

Temporal variability of air–sea carbon dioxide exchange in the coastal water of the Baltic Sea: Supplementary information

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This document is the Supplementary information for the publication "Temporal variability of air–sea carbon dioxide exchange in the coastal water of the Baltic Sea". The document contains Figures S1–S5 and Tables S1–S2.



Figure S1: Photograph of the eddy covariance site, looking southeast. The EC tower is in the middle of the photograph. The mast with the radiometer is standing on the concrete base in the sea. Cabinets for the computers as well as the temperature (T), relative humidity (RH) and radiation sensors are located at the highest point of the islet.

Table S1: Monthly means of the non-gapfilled FCO_2 multiplied by the length of the month, in $g\ C\ m^{-2}$. Asterisk indicates a statistically significant difference between day- and nighttime fluxes.

Month	2022	2023	2024
Jan	–	3.69 ± 0.15	-0.83 ± 0.21
Feb	–	3.72 ± 0.23	$1.86 \pm 0.32^*$
Mar	-0.34 ± 0.33	-1.96 ± 0.22	-0.44 ± 0.19
Apr	$-8.16 \pm 0.21^*$	$-7.78 \pm 0.38^*$	-6.10 ± 0.21
May	$-4.93 \pm 0.12^*$	$-5.82 \pm 0.25^*$	-2.87 ± 0.39
Jun	$0.02 \pm 0.23^*$	-0.49 ± 0.36	$-3.97 \pm 0.25^*$
Jul	$-0.01 \pm 0.28^*$	$3.80 \pm 0.22^*$	$-2.28 \pm 0.25^*$
Aug	$-0.68 \pm 0.31^*$	$-0.09 \pm 0.28^*$	$-3.58 \pm 0.48^*$
Sep	-2.54 ± 0.42	$3.61 \pm 0.21^*$	–
Oct	6.12 ± 0.21	$4.77 \pm 0.43^*$	$5.05 \pm 0.28^*$
Nov	7.13 ± 0.21	4.35 ± 0.27	$10.95 \pm 0.53^*$
Dec	4.80 ± 0.31	4.61 ± 0.57	4.44 ± 0.25

Table S2: Monthly sums of the gap-filled FCO_2 in $g\ C\ m^{-2}$. The sums in 2022 start from 10 March.

Month	2022	2023	2024
Jan	–	3.03 ± 0.06	2.08 ± 0.05
Feb	–	3.53 ± 0.08	3.20 ± 0.06
Mar	1.01 ± 0.18	0.57 ± 0.07	0.93 ± 0.05
Apr	-4.01 ± 0.10	-3.97 ± 0.11	-3.69 ± 0.08
May	-2.66 ± 0.07	-1.27 ± 0.13	-0.62 ± 0.14
Jun	1.58 ± 0.14	2.08 ± 0.14	-0.95 ± 0.16
Jul	1.80 ± 0.13	3.62 ± 0.20	0.94 ± 0.13
Aug	1.99 ± 0.16	1.29 ± 0.17	1.11 ± 0.13
Sep	-0.05 ± 0.10	3.05 ± 0.19	2.80 ± 0.07
Oct	2.06 ± 0.06	4.15 ± 0.08	3.05 ± 0.09
Nov	7.40 ± 0.11	4.66 ± 0.16	7.44 ± 0.07
Dec	4.60 ± 0.14	3.55 ± 0.18	2.88 ± 0.08

