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Characterising marine heatwaves in the Svalbard Archipelago and surrounding seas

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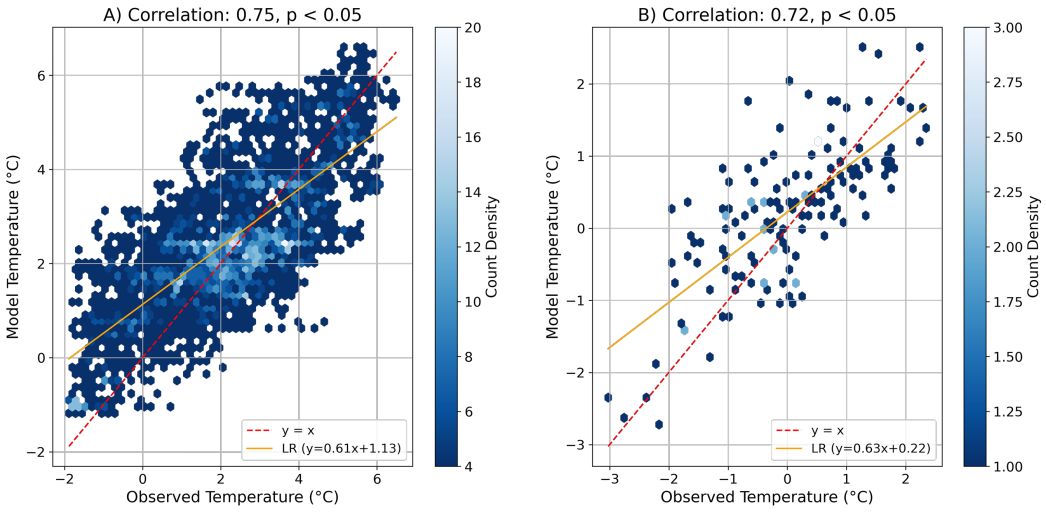

Figure S1. Correlation of a) daily average temperature and b) monthly temperature anomalies between TOPAZ TP1 (78.125°N,11.75°E) and the Isfjorden Mouth Mooring (ISM) at **50 m**. LR denotes the least squares linear regression.

