



Supplement of

Surface networks in the Arctic may miss a future *methane bomb*

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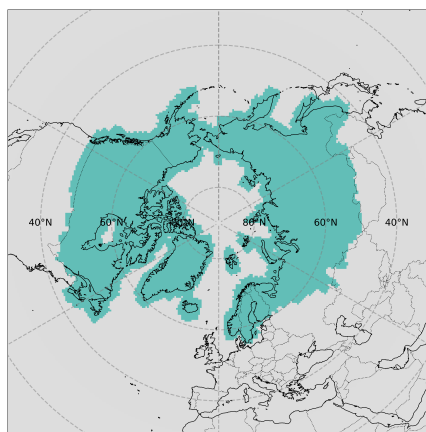
Table S1: *Selected atmospheric observation sites for this study, by decreasing latitudes.*

ID	Site, country	Latitude	Longitude	Elevation (masl)	Operator
ALT	Alert, CAN	82.5° N	62.5° W	185	ECCC
ZEP	Zeppelin, NOR	78.9° N	11.9° E	474	NOAA-ESRL
SUM	Summit, GRL	72.6° N	38.4° E	3210	NOAA-ESRL
TIK	Tiksi, RUS	71.9° N	128.9° E	19	FMI/NOAA
BRW	Barrow, USA	71.3° N	156.6° W	11	NOAA-ESRL
CBY	Cambridge Bay, CAN	69.1° N	105.1° W	35	ECCC
INK	Inuvik, CAN	68.3° N	133.5° W	113	ECCC
PAL	Pallas, FIN	68.0° N	24.1° E	565	FMI/NOAA
CRV	CARVE, USA	65.0° N	147.6° W	611	NOAA-ESRL
BLK	Baker Lake, CAN	64.3° N	96.0° W	95	ECCC
NOY	Noyabrsk, RUS	63.4° N	75.8° E	100	JR-stations NIES
ICE	Storhovdi Island, ISL	63.4° N	20.2° E	118	NOAA-ESR
IGR	Igrim, RUS	63.2° N	64.4° E	25	JR-stations NIES
BCK	Behchoko, CAN	62.8° N	115.9° W	160	ECCC
YAK	Yakutsk, RUS	62.1° N	129.4° E	130	JR-stations NIES
DEM	Demyanskoe, RUS	59.8° N	70.9° E	75	JR-stations NIES
FNE	Fort Nelson, CAN	58.8° N	122.6° W	361	ECCC
CHU	Churchill, CAN	58.7° N	93.8° W	29	ECCC
KRS	Karasevoe, RUS	58.3° N	82.4° E	50	JR-stations NIES
BRZ	Berezorechka, RUS	56.1° N	112.5° E	150	JR-stations NIES
CBA	Cold Bay, USA	55.2° N	162.7° E	21	NOAA-ESRL
LLB	Lac La Biche, CAN	55.0° N	112.5° W	540	ECCC
AZV	Azovo, RUS	54.7° N	73.0° E	100	JR-stations NIES
VGN	Vaganovo, RUS	54.5° N	62.3° E	200	JR-stations NIES
ETL	East Trout Lake, CAN	54.3° N	105.0° W	500	ECCC
MHD	Mace Head, IRL	53.3° N	9.9° W	5	NOAA-ESRL
SHM	Shemya Island, USA	52.7° N	174.1° W	23	NOAA-ESRL
EST	Esther, CAN	51.7° N	110.2° W	707	ECCC
SVV	Savvushka, RUS	51.3° N	82.1° E	400	JR-stations NIES
BRA	Bratt's Lake, CAN	50.2° N	104.7° W	595	ECCC
FRD	Fraserdale, CAN	49.9° N	81.6° W	210	ECCC

