

Supporting Information for "Mountain Peatlands and Drought: Carbon Cycling in the Pyrenees Amidst Global Climate Change"

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Table S1. Values of the empirical parameters used to fit the models to the data.

Parameter	Value	Equation number	Associated variable	Unit
a	$2.1795 \cdot 10^{-5}$	2	<i>GPP</i>	K^{-1}
b	$1.2986 \cdot 10^{-7}$	3	<i>ER</i>	$\mu mol.m^{-2}.s^{-1}$
c	$8.4524 \cdot 10^{-8}$	3	<i>ER</i>	–
d	1.7902	3	<i>ER</i>	–
f	$2.9199 \cdot 10^{-1}$	3	<i>ER</i>	–
g	1.4* / 0.0	3	<i>ER</i>	$\mu mol.m^{-2}.s^{-1}$
<i>WTD_{min}</i>	–0.70	3	<i>ER</i>	<i>m</i>
<i>AT_{max}</i>	360.2	3	<i>ER</i>	<i>K</i>
h	$-1.1743e - 1$	5	<i>FCH4</i>	–
i	2.6570	5	<i>FCH4</i>	$K^{-1}\mu mol.m^{-2}.s^{-1}$
j	$9.6778 \cdot 10^{-1}$	5	<i>FCH4</i>	$K^{-1}\mu mol.m^{-2}.s^{-1}$
l	$9.3287 \cdot 10^{-5}$	5	<i>FCH4</i>	–
m	$9.3851 \cdot 10^{-5}$	5	<i>FCH4</i>	m^{-1}

* 1.4 for all months except May, June, July and August when **g** = 0.0

Table S2. Depths (cm), 14C data for the selected samples

Sample depth	Code BETA	Fraction of modern Carbon
1.5	476107	1.0329 ± 0.0039
3.3	476111	1.0393 ± 0.0039
5.4	476108	1.0524 ± 0.0039
7.4	476110	1.0883 ± 0.0041
13.6	479471	1.2496 ± 0.0047
28.7	476109	0.9455 ± 0.0035
67.7	476112	0.6639 ± 0.0025

Table S3. R^2 of models with and without CI index

Modelled	R^2 with CI	R^2 without CI fluxes
GPP	0.69	0.25
ER	0.84	0.75
CH4	0.59	0.26



Figure S1. *Aerial photograph of the Bernadouze peatland taken with a drone (Crédit : A. Séjourné). The white areas indicate the several Sphagnum-dominated areas from Henry et al (2014).*

