S1. Chamber characteristics

Table S1: Vegetation and distance to nearest trees and ditches. Only living trees growing within 5 m from each chamber are included.

Chamber	Species	Trees (< 5m from chamber)	Distance to ditch
1	*Vaccinum vitis-idea, Carex globularis, Pleurozium schreberi, Hylocomium splendens, Dicranum polysetum*	2.6 m Picea abies, 3.1 m Betula pubescens, 4.8 m Picea Abies	12 m
2	*Vaccinum myrtillus, Dryopteris carthusiana, Dicranum polysetum, Pleurozium schreberi*	Picea abies 3.7 m	10 m
3	*Sphagnum spp., Trientalis europaea*	3.2 m Picea abies, 4.2 m Betula pubescens, 2.4 m Picea abies, 2.2 m Betula pubescens, 3 m Picea abies, 4.2 m Betula pubescens, 4.4 m Picea abies	20 m
4	*Pleurozium schreberi, Dicranum polysetum*	2.9 m Picea abies, 2.5 m Betula pubescens, 3.3 m Picea abies, 3.5 m Betula pubescens, 2.4 m Betula pubescens, 2.4 m Picea abies, 2.8 m Picea abies	5 m
5	*Dryopteris carthusiana, Vaccinum vitis-idae, Vaccinum myrtillus, Pleurozium schreberi, Dicranum polysetum, Hylocomium splendens*	1.9 m Picea abies, 1.6 m Picea abies, 1.2 m Pinus sylvestris, 4.8 m Betula pubescens, 4.5 m Picea abies	5 m
6	*Trientalis europaea, Pleurozium schreberi, Dicranum polysetum, Hylocomium splendens*	2.8 m Picea abies, 3.4 m Betula pubescens, 4.9 m Picea abies, 1.9 m Picea abies, 3.4 m Betula pubescens, 3.8 m Picea abies, 5 m Picea abies, 3.2 m Picea abies, 2.1 m Picea abies, 2.3 m Betula pubescens, 2.7 m Picea abies	20 m

S2. N_2O flux histograms

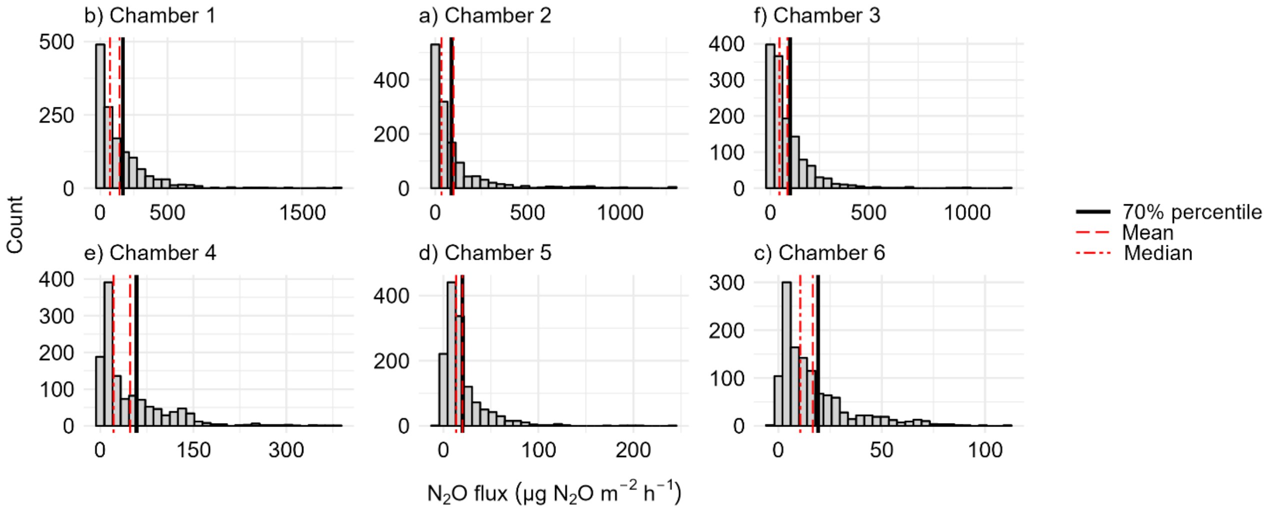


Figure S2: Distribution of daily mean N_2O flux in chambers 1-6. The chamber-specific mean, median and 70 % percentile that was used to define high-flux days, are shown as vertical lines.

S3. Spatio-temporal variation of N_2O fluxes

Table S3.1: Mean, minimum and maximum N_2O fluxes in different measurement years. Unit of the N_2O flux is μg N_2O m^{-2} h^{-1}. Years 2015 and 2019 include only part of the year (*). Measurements in Chamber 6 ended six months earlier in 2019 than in other chambers.

	2015*			2016			2017			2018			2019*		
Chamber	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
1	77	2	467	215	26	1266	233	-1	1761	43	0.1	322	131	0.5	717
2	63	4	359	189	6	1272	145	-1	1282	24	0.4	198	48	0	294
3	61	-12	476	151	15	1192	130	7	937	30	0.5	227	50	0	333
4	27	2	85	71	9	228	89	7	381	21	1	110	18	-1	87
5	16	0	54	24	3	118	27	-1	244	12	-5	201	21	-2	103
6	16	1	71	24	-1	111	23	-1	74	7	-3	31	7	-3	25

Table S3.2: Mean, minimum and maximum N_2O fluxes (μg N_2O m^{-2} h^{-1}) in different thermal seasons. All years are included.

