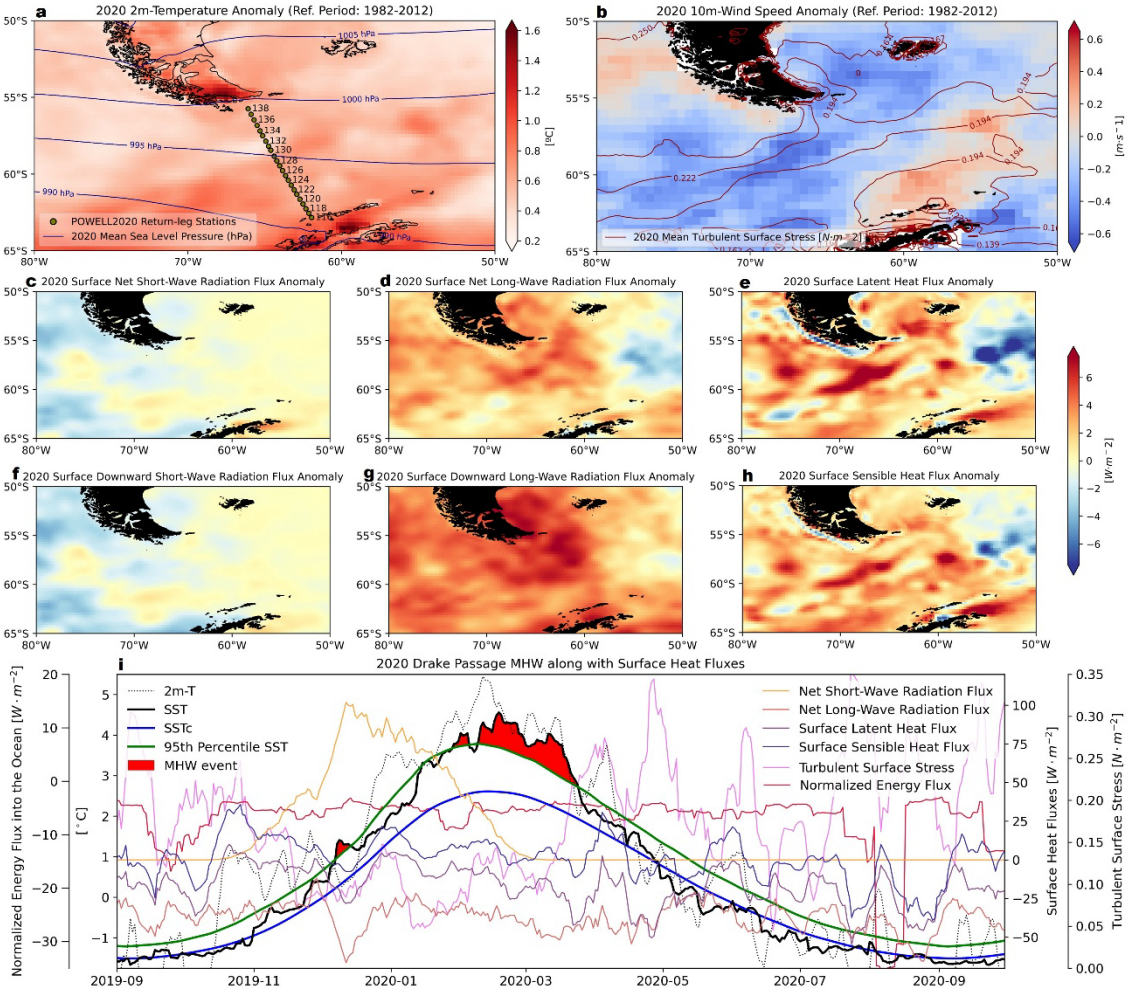

Figure S1. Characterization of sea-air heat fluxes, and surface energy inputs during the austral summer (January 31–February 2) of 2020 in the Drake Passage. (a) ECMWF ERA5 2-meter air temperature anomaly (2m-T, shading) and mean sea level pressure (blue contours). **(b)** ECMWF ERA5 10-meter wind speed anomaly (shading) and mean turbulent surface stress (dark red contours). (**c–h**) ECMWF ERA5 surface heat flux anomalies: **(c)** net short-wave radiation flux anomaly, **(d)** net long-wave radiation flux anomaly, **(e)** latent heat flux anomaly, **(f)** downward short-wave radiation flux anomaly, **(g)** downward long-wave radiation flux anomaly, and **(h)** sensible heat flux anomaly. Positive values indicate anomalous energy flux into ocean, while negative values represent energy loss. **(i)** Temporal evolution of 2m-T (black dotted line), net short-wave radiation flux (orange), net long-wave radiation flux (magenta), surface latent heat flux (violet), surface sensible heat flux (dark blue), turbulent surface stress (pink), and normalized energy flux into the ocean (dark red), together with MHW events (red shading), as indicated by ESA CCI C3S L4 daily SST (black), climatological SST (SSTc, blue), and MHW criterion (95th percentile SST, green), during 2019–2020. Time series represent spatial averages over the return-leg stations of the POWELL-2020 campaign (green dots in **(a)**). Anomalies shown in panels **(a–h)** are computed for the period January 31–February 2, 2020, coinciding with the return transect of the POWELL-2020 campaign. Both the anomalies and MHWs **(i)** are computed relative to the 1982–2012 reference period. A 7-day running mean filter is applied surface heat fluxes and surface energy input series in **(i)**.