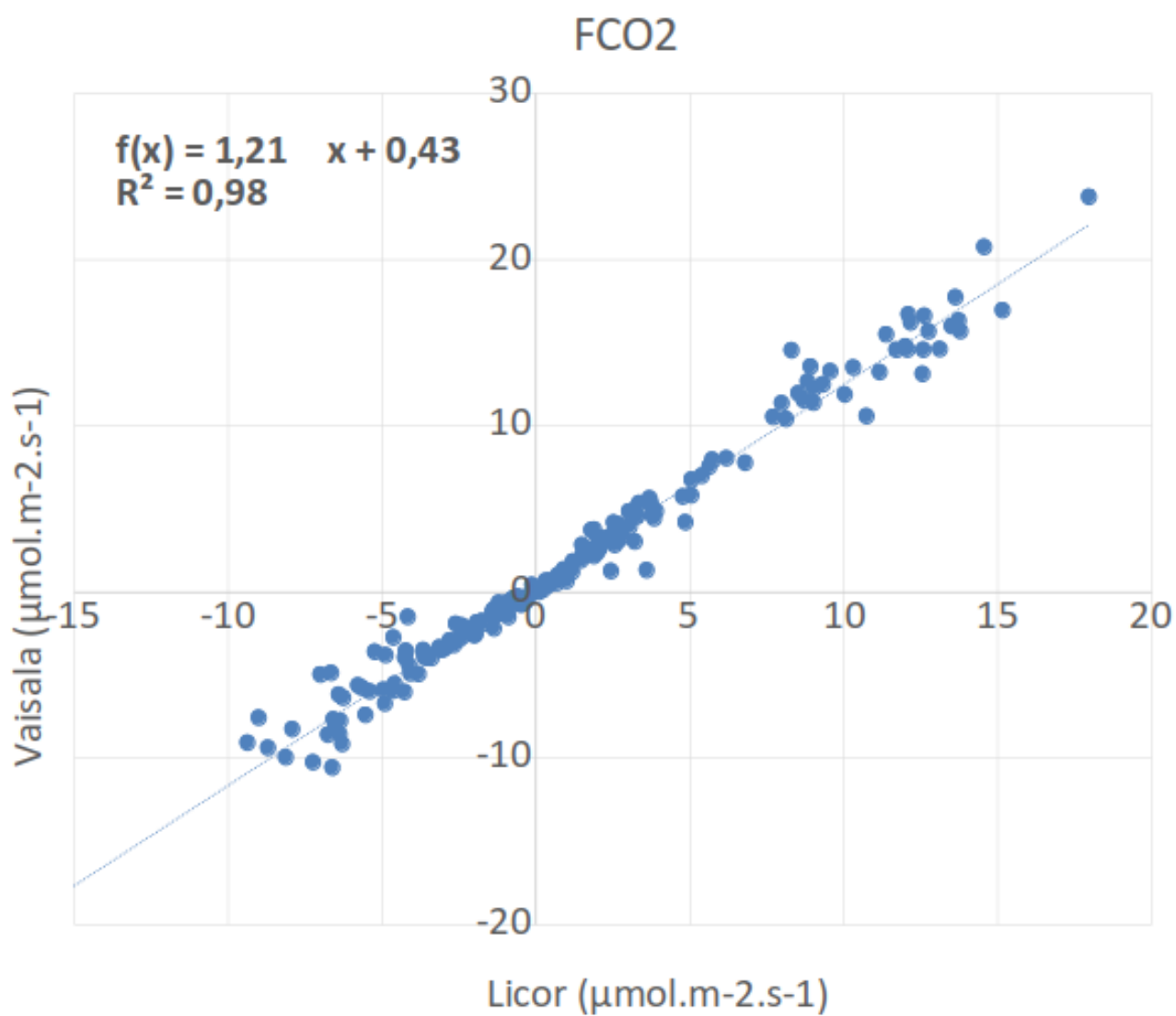


Figure S2. Comparison of CO₂ fluxes conducted simultaneously by a VAISALA GMP343 probe and a LI-COR LI-7810 analyser.

