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Supplement of

UEx-L-Eddies: decadal and global long-lived mesoscale eddy trajectories with coincident air–sea CO_2 fluxes and environmental conditions

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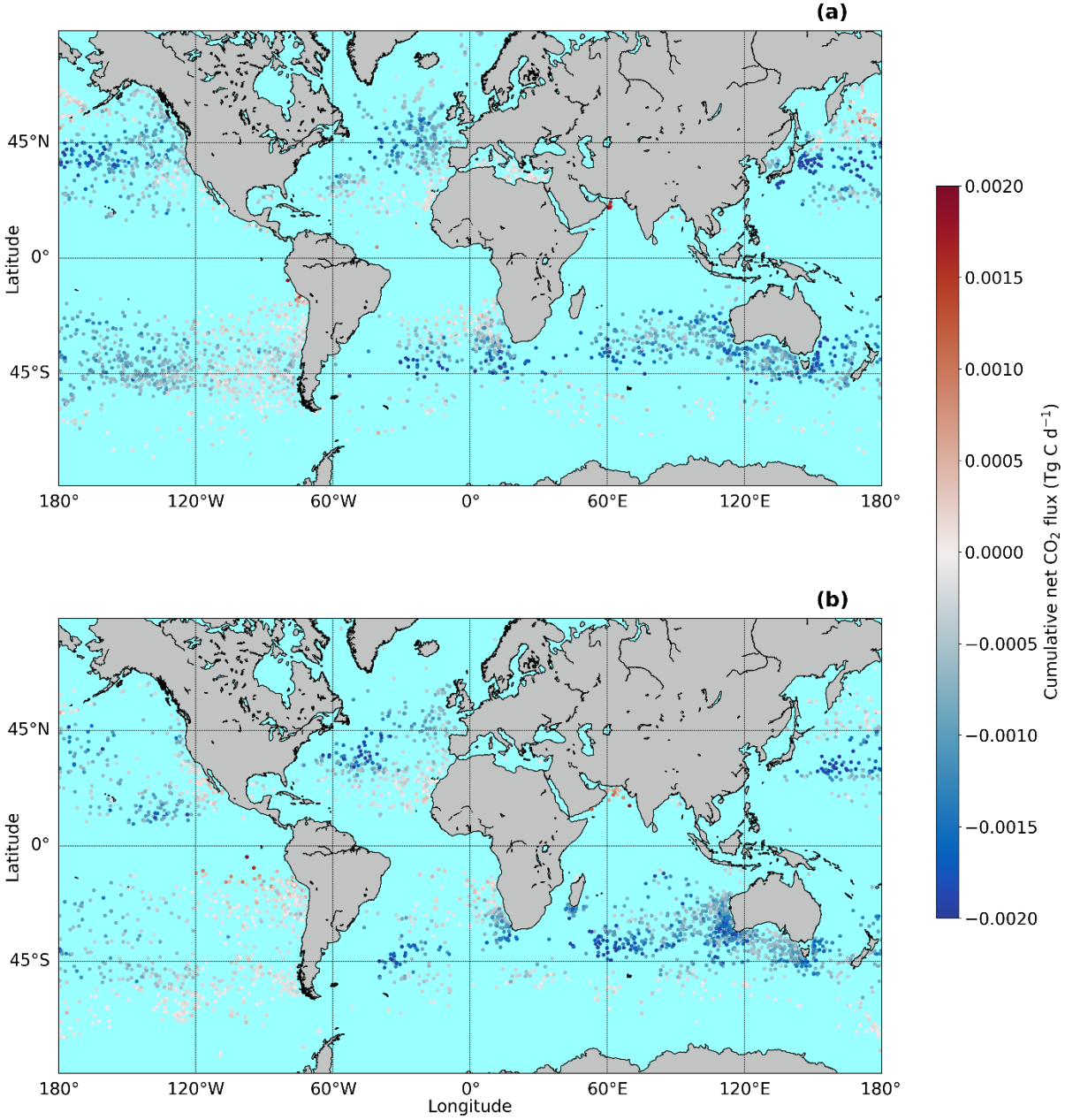
Supplement

Supporting Information

Table S1: Median decadal eddy modification of the air-sea CO_2 flux for both cyclonic and anticyclonic eddies. Uncertainties are the 95 % confidence interval of the propagated uncertainties. Number in square brackets indicates the number of eddies considered. Note eddies that form in one period and dissipate in another are considered in both periods.