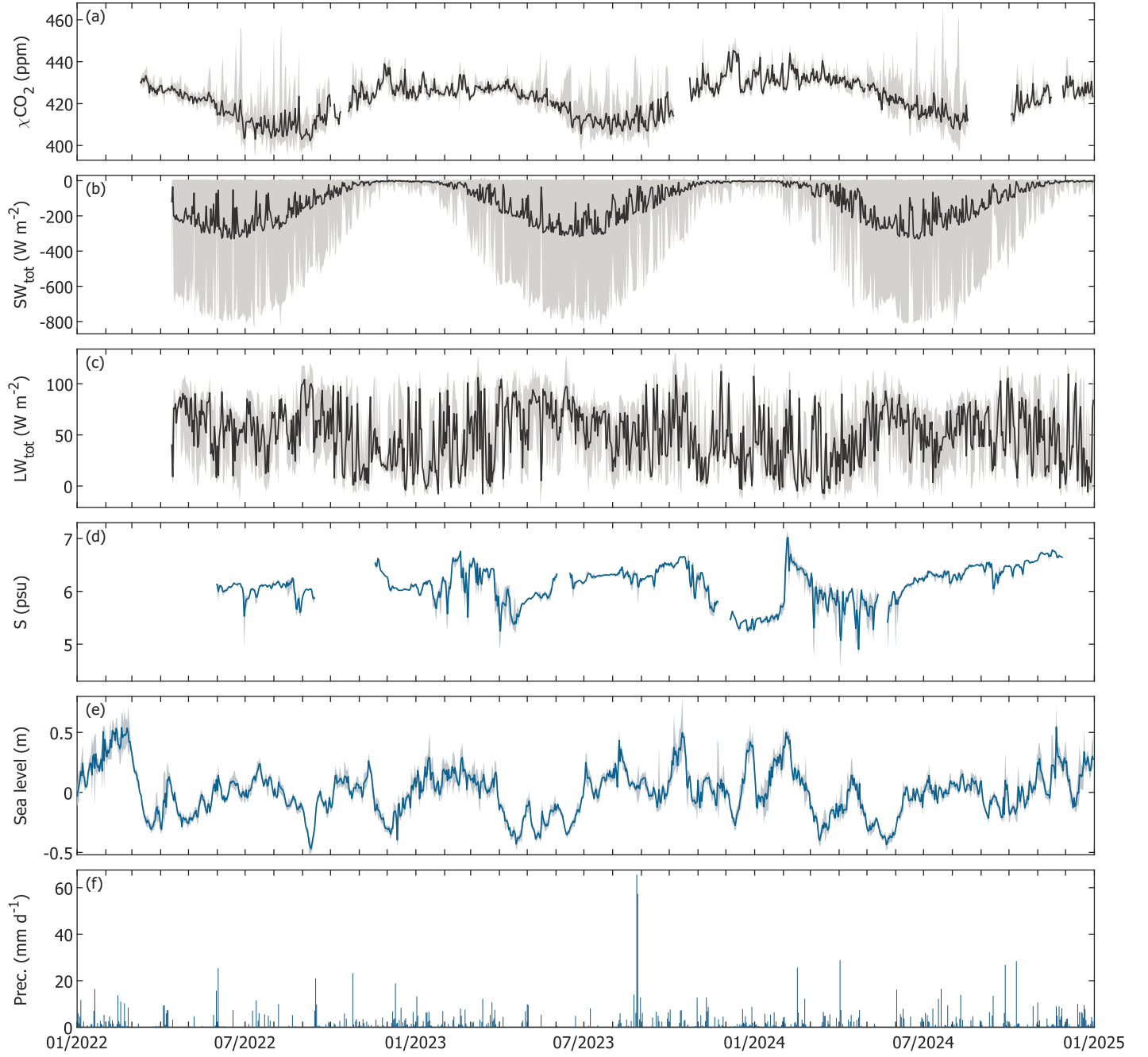


Figure S2: Additional environmental parameters at or in close vicinity of the EC site. In (a–e), the line and the shading denote the daily mean and maximal daily variability, respectively. (a) Mixing ratio of atmospheric CO₂ at 4.2 m above mean sea level. (b) Sum of down- and upwelling shortwave radiation (SW). Negative values indicate downwelling radiation. (c) Sum of down- and upwelling longwave radiation (LW). Negative values indicate downwelling radiation. (d) Salinity (S) at the Monicoast buoy. (e) Sea level in Hanko, 20 km west of the measurement site. Zero is set to match the mean sea level during 2022–2024. (f) Daily precipitation at the FMI Tvärminne weather station.