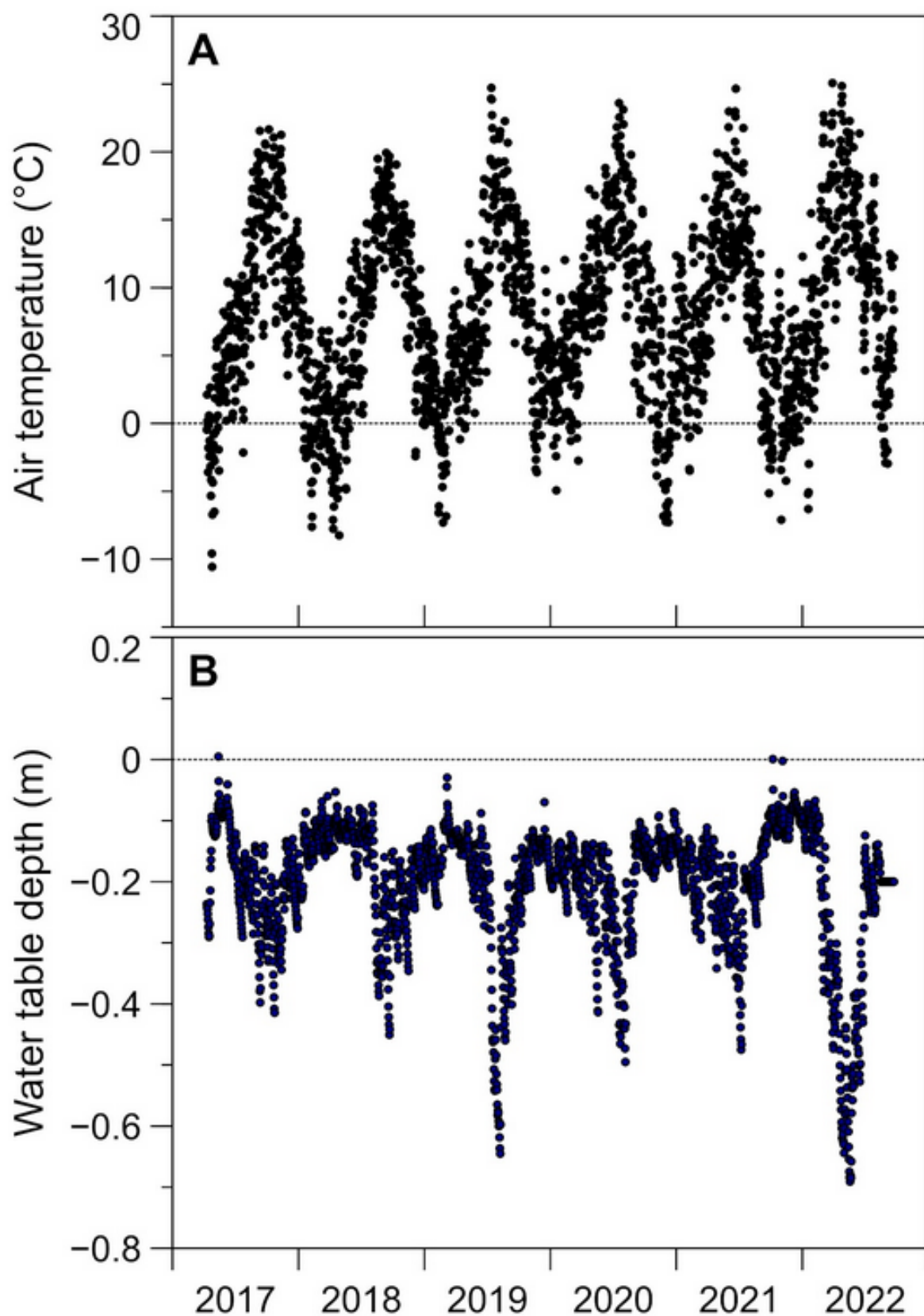


Figure S3. Mean diurnal A) air temperature ($^{\circ}\text{C}$) and B) water table depth (m) from January 2017 to December 2022 in the Bernadouze peatland.