Time period	Anticyclonic eddy modification of air-sea CO_2 flux	Cyclonic eddy modification of air-sea CO_2 flux
1993 to 2000	-2.57 ± 6.23 % [753]	1.66 ± 5.95 % [617]
2000 to 2010	-4.28 ± 4.53 % [1321]	0.74 ± 4.32 % [1119]
2010 to 2020	-5.48 ± 3.62 % [1482]	0.30 ± 3.60 % [1283]



15 **Figure S1: (a) The cumulative air-sea CO_2 flux into the anticyclonic eddies normalised by eddy lifetime in days where the scatter points are plotted at the formation location of each eddy. (b) same as (a) but for cyclonic eddies.**

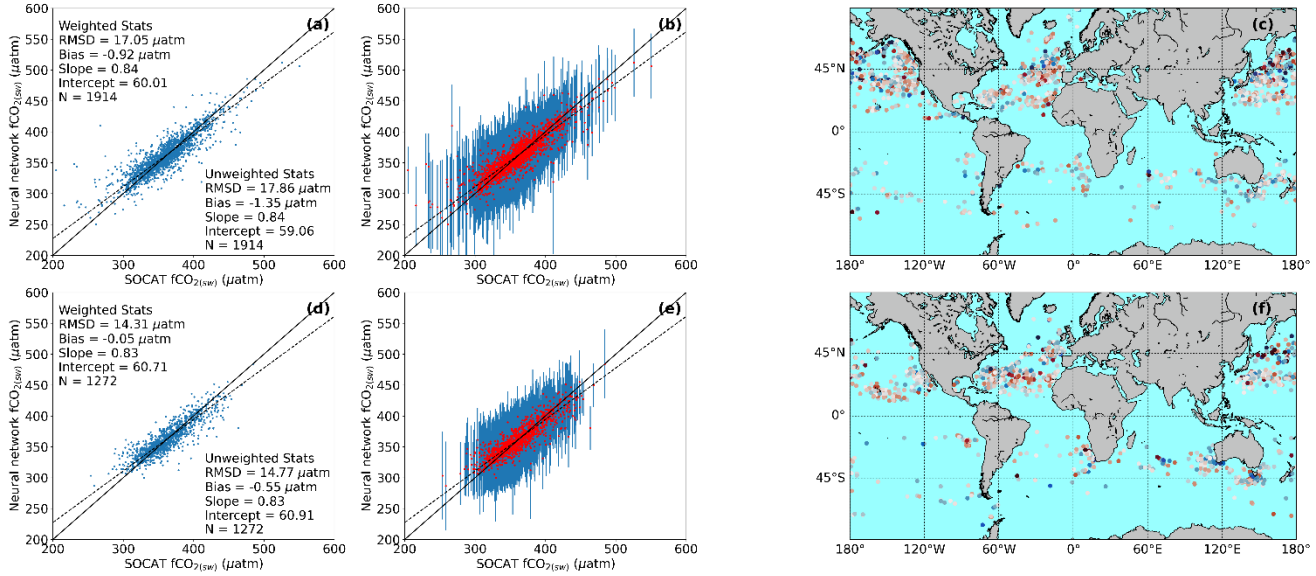


Figure S2: (a) Comparison of the neural network $fCO_{2\,(sw)}$ (with chl-a added as a predictor) to in situ SOCAT observations within anticyclonic eddies. Solid black line is the 1:1. Dashed line is the Type II linear regression. In text statistics are root mean square difference (RMSD), bias, slope and intercept of a Type II linear regression and number of matches (N). (b) same as (a) but showing the uncertainty on the neural network $fCO_{2\,(sw)}$ (2 sigma; 95% confidence) as errorbars for anticyclonic eddies. (c and d) same as (a and b) for cyclonic eddies.