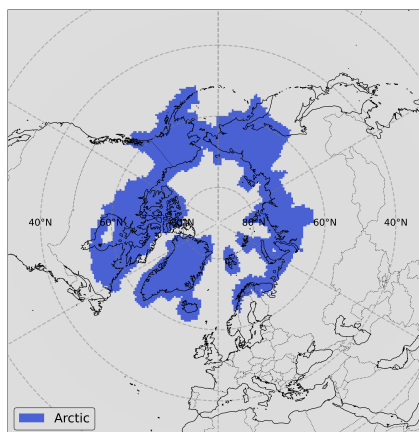
CPS	Chapais, CAN	49.8° N	75.0° W	391	ECCC
CHB	Chibougamau, CAN	49.7° N	74.3° W	393	ECCC
ESP	Estevan Point, CAN	49.4° N	126.5° W	7	ECCC
ABT	Abbotsford, CAN	49.0° N	122.3° W	40	ECCC
EGB	Egbert, CAN	44.2° N	79.8° W	251	ECCC
WSA	Sable Island, CAN	43.9° N	60.0° W	5	ECCC
DWN	Downsview, CAN	43.8° N	79.5° W	198	ECCC
HNP	Hanlan's Point, CAN	43.6° N	79.4° W	87	ECCC
TKP	Turkey Point, CAN	42.6° N	80.6° W	231	ECCC

Table S2: Additional observation sites.

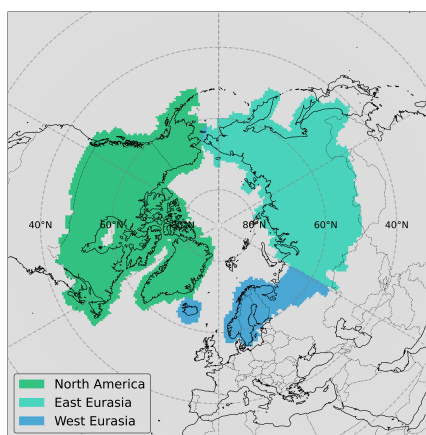
ID	Site, country	Latitude	Longitude	Elevation (masl)	Operator
SNO	Station Nord, GRL	81.6° N	16.7° W	8	ICOS
KJN	Kjolnes, NOR	70.9° N	29.2° E	30	Univ. Exeter/ICOS
AMB	Ambarchik, RUS	69.6° N	162.3° E	5	MPI-BGC
TER	Teriberka, RUS	69.2° N	35.1° E	83	MGO
CHS	Cherskii, RUS	68.6° N	161.3° E	23	IASOA
SOD	Sodankyla, FIN	67.4° N	26.6° E	227	ICOS
SVB	Svartberget, SWE	64.3° N	19.8° E	275	ICOS
SMR	Hyytiälä, FIN	61.9° N	24.3° E	181	ICOS
ZOT	Zotto, RUS	60.8° N	89.4° E	104	MPI-BGC
NOR	Norunda, SWE	60.1° N	17.5° E	46	ICOS
UTO	Utö, FIN	59.8° N	21.4° E	65	ICOS
BIR	Birkenes Observatory, NOR	58.4° N	8.3° E	219	ICOS
HTM	Hyltemossa, SWE	56.1° N	13.4° E	255	ICOS
VHL	Vavihill, SWE	56.0° N	13.2° E	175	PSI
PLA	Preila, LTU	55.4° N	21.1° E	5	FTMC
CDL	Candle Lake, CAN	55.4° N	105.1° E	600	ECCC



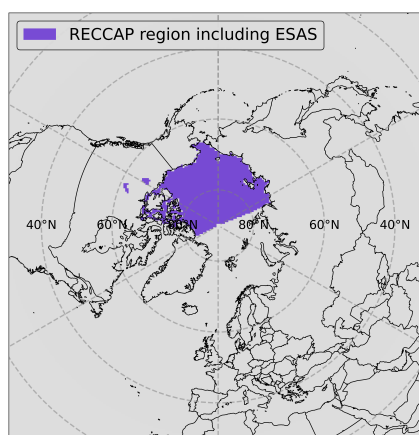
(a) Entire Region



(b) Arctic



(c) Sub-continental regions



(d) Region including ESAS

Figure S1. *Supra-regions (figures a to c) used for applying trends on wetland and anthropogenic CH₄ emissions and RECCAP region including the ESAS (figure d) used for applying trends on oceanic methane sources.*