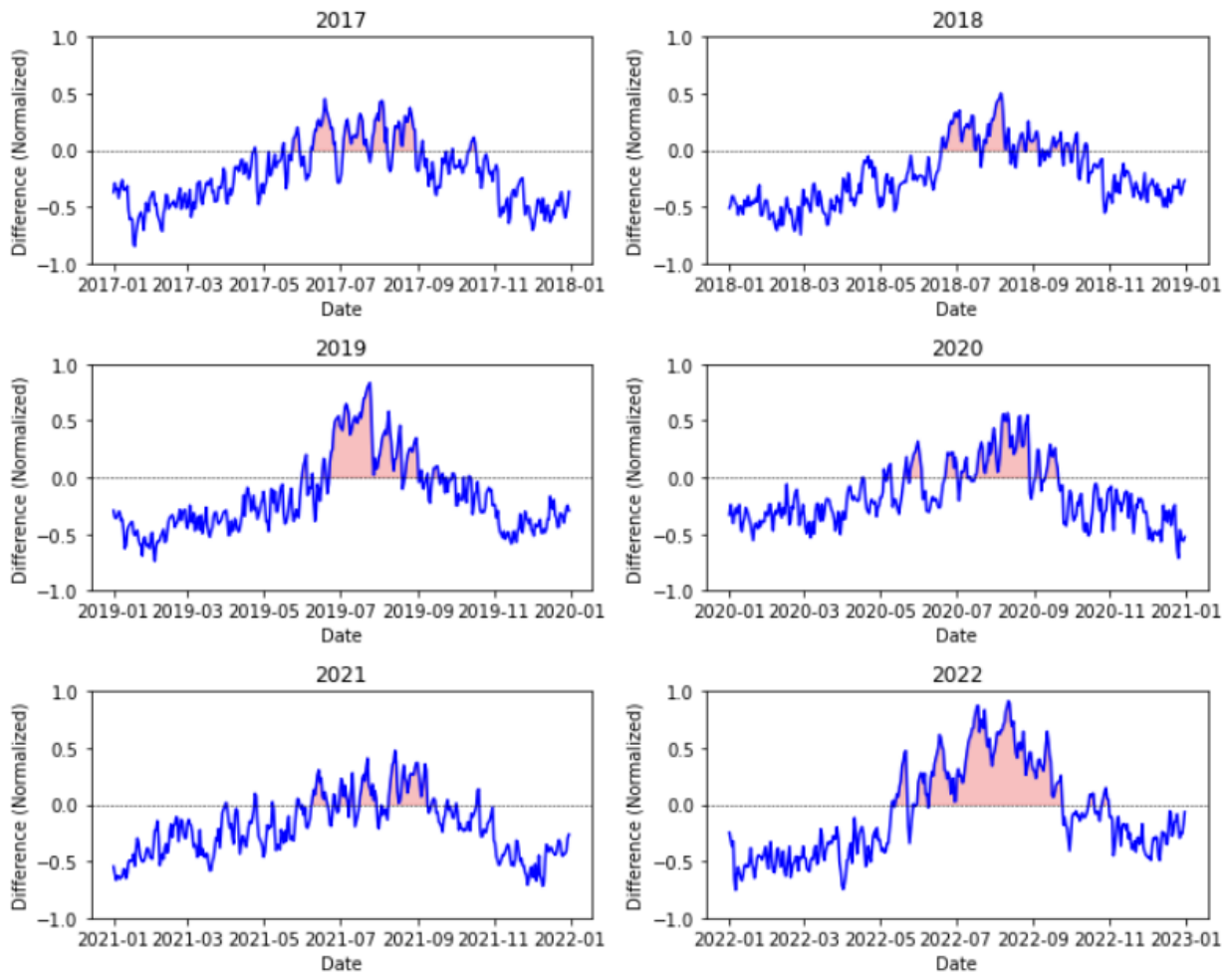


Figure S4. *Time series of the difference between normalized AT and normalized WTD values, for each year. Normalization of each variable (X) was done following $X_{normalized} = \frac{X - X_{min}}{X_{max} - X_{min}}$. Then DI is derived from the calculation of the area under the curve (in pink) when the $AT_{normalized} - WTD_{normalized}$ difference is positive.*

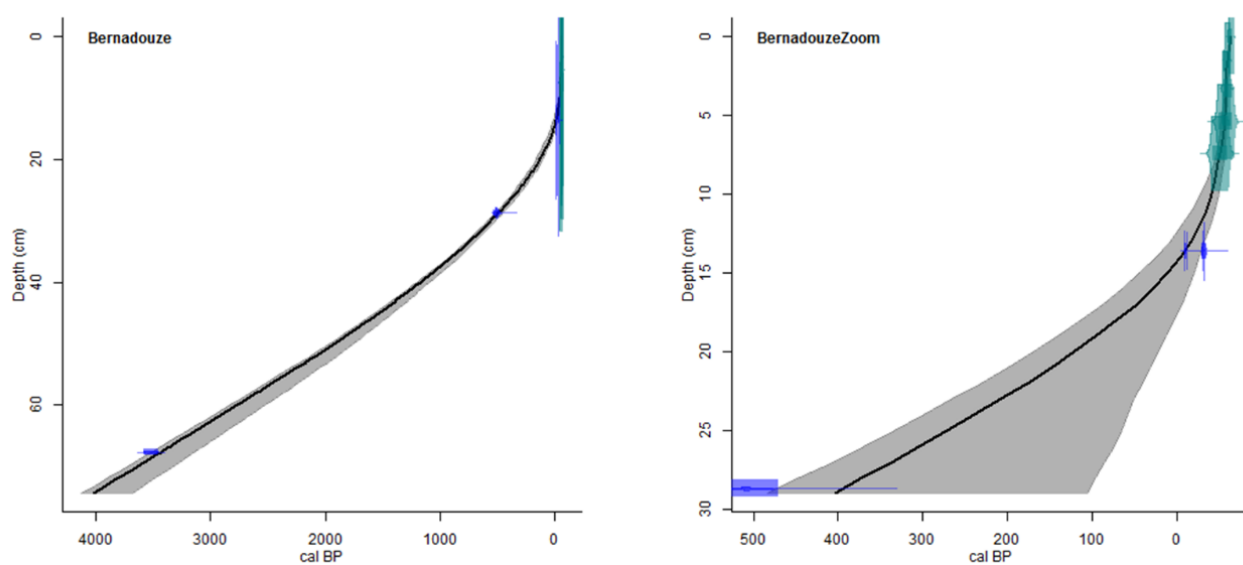


Figure S5. *Clam parameters: calibration curves: IntCal13.14C, postbomb_NH1.14C for postbomb dates; smooth spline (type 4) with spar of 0.3 (smooth).*