	Spring			Summer			Autumn			Winter		
Chamber	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
1	122	0	621	199	0	1761	86	2	717	117	-1	1266
2	55	-1	298	173	0	1282	45	6	211	49	0	339
3	57	1	228	96	3	937	44	-12	220	117	0	1192
4	71	1	306	47	-1	381	14	1	72	62	1	184
5	15	0	52	20	-5	244	11	-1	54	30	-3	201
6	9	-3	41	20	-1	77	8	-3	42	21	-1	112

S4. Time series correlations

Table S4.1: Correlation of N_2O time series between each pair of chambers. Correlations were statistically significant ($p < 0.05$).

	Chamber 1	Chamber 2	Chamber 3	Chamber 4	Chamber 5	Chamber 6
Chamber 1	1.00	0.79	0.64	0.65	0.36	0.40
Chamber 2	0.79	1.00	0.75	0.55	0.29	0.47
Chamber 3	0.64	0.75	1.00	0.69	0.41	0.53
Chamber 4	0.65	0.55	0.69	1.00	0.46	0.48
Chamber 5	0.36	0.29	0.41	0.46	1.00	0.49
Chamber 6	0.40	0.47	0.53	0.48	0.49	1.00

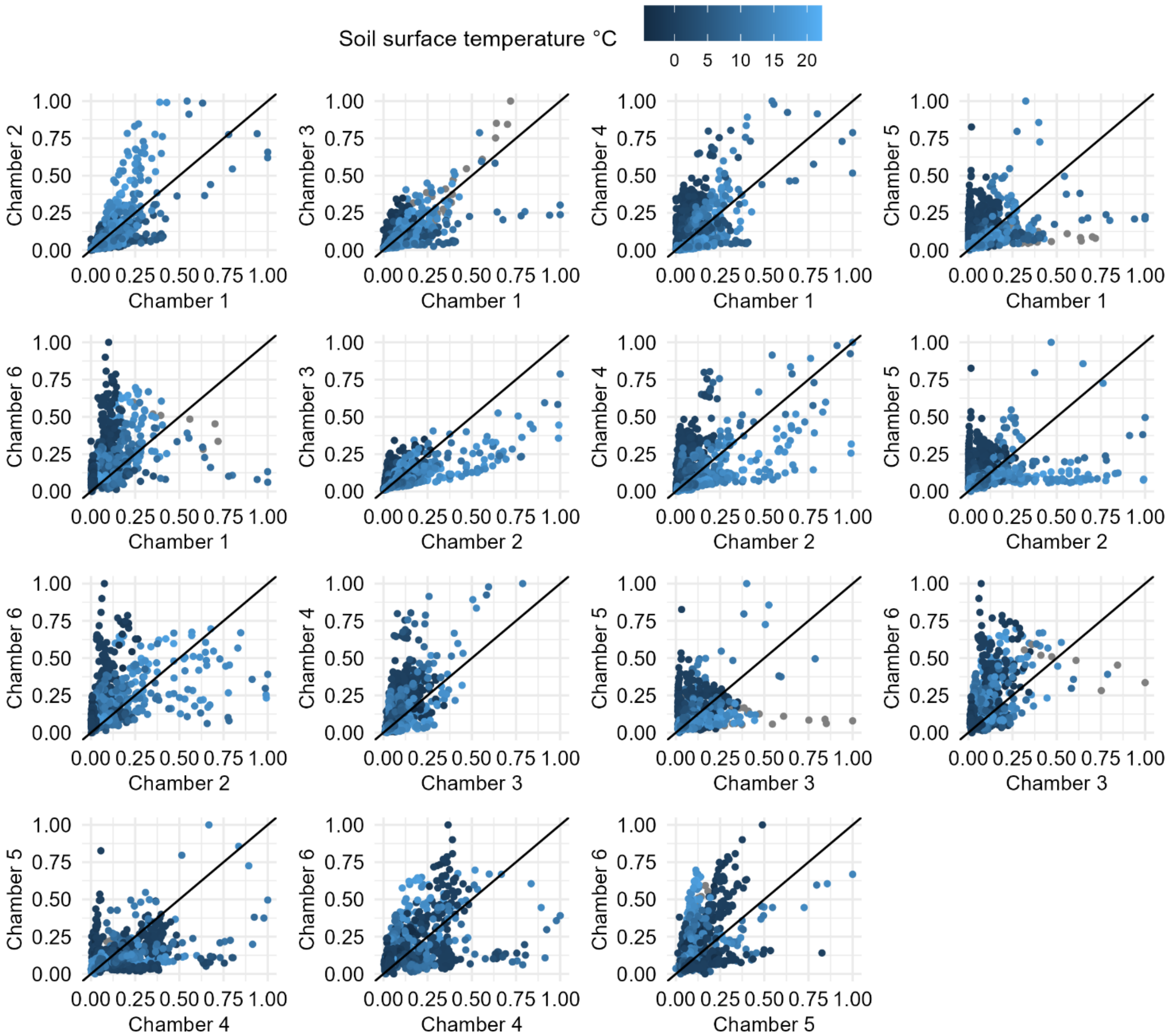


Figure S4.2: Correlations of scaled N_2O fluxes. Figure axes show scaled daily mean N_2O fluxes of each chamber (maximum daily mean flux = 1, minimum daily mean flux = 0). Daily mean fluxes are colored by daily mean soil surface temperature that explained variance between fluxes of each chamber pair statistically significantly ($p < 0.05$) in all chamber pairs except between chambers 1 and 2 and chamber 3 and 6.