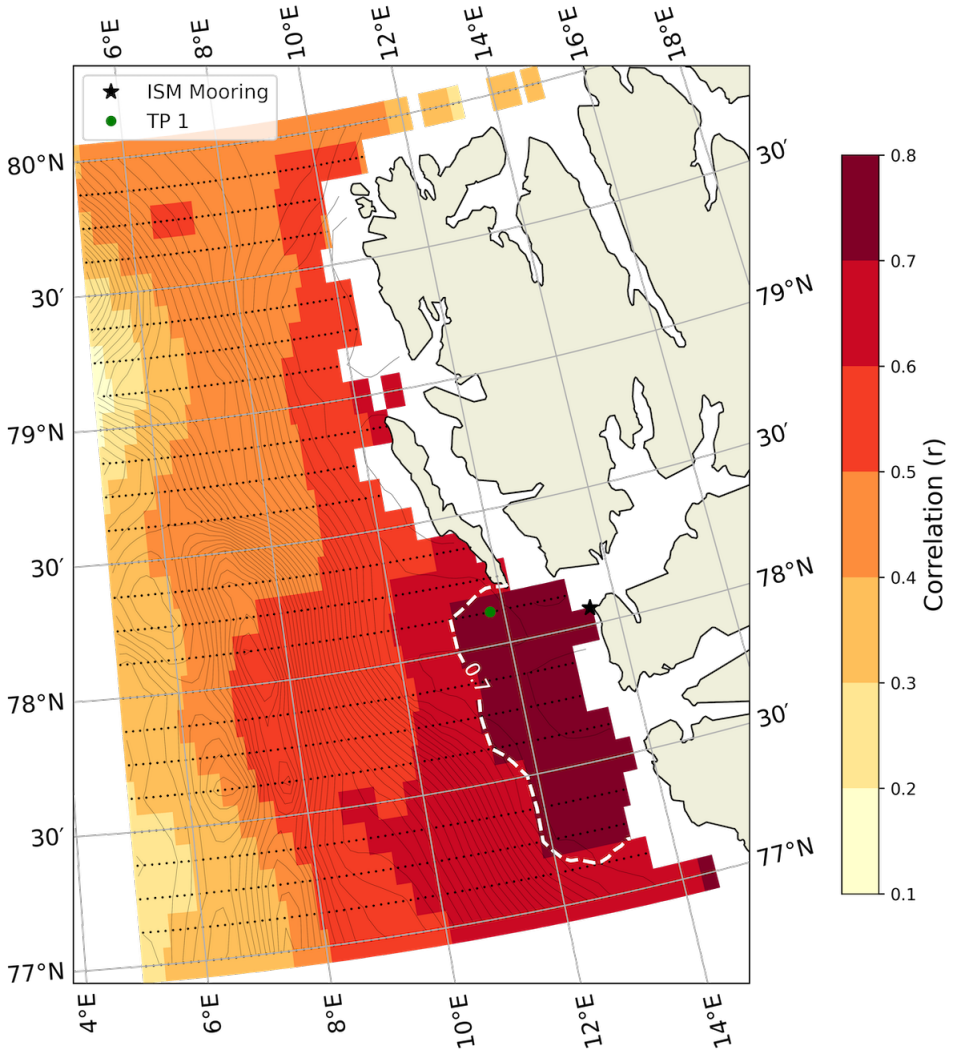

Figure S2. Correlation of monthly temperature anomalies between the Isfjorden Mouth Mooring (ISM) and all TOPAZ grid points at **50 m** in Svalbard West. Location of Isfjorden Mouth Mooring and the TOPAZ comparison point (TP1) is shown. Bathymetry lines shown. Pixels with dots are statistically significant ($p < 0.05$). Isoline at r = 0.7 is shown.

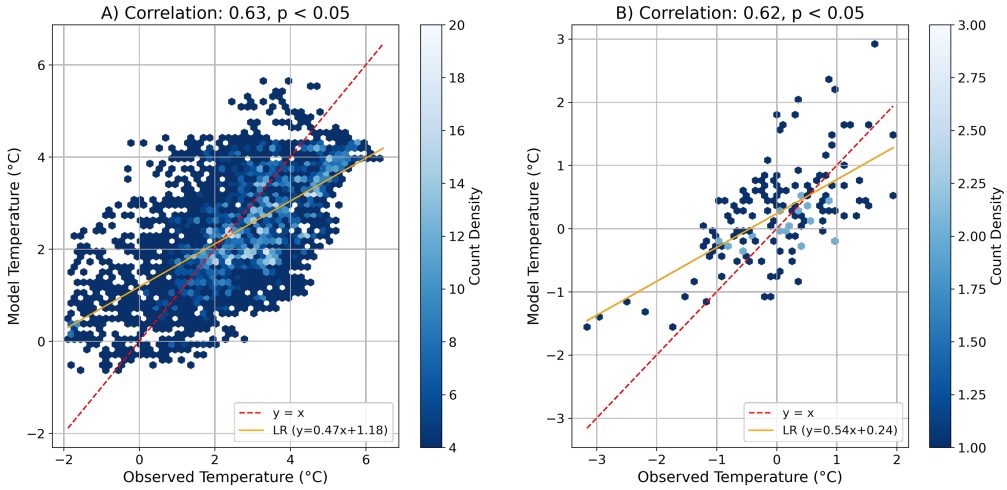

Figure S3. Correlation of a) daily average temperature and b) monthly temperature anomalies between TOPAZ TP1 (78.125°N,11.75°E) and the Isfjorden Mouth Mooring (ISM) at **150 m**. LR denotes the least squares linear regression.

