

Figure S1. Time series of temperature measurements recorded by Abisko SMHI (Sveriges meteorologiska och hydrologiska institut) at ANS (Abisko Naturvetenskapliga Station), 10 km to the east of Stordalen Mire, with years 2014-2016 indicated with orange circles.

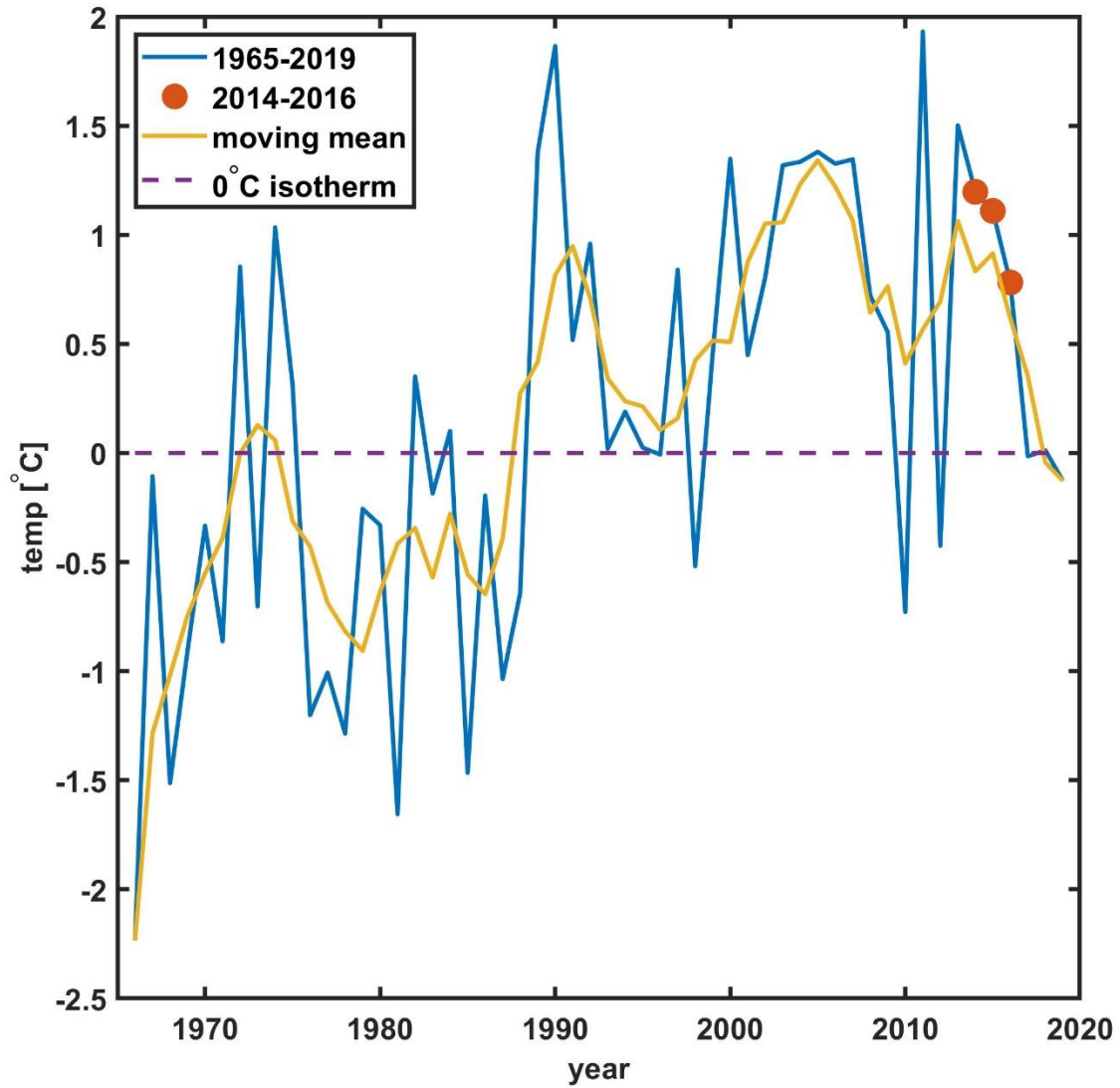