S5. Temporal variation of N_2O within a year

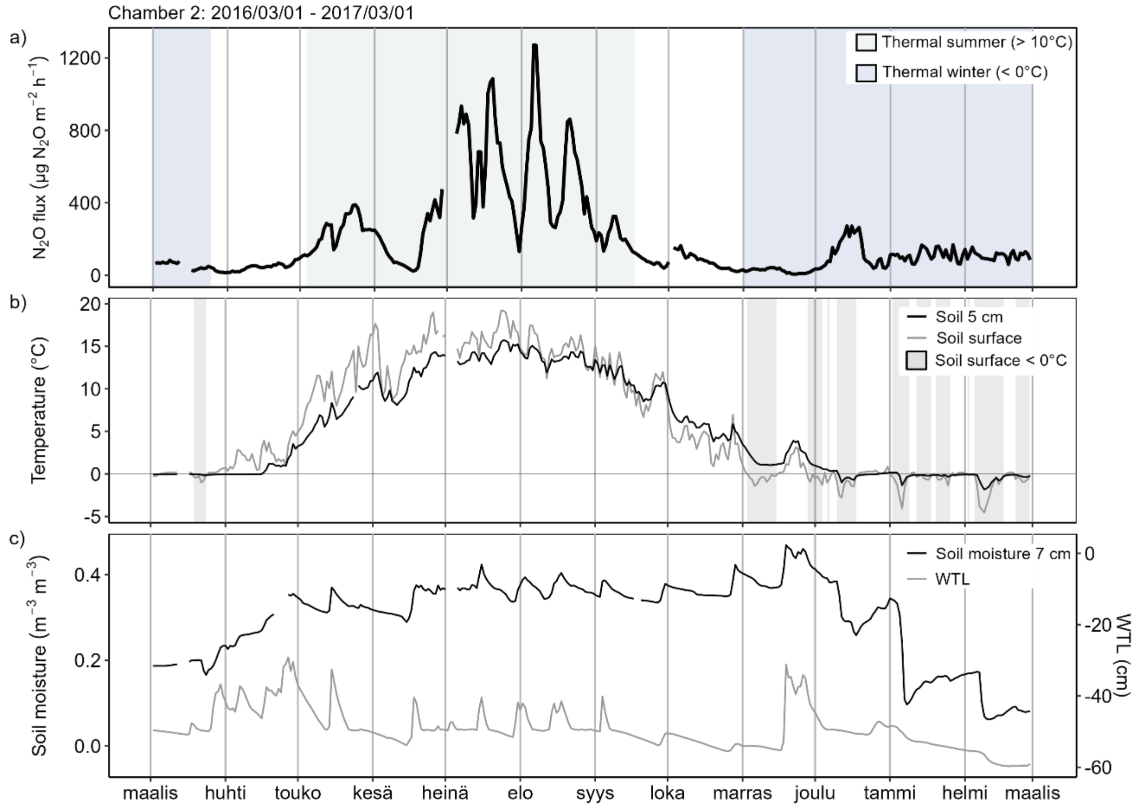


Figure S5.1: a) Daily mean N_2O flux, b) soil surface temperature and temperature at 5 cm depth with highlighted freezing periods (soil surface temperature < 0°C), and c) soil moisture and water table level (WTL) from February 2016 to March 2017 in Chamber 2. The shown temporal dynamics of N_2O flux were measured in a year with relatively wet summer and warm winter. Data are not gap-filled. Figure for Chamber 1 is presented in the manuscript (Fig. 6).

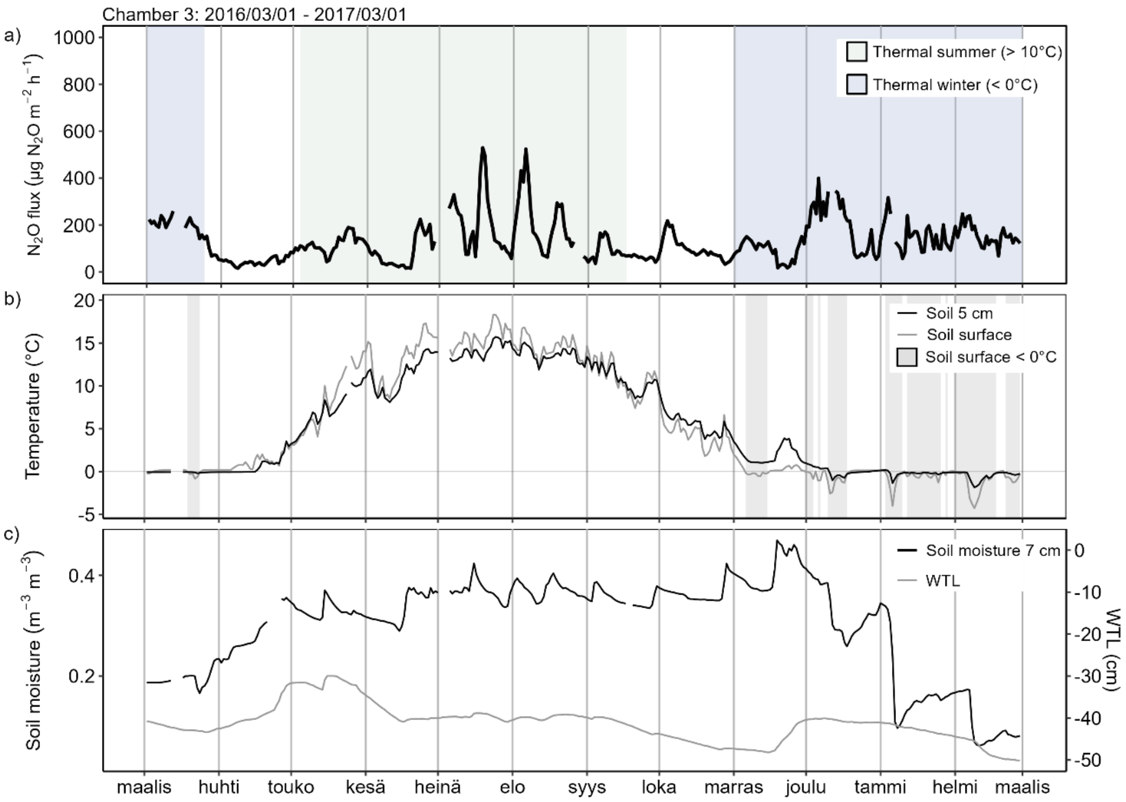


Figure S5.2: Temporal variation of N_2O flux and environmental conditions between springs 2016 and 2017 in chamber 3. See details in caption above (Fig. S5.1)