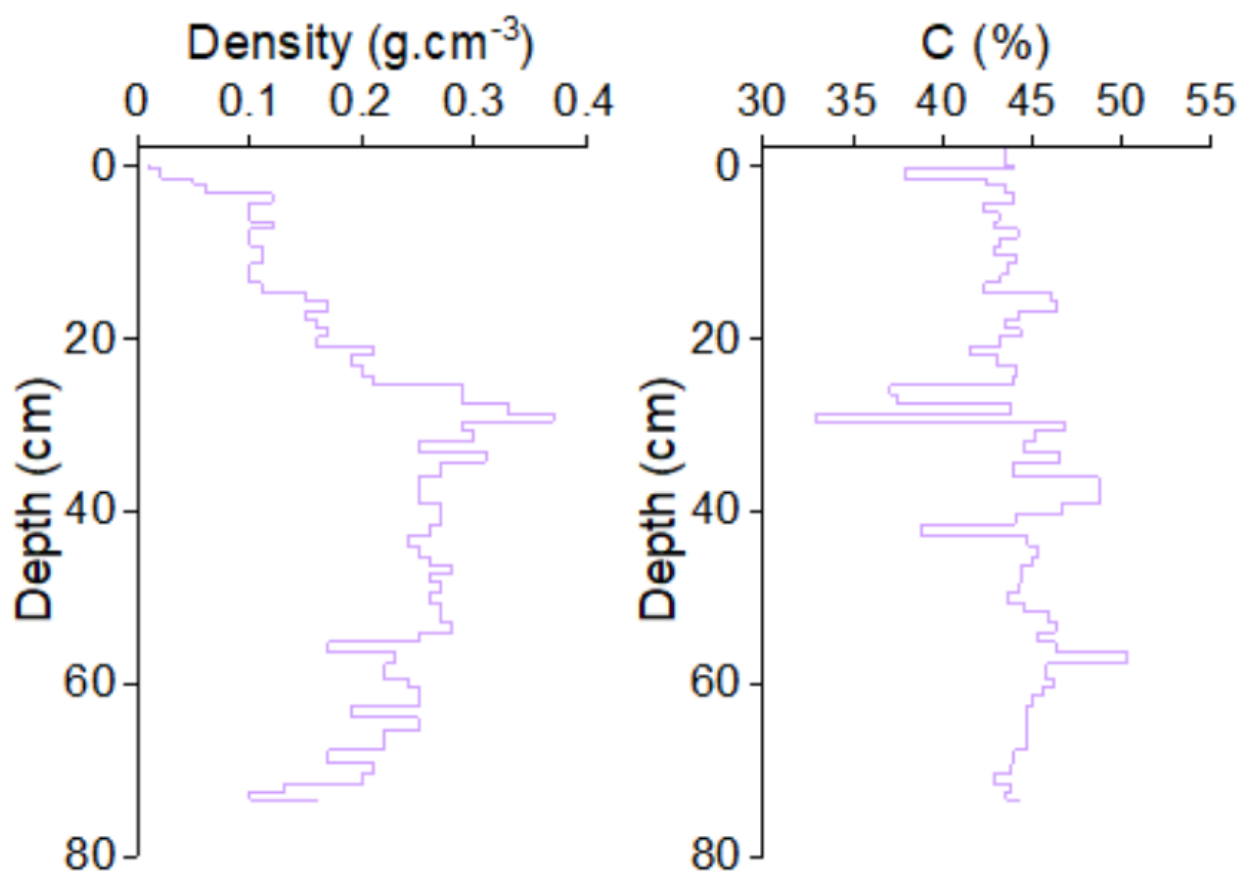


Figure S6. Profiles of dry density and carbon content for the analysed peat core.