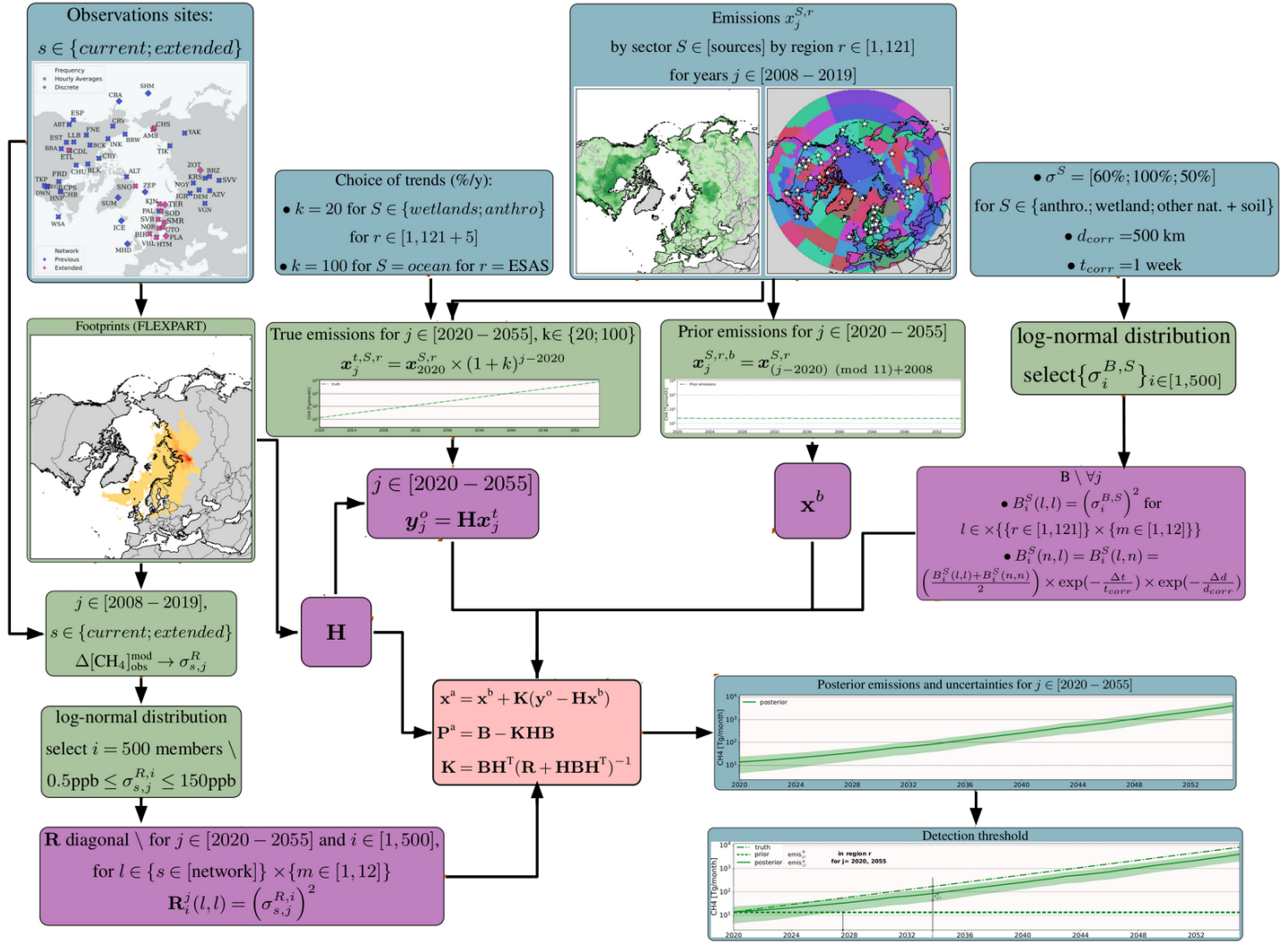


Figure S2. Principle of the inversion set-up used in this study. The observation networks, details on the CH₄ emission scenarios as well as the output data are shown in the blue boxes. The green boxes represent methods on obtaining the input data for the inversion. The red box shows the optimization strategy and the purple boxes the corresponding variables. See Wittig et al. (2023) for full details.