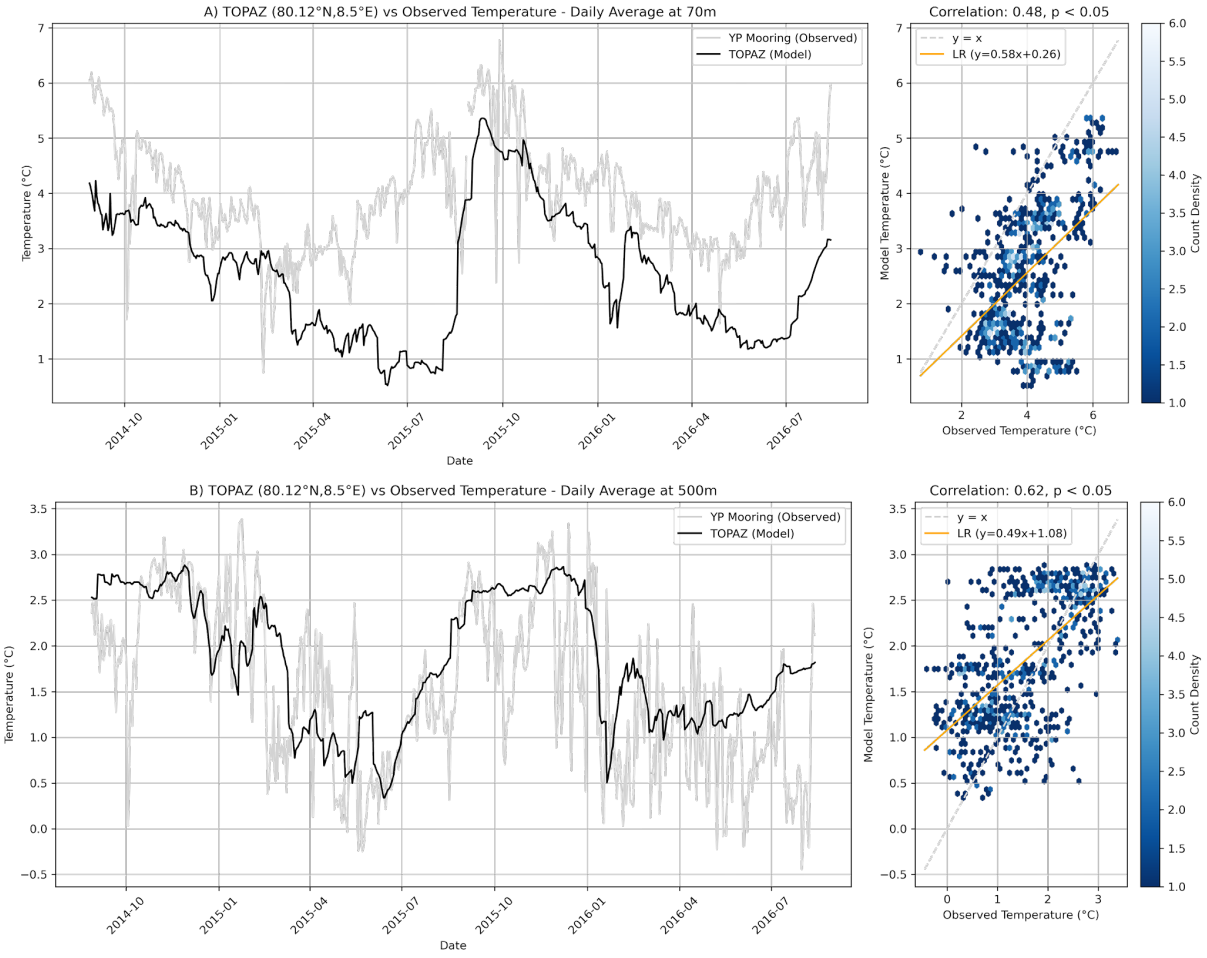

Figure S4. Comparison (left panel) and correlation (right panel) of daily average temperature between TOPAZ and the Yermak Plateau Mooring (YPM) at a) 70 m and b) 500 m. LR denotes the least squares linear regression.