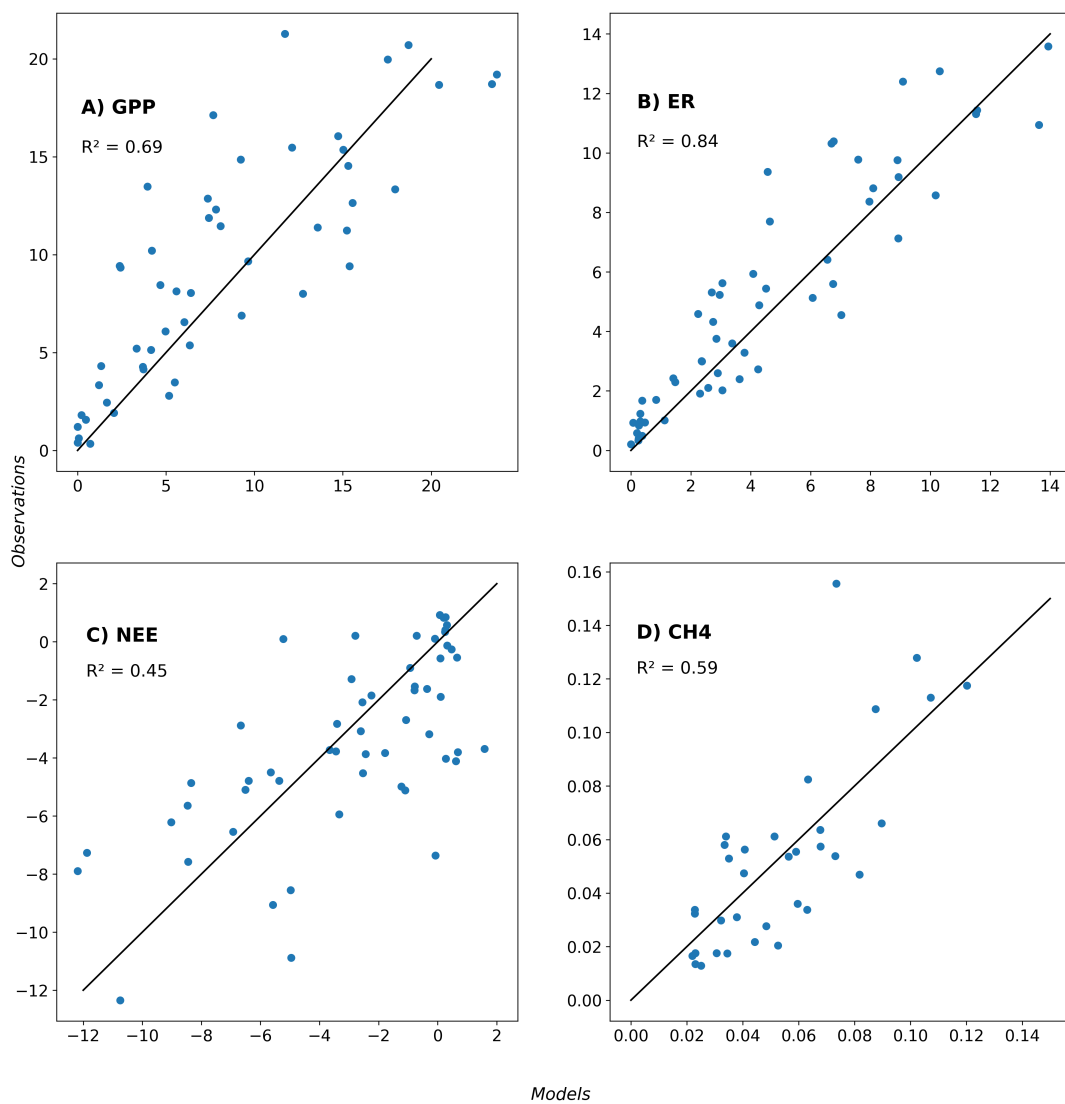


Figure S7. *Observations fluxes versus models fluxes*