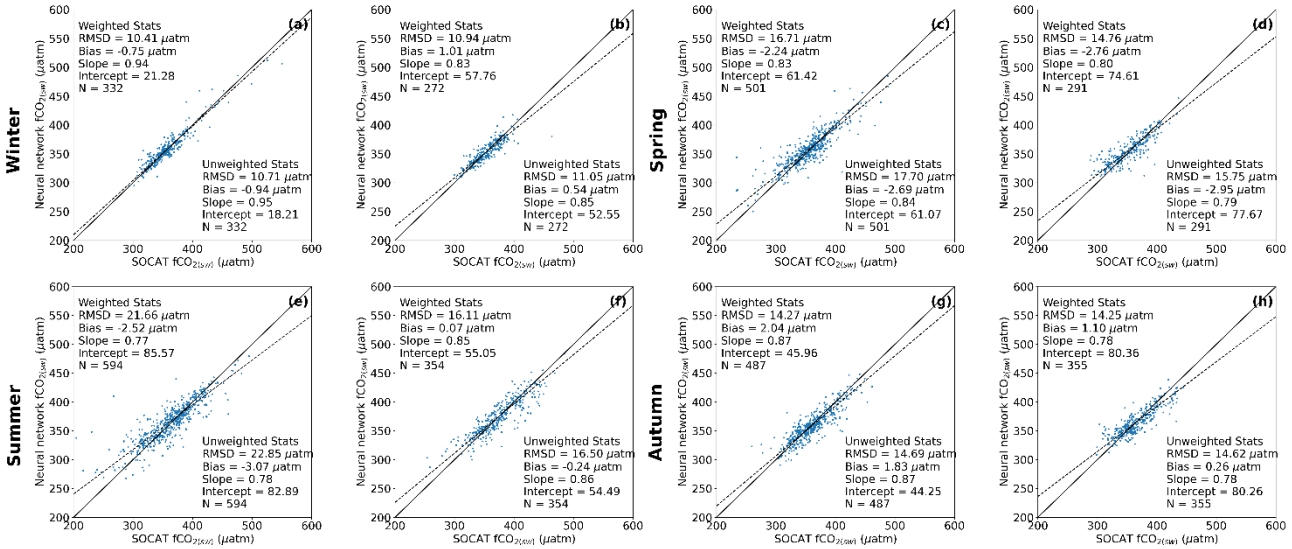


Figure S3: (a) Comparison of the neural network $fCO_{2\,(sw)}$ (with chl-a added as a predictor) to in situ SOCAT observations within anticyclonic eddies during winter. Solid black line is the 1:1. Dashed line is the Type II linear regression. In text statistics are root mean square difference (RMSD), bias, slope and intercept of a Type II linear regression and number of matches (N). (b) same as (a) but for cyclonic eddies in the winter. (c) and (d) same as (a) and (b) for spring. (e) and (f) same as (a) and (b) for summer. (g) and (h) same as (a) and (b) for autumn.

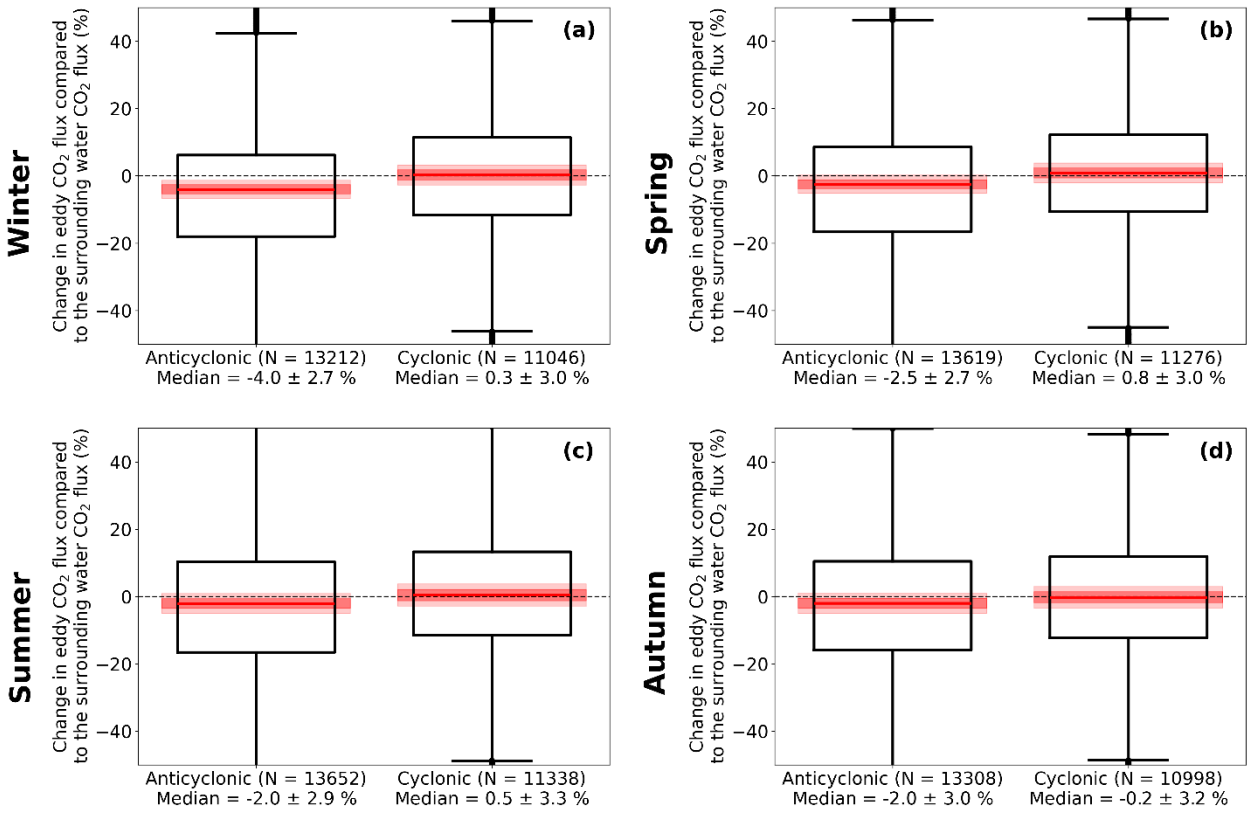


Figure S4: (a) Box plot showing the eddy modification of the air-sea CO_2 flux during winter using the UExP-FNN-U. Red line indicates the median, box indicates the 25th and 75th quartiles, whiskers extend from the 25th and 75th quartiles by 1.5 interquartile ranges. Circles indicate data considered outliers. Dark red shading indicates the 1 sigma (~68% confidence) uncertainty on the median by propagating the air-sea CO_2 flux uncertainties using a Monte Carlo uncertainty propagation. Light red shading indicates the 2 sigma uncertainty on the median (~95% confidence). X-axis label shows number of eddies (N), the median modification with the 2 sigma uncertainty. (b) same as (a) but for spring. (c) same as (a) but for summer. (d) same as (a) for autumn.