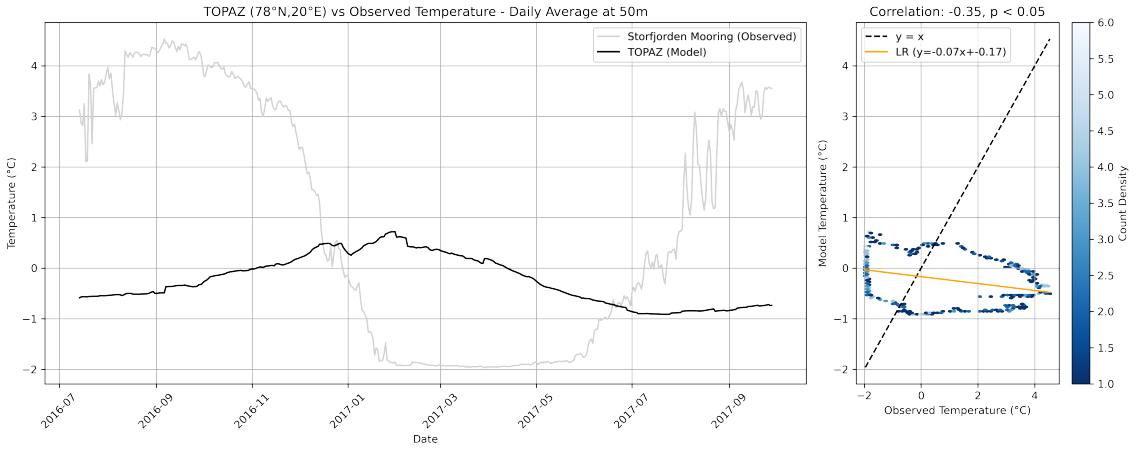

Figure S5. Comparison (left panel) and correlation (right panel) of daily average temperature between the Storfjorden STeP project moorings (M1, M2) and TOPAZ at 50 m. LR denotes the least squares linear regression.

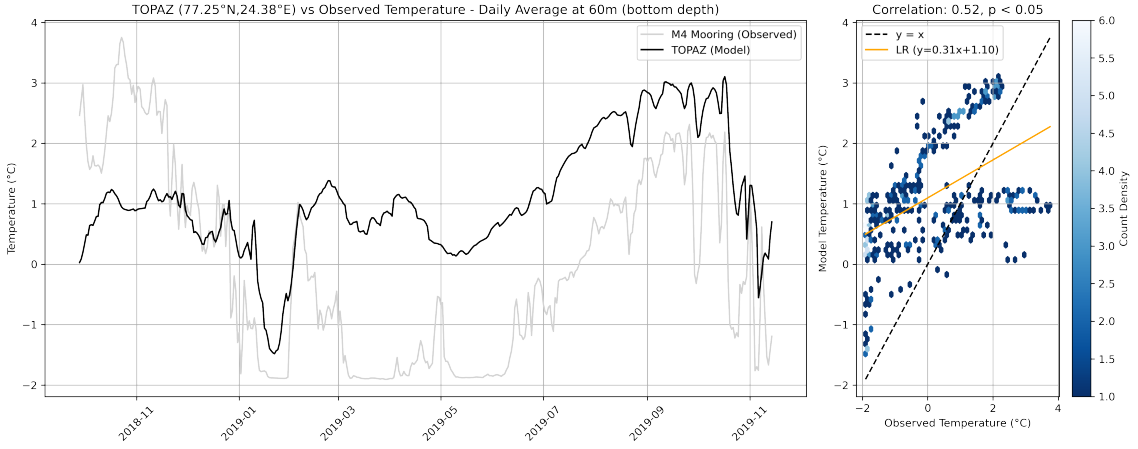

Figure S6. Comparison (left panel) and correlation (right panel) of daily average bottom (60 m) temperature in the M4 Mooring and TOPAZ at the mooring location. LR denotes the least squares linear regression.