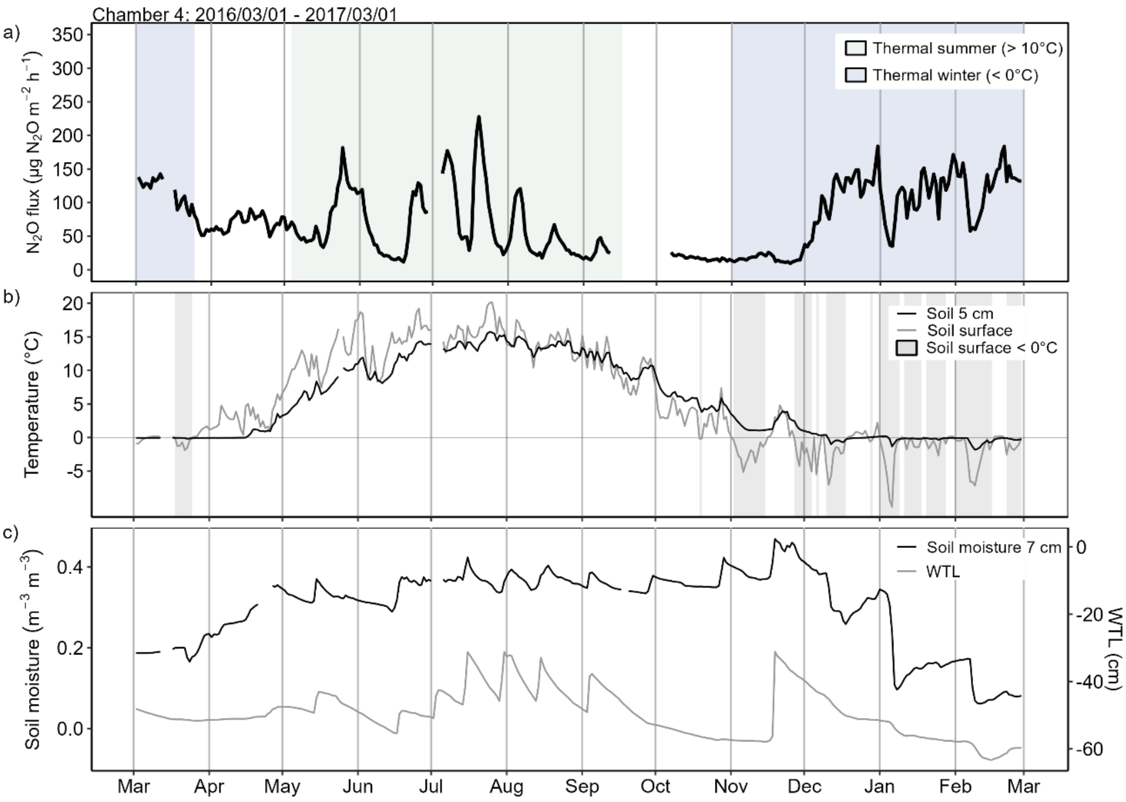


Figure S5.3: Temporal variation of N_2O flux and environmental conditions between springs 2016 and 2017 in chambers 4. See details in caption above (Fig. S5.1)