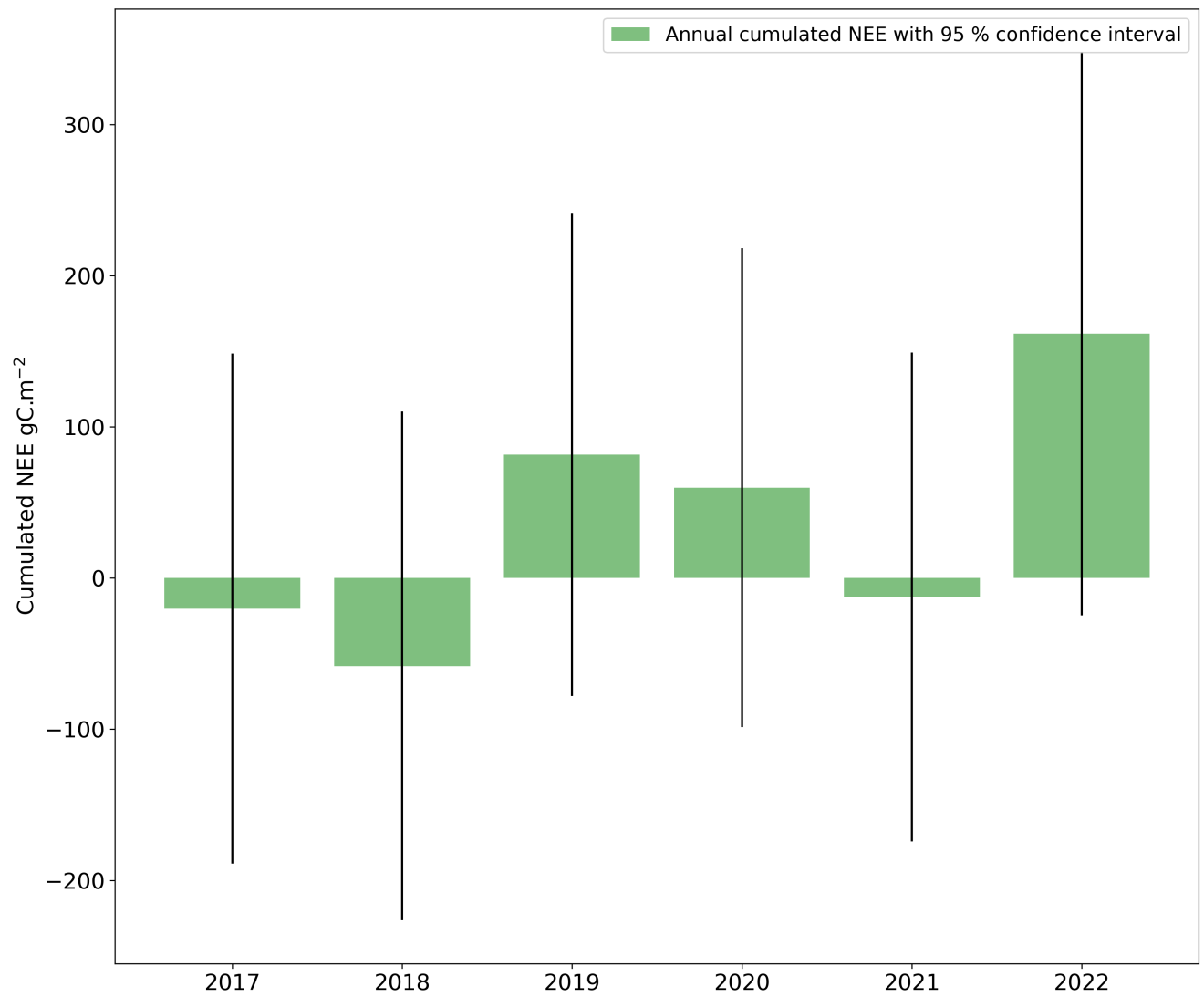


Figure S8. *Cumulated NEE fluxes over the 2017-2022 period with associated uncertainties*