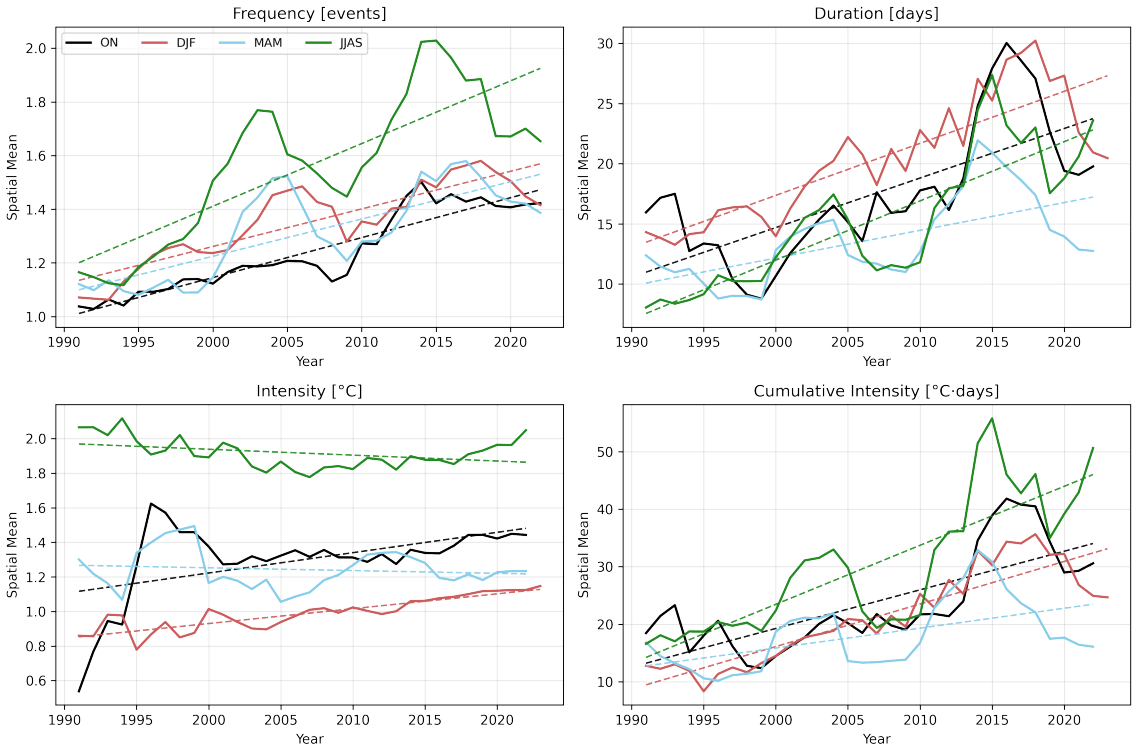

Figure S7. Spatially averaged MHW frequency (events), duration (days), intensity (°C) and cumulative intensity (°C·days) for the Svalbard Archipelago and surrounding seas (69-82°N, -10W-35°E) for autumn (ON), winter (DJF), spring (MAM) and summer (JJAS). Data is smoothed using a 5-year running mean. MHWs are not analysed north of the sea ice edge (sea ice concentration $\geq$ 15%). Dashed lines represent the linear fittings.

Table S1. Summary of summer MHW events in Svalbard West detected using a 10-year climatology (2011–2022).

Category	Year	Start Date	End Date	Duration	Max Intensity (°C)
Strong[a]	2011	14-06	04-07	21	2.1
Moderate[b]	2013	28-08	06-09	10	1.0
Moderate[b]	2013	13-09	01-10	19	1.0
Moderate[a]	2015	06-08	18-08	13	1.4
Strong[b]	2016	07-07	25-07	19	2.4
Moderate[b]	2017	17-09	26-09	10	1.0
Moderate[b]	2022	04-07	18-08	15	1.8
Moderate[b]	2022	24-08	06-09	14	1.0

