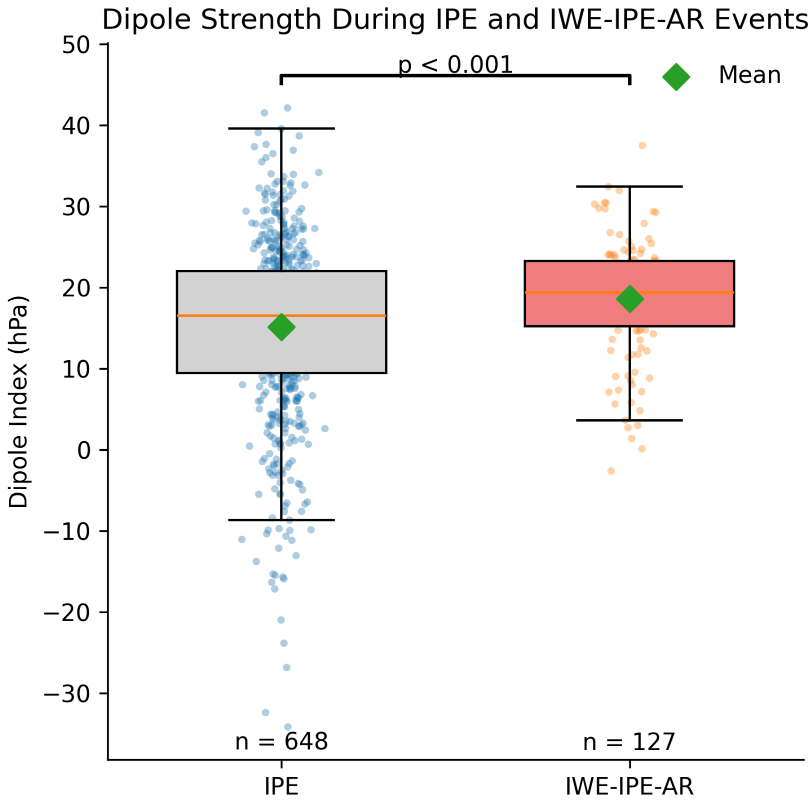



Figure S9. Distribution of the dipole index, defined as the difference between sea-level pressure anomalies over the Malvinas/Falkland Islands and the Bellingshausen Sea, during IPE days and compound IWE–IPE-AR events. Boxes indicate the interquartile range, horizontal lines denote the median, diamonds represent the mean, and individual points correspond to daily values. Compound events exhibit significantly larger dipole indices than IPE days (Mann–Whitney U test, $p < 0.001$), indicating a stronger large-scale circulation pattern during compound events.

## 2. References

Bravo, C., Ross, A. N., Quincey, D. J., Cisternas, S., & Rivera, A. (2022). Surface ablation and its drivers along a west–east transect of the Southern Patagonia Icefield. *Journal of Glaciology*, *68*(268), 305-318. https://doi.org/10.1017/jog.2021.92

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