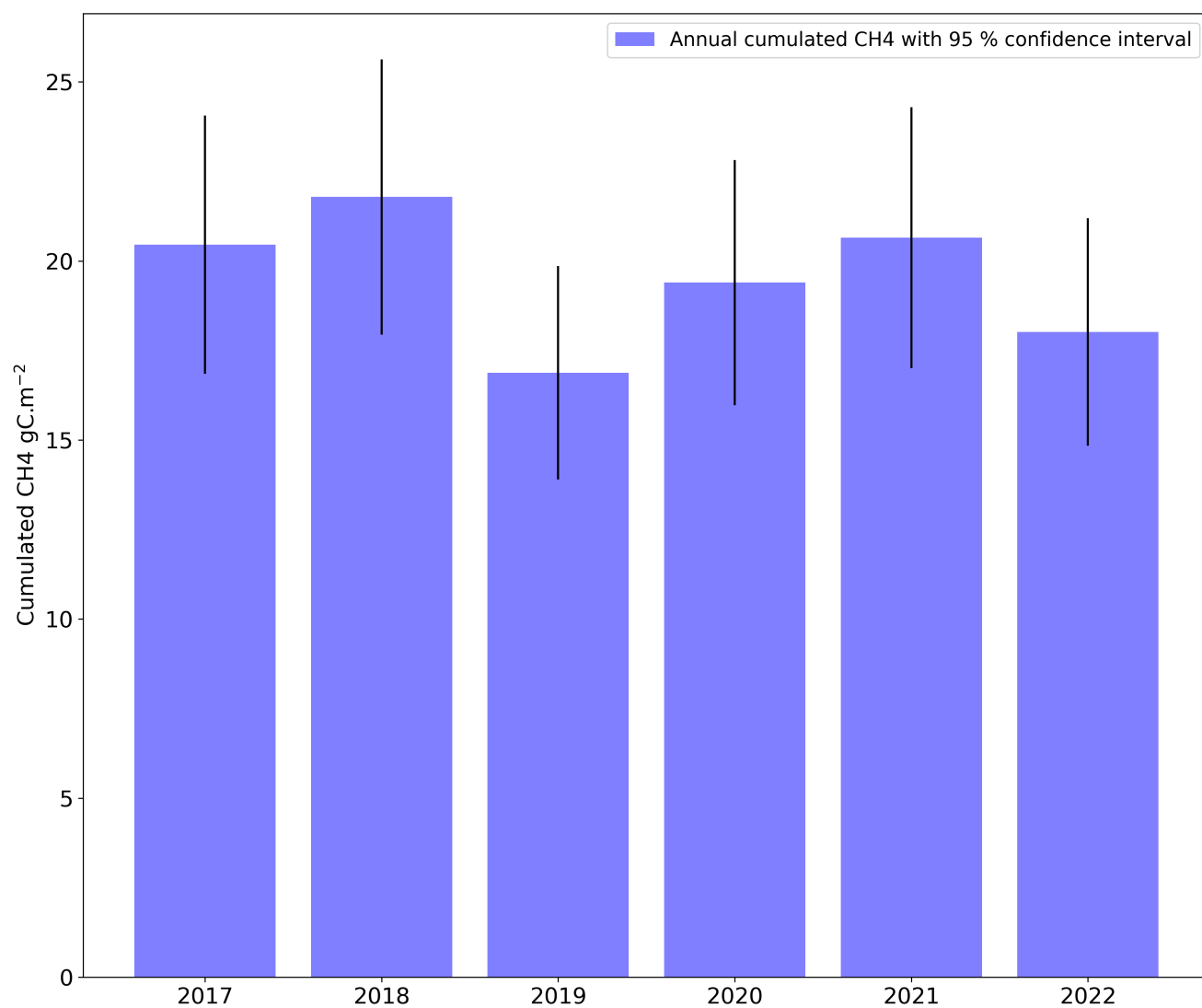


Figure S9. *Cumulated FCH₄ fluxes over the 2017-2022 period with associated uncertainties*

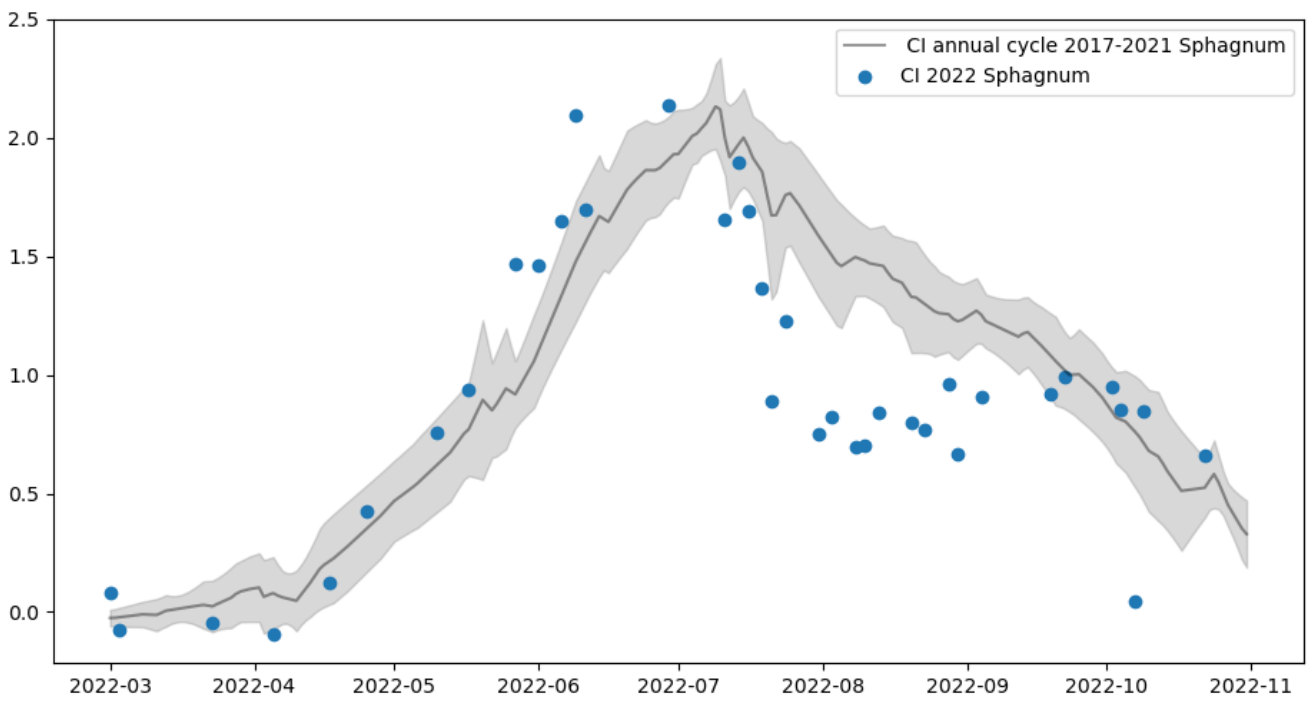


Figure S10. Comparison of the chlorophyll index during the 2022 drought with the period from 2017 to 2021.