[a]Category II [b]Category I

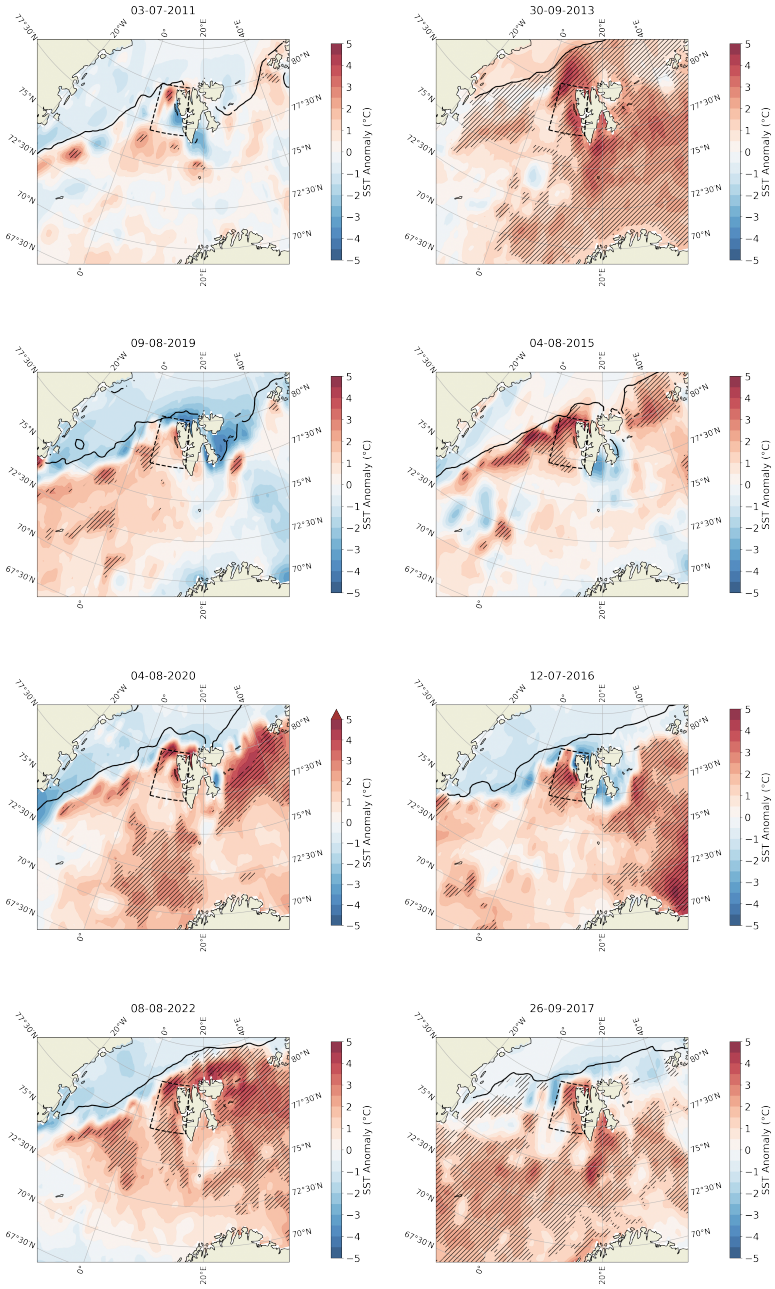

Figure S8. Horizontal extent of all detected shallow (left panel) and deep (right panel) MHWs. Horizontal extent is shown for the peak date (date of peak intensity - maximum SSTA, °C) of each MHW using **DOISST satellite data**. Hatching represents where the SST exceeds the 90th percentile. DOISST SSTA (°C) for the peak date is plotted in the background and the TOPAZ sea ice edge (sea ice concentration of 15%) is indicated by the black line. MHWs are not detected above the sea ice edge.

Table S2. Mean heat budget terms and anomalies (shown in brackets) for the duration of each summer MHW event in Svalbard West. Surface heat flux (SHF) is summed over the area bounded by Svalbard West. Positive SHF reflects heat input to the ocean surface, negative SHF reflects heat loss. Positive ocean heat transport (OHT) indicates heat moving into the region. Negative OHT indicates heat moving out of the region. OHT values are rounded to the nearest whole number. OHT "s, n, w" represent the south, north and west bounds of the black dashed box in Fig. 1. The months for each event are listed after the year (e.g. "6/7" means the event ran from June through July). Due to seasonal variations in SHF and OHT, MHW events have been listed by season.

Event	**Classification**	**SHF** (TW)	**OHT**$_s$ (TW)	**OHT**$_n$ (TW)	**OHT**$_w$ (TW)	**Total OHT** (TW)
2011-6/7	Shallow	3 (–0.9)	28 (8)	–7 (–2)	–14 (–5)	7 (1)
2016-7	Deep	4 (0.6)	29 (8)	–13 (–7)	–14 (–4)	2 (–3)
2015-7/8	Deep	2 (0.9)	35 (9)	–12 (–3)	–17 (–5)	6 (1)
2020-7/8	Shallow	4 (2)	29 (5)	–9 (–1)	–7 (4)	1 (8)
2022-7/9	Shallow	0.6 (0.4)	34 (8)	–8 (1)	–16 (–4)	10 (5)
2019-8	Shallow	–0.04 (–2)	35 (10)	–13 (–5)	–7 (4)	1 (9)
2013-8/10	Deep	–3 (1)	45 (12)	–15 (–3)	–22 (–7)	8 (2)
2017-9	Deep	–3 (3)	60 (25)	–31 (–18)	–22 (–6)	7 (2)