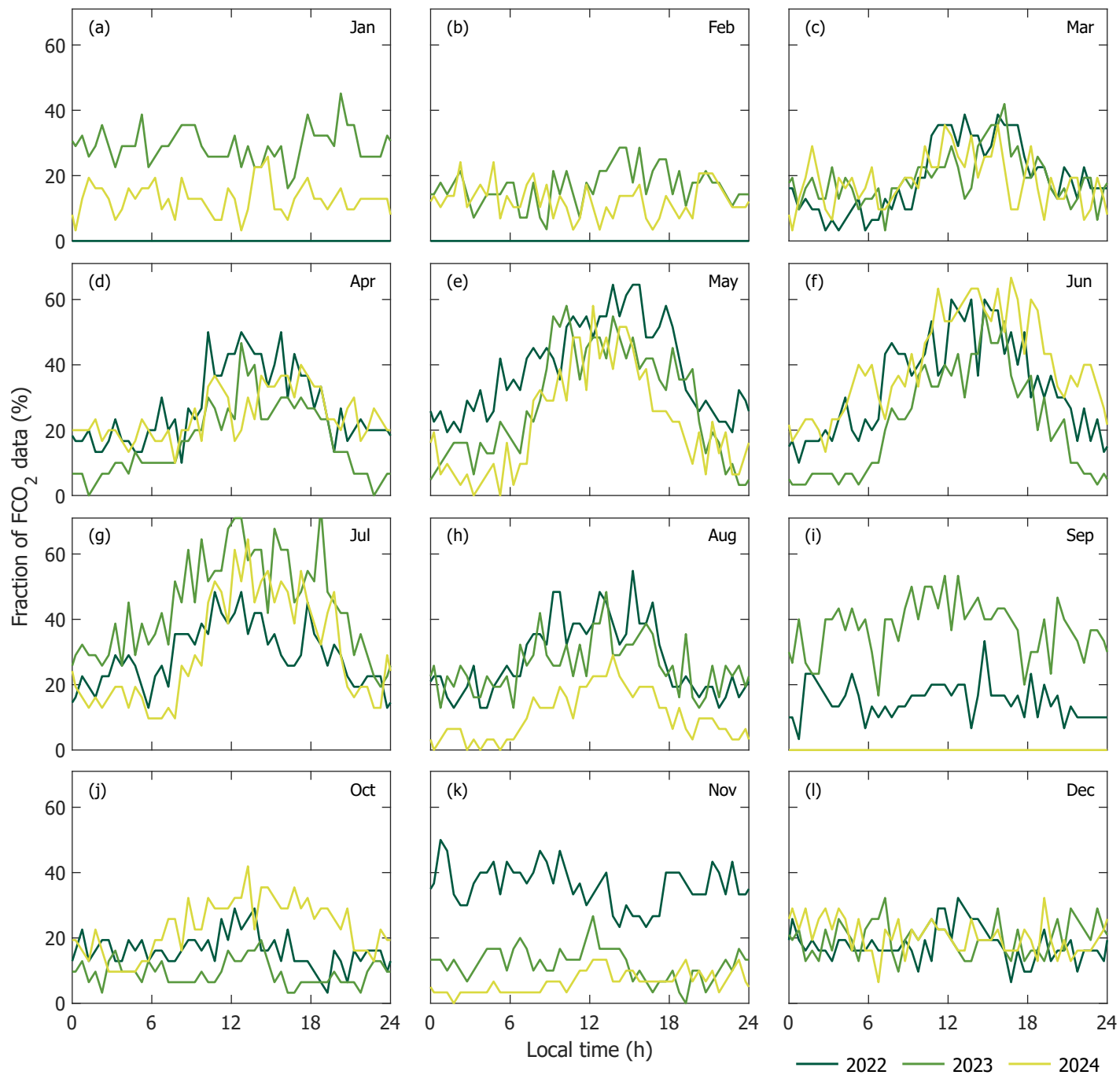


Figure S3: Mean diurnal distribution of fraction of quality-controlled FCO_2 to total amount of data in different months (panels a-l) and years (colours).

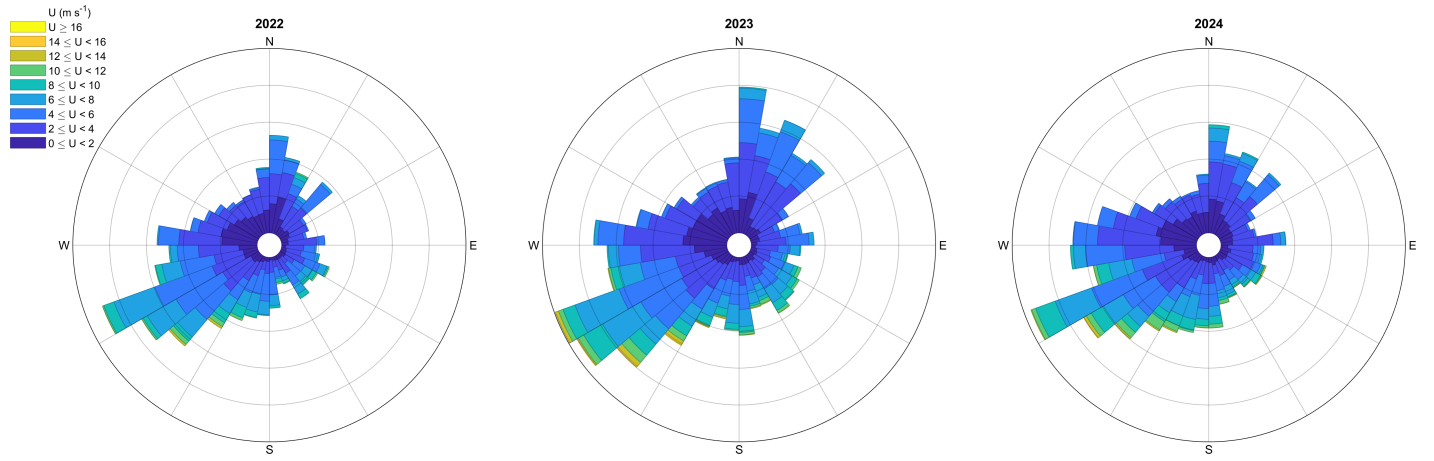


Figure S4: The distribution of wind speeds per 10° bins for the years 2022–2024.