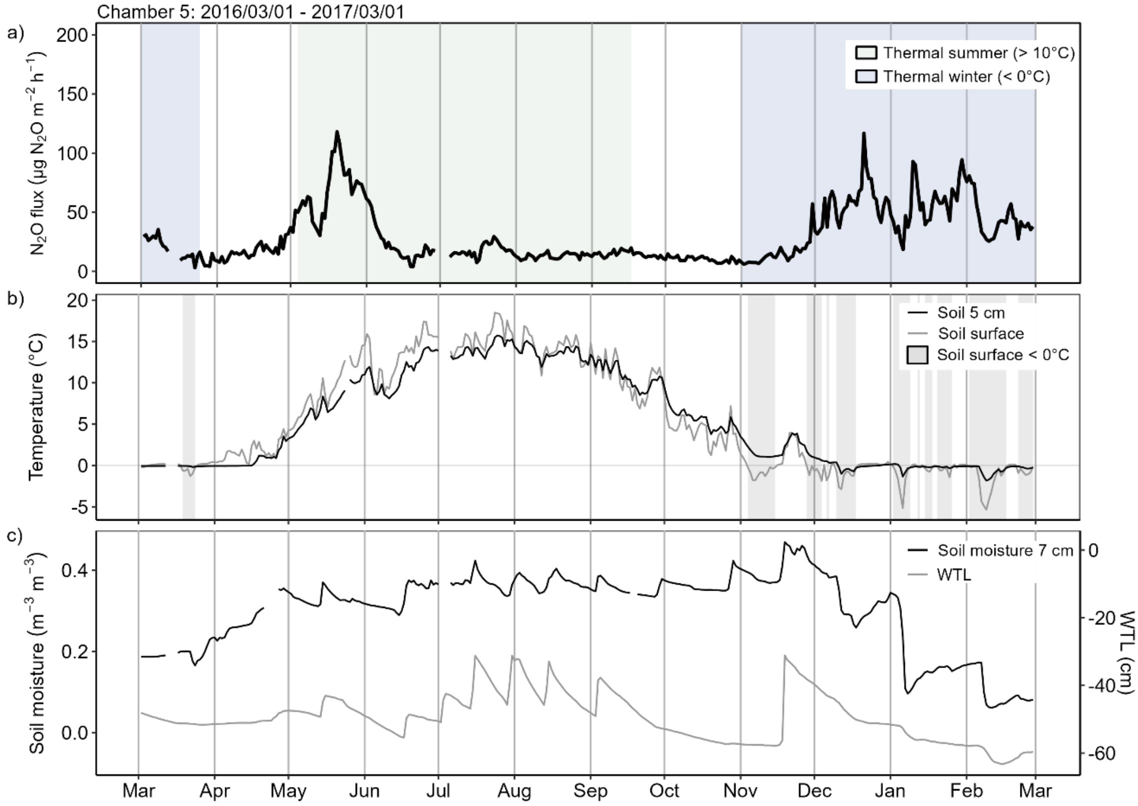
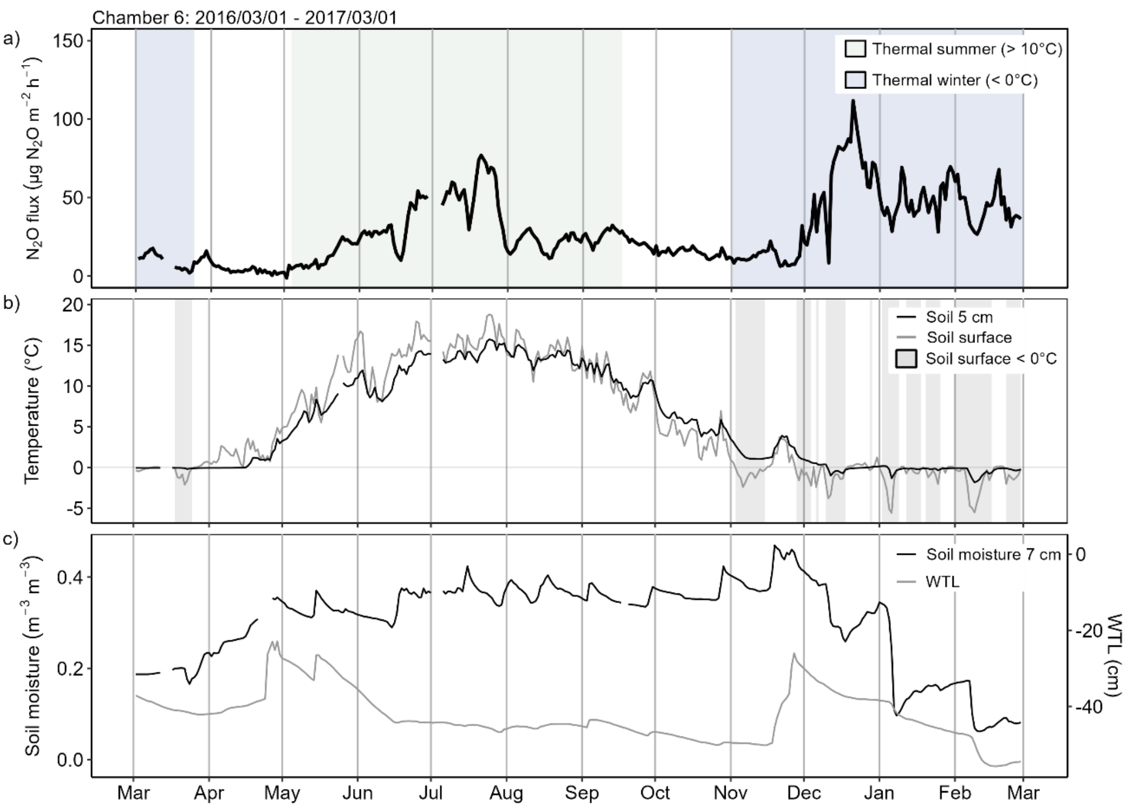


Figure S5.4: Temporal variation of N_2O flux and environmental conditions between springs 2016 and 2017 in chambers 5. See details in caption above (Fig. S5.1)



Figures S5.5: Temporal variation of N_2O flux and environmental conditions between springs 2016 and 2017 in chambers 6. See details in caption above (Fig. S5.1)