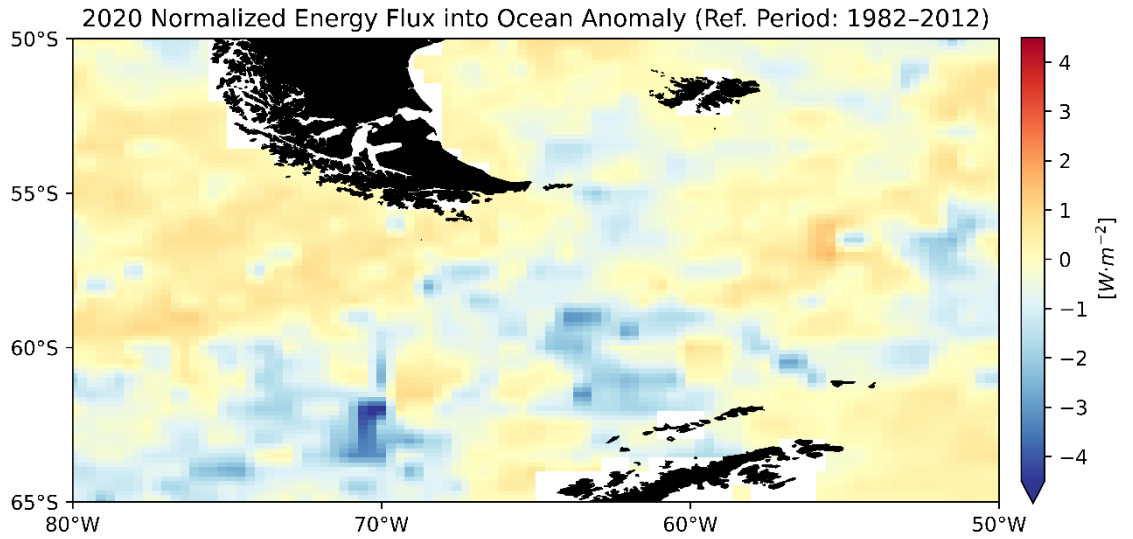

Figure S2. Normalized surface energy flux anomaly into the ocean during the austral summer (January 31–February 2) of 2020 in the Drake Passage. Positive values indicate enhanced net energy input into the ocean, while negative values indicate reduced input or net energy loss. Anomalies are computed relative to the 1982–2012 reference period using ECMWF ERA5 reanalysis data.

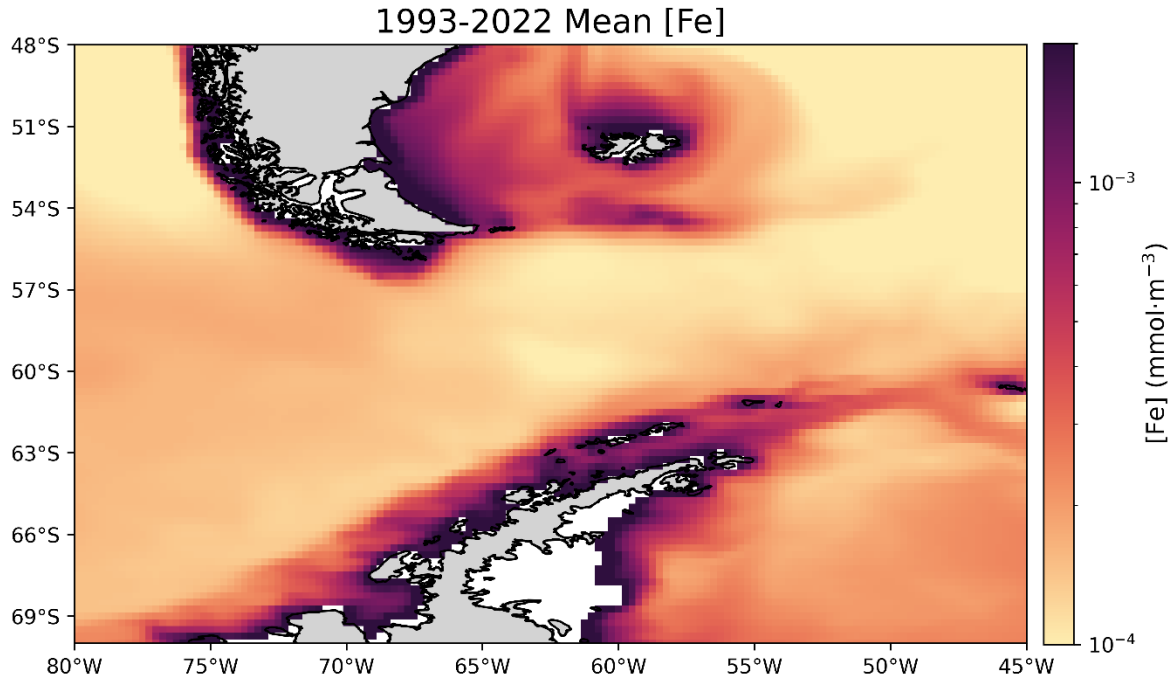

Figure S3. Climatology of modeled dissolved iron concentration (mmol m^{-3}; logarithmic scale) from the CMS Global Ocean Biogeochemistry Hindcast in the study region.