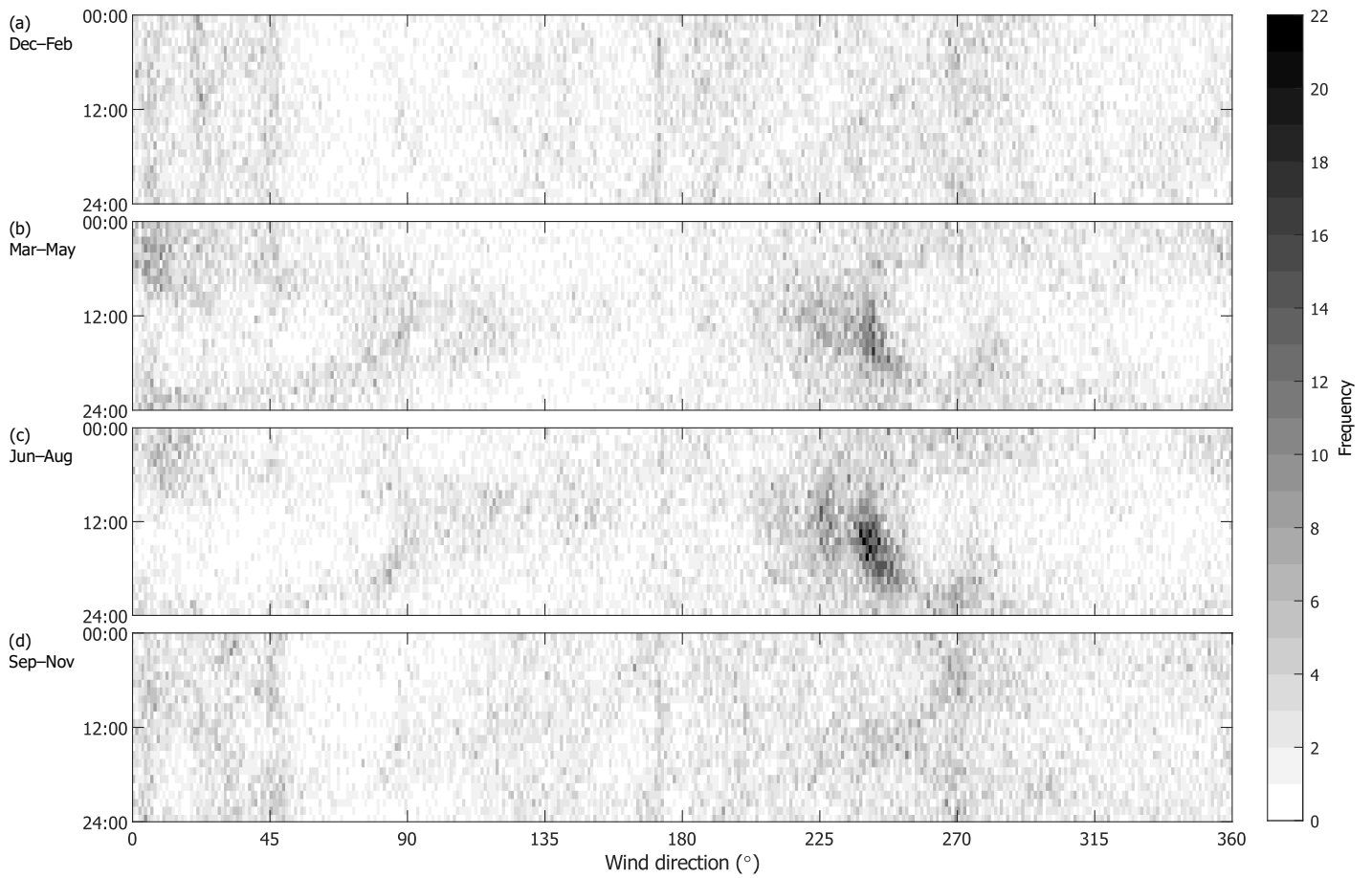


Figure S5: Distribution of wind by local time and wind direction in 2022–2024. The local time is divided in one-hour bins and the wind direction in one-degree bins. The data are additionally grouped in four seasons. The colour scale indicates the number of occurrences.