S6. N_2O flux responses to immediate and time-lagged environmental conditions

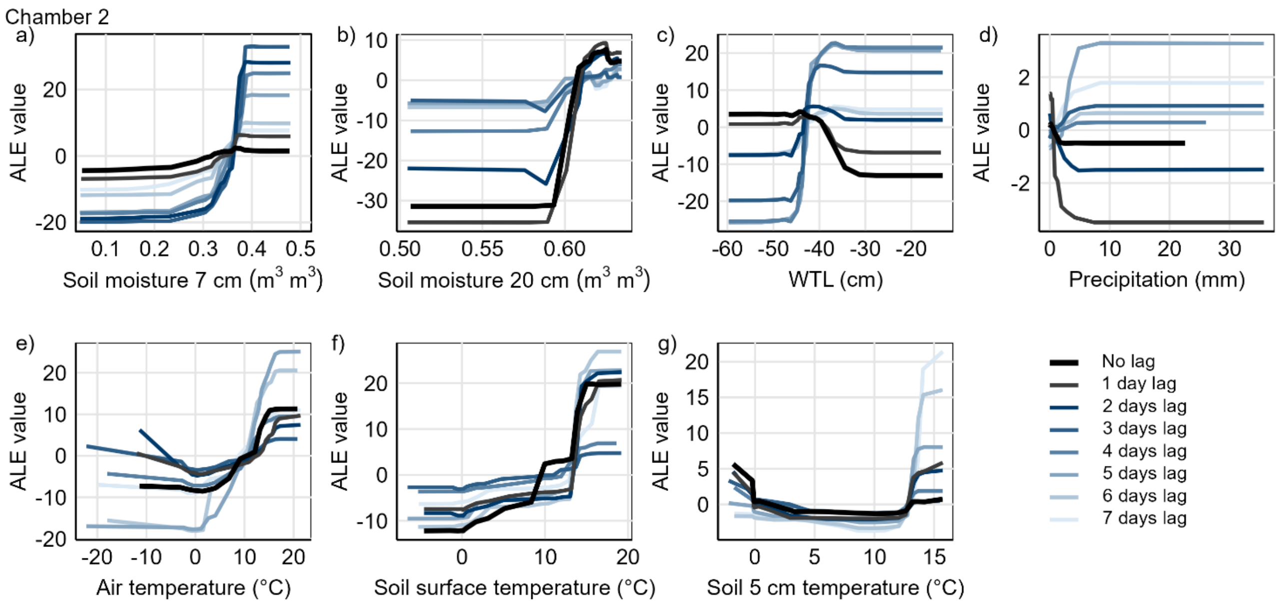


Figure S6.1: Response curves between N_2O flux and environmental variables for Chamber 2 visualized using Accumulated Local Effects (ALE). Figures illustrate how the predicted N_2O flux values deviate from the mean predicted flux (ALE = 0) along the gradients of a) soil moisture at 7 cm depth, b) soil moisture at 20 cm depth, c) water table level (WTL), d)

precipitation, e) air temperature, f) soil surface temperature and g) soil temperature at 5 cm. ALE responses for unlagged and lagged variables (1–7 days) are included. Lines represent the mean ALE values of 10 model runs. Responses for chamber 1 are presented in the manuscript (Fig. 9).

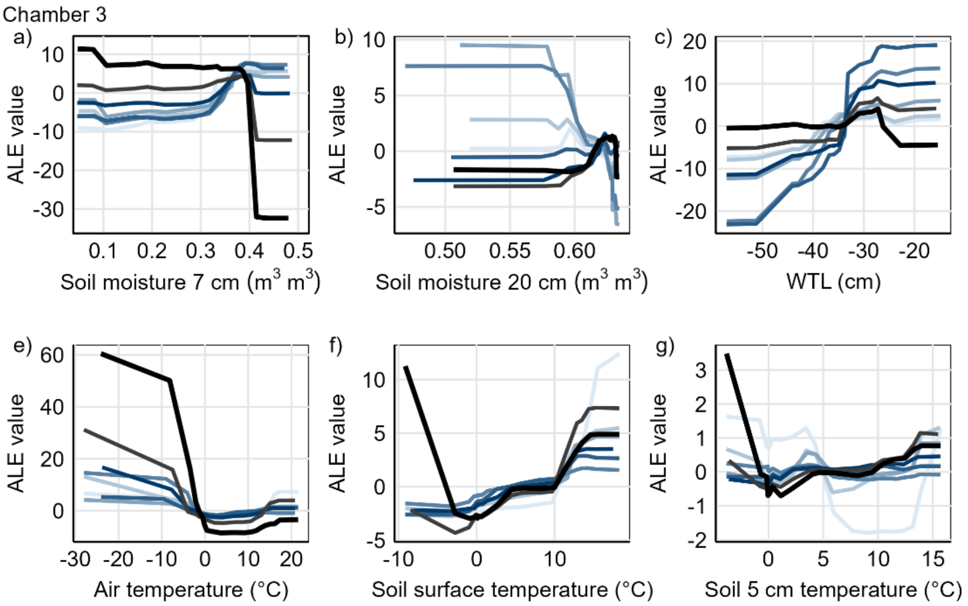


Figure S6.2: Response curves between N_2O flux and environmental variables visualized using Accumulated Local Effects (ALE) for chamber 3. See details in caption above (Fig. S6.1)

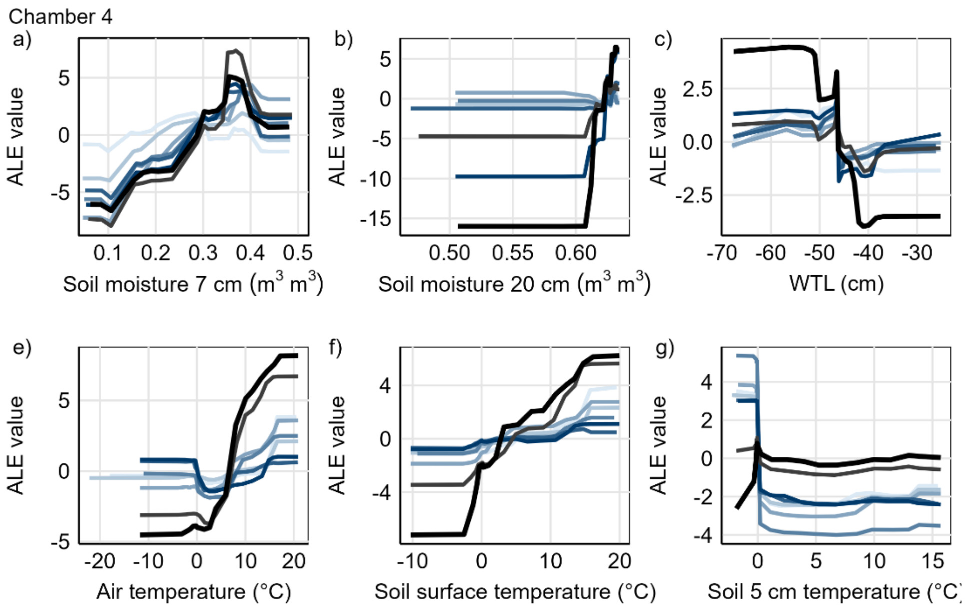


Figure S6.3: Response curves between N_2O flux and environmental variables visualized using Accumulated Local Effects (ALE) for chamber 4. See details in caption above (Fig. S6.1)

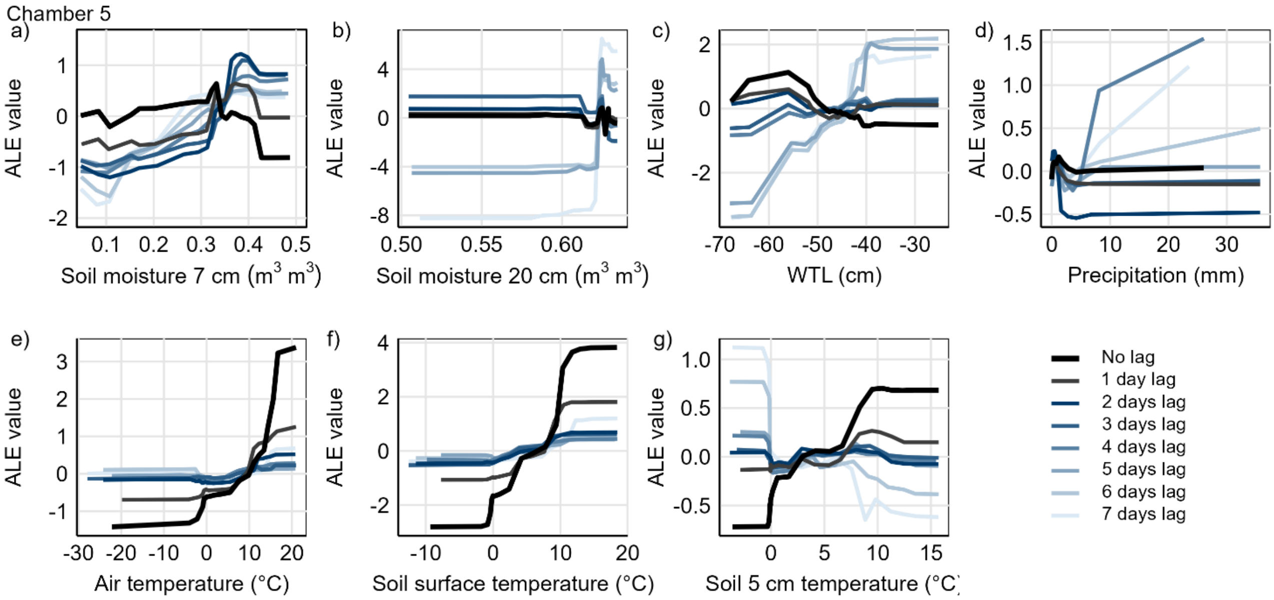


Figure S6.4: Response curves between N_2O flux and environmental variables visualized using Accumulated Local Effects (ALE) for chamber 5. See details in caption above (Fig. S6.1)

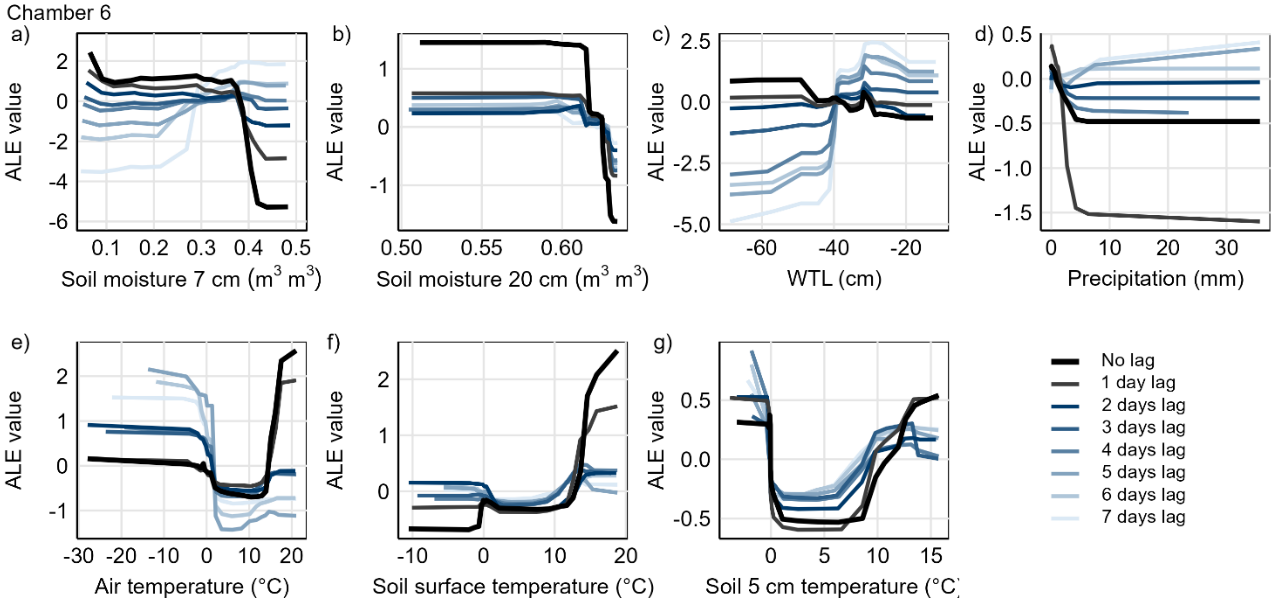


Figure S6.5: Response curves between N_2O flux and environmental variables visualized using Accumulated Local Effects (ALE) for chamber 6. See details in caption above (Fig. S6.1)

S7. N_2O budgets and seasonal contributions

Table S7.1: Annual N_2O budgets in different chambers. Unit of N_2O budget is mg N_2O m^{-2} y^{-1}. The annual N_2O budget includes only part of the year in 2015 (summer and autumn) and 2019 (spring and summer) (*).

Chamber	2015*	2016	2017	2018	2019*
1	469	1886	2114	399	790
2	360	1613	1367	222	283
3	350	1340	1116	281	284
4	141	613	743	214	112
5	88	210	246	112	155
6	87	214	200	59	85

Table S7.2: Contributions of spring fluxes to annual N_2O budgets. Contributions are expressed as percentages of the annual budget (%). The annual N_2O budget includes only part of the year in 2015 and 2019 (*).

Chamber	2015*	2016	2017	2018	2019*
1	-	5	12	9	24
2	-	3	11	6	19
3	-	4	14	9	26
4	-	11	27	13	45
5	-	8	6	8	21
6	-	2	12	9	33

Table S7.3: Contributions of summer fluxes to annual N_2O budgets. Contributions are expressed as percentages of the annual budget (%). The annual N_2O budget includes only part of the year in 2015 and 2019 (*).

Chamber	2015*	2016	2017	2018	2019*
1	77	52	61	64	48
2	53	79	67	59	64
3	63	36	48	41	63
4	66	35	39	36	34
5	52	44	48	28	15
6	66	45	42	42	45

Table S7.4: Contributions of autumn fluxes to annual N_2O budgets. Contributions are expressed as percentages of the annual budget (%). The annual N_2O budget includes only part of the year in 2015 and 2019 (*).

Chamber	2015*	2016	2017	2018	2019*
1	18	5	14	7	-
2	37	5	9	12	-
3	24	7	14	13	-

4	30	5	6	5	-
5	41	6	16	8	-
6	25	8	12	6	-

Table S7.5: Contributions of winter fluxes to annual N_2O budgets. Contributions are expressed as percentages of the annual budget (%). The annual N_2O budget includes only part of the year in 2015 and 2019 (*).

Chamber	2015*	2016	2017	2018	2019*
1	-	37	14	20	-
2	-	13	24	23	-
3	-	53	27	36	-
4	-	49	30	45	-
5	-	43	34	56	-
6	-	44	20	43	-

S8. Model performance outside training period

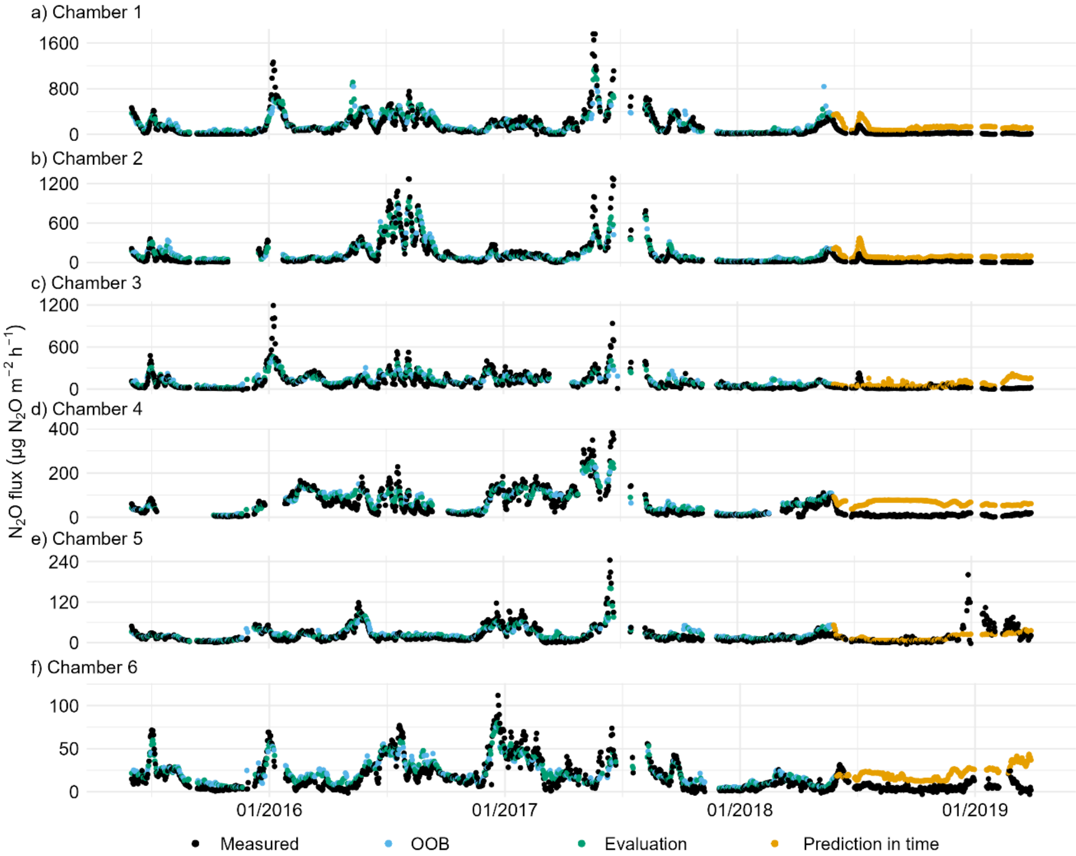


Figure S8: Measured and predicted N_2O fluxes plotted against time. Figures (a-f) show predicted values from random forest with conditional inference trees separately for six chambers. Points are colored by the used data with out-of-bag (OOB) data, evaluation data within training period (30 % of first three years of data) and prediction in time data (outside model training period, fourth year of data) different types of evaluation datasets, and daily means of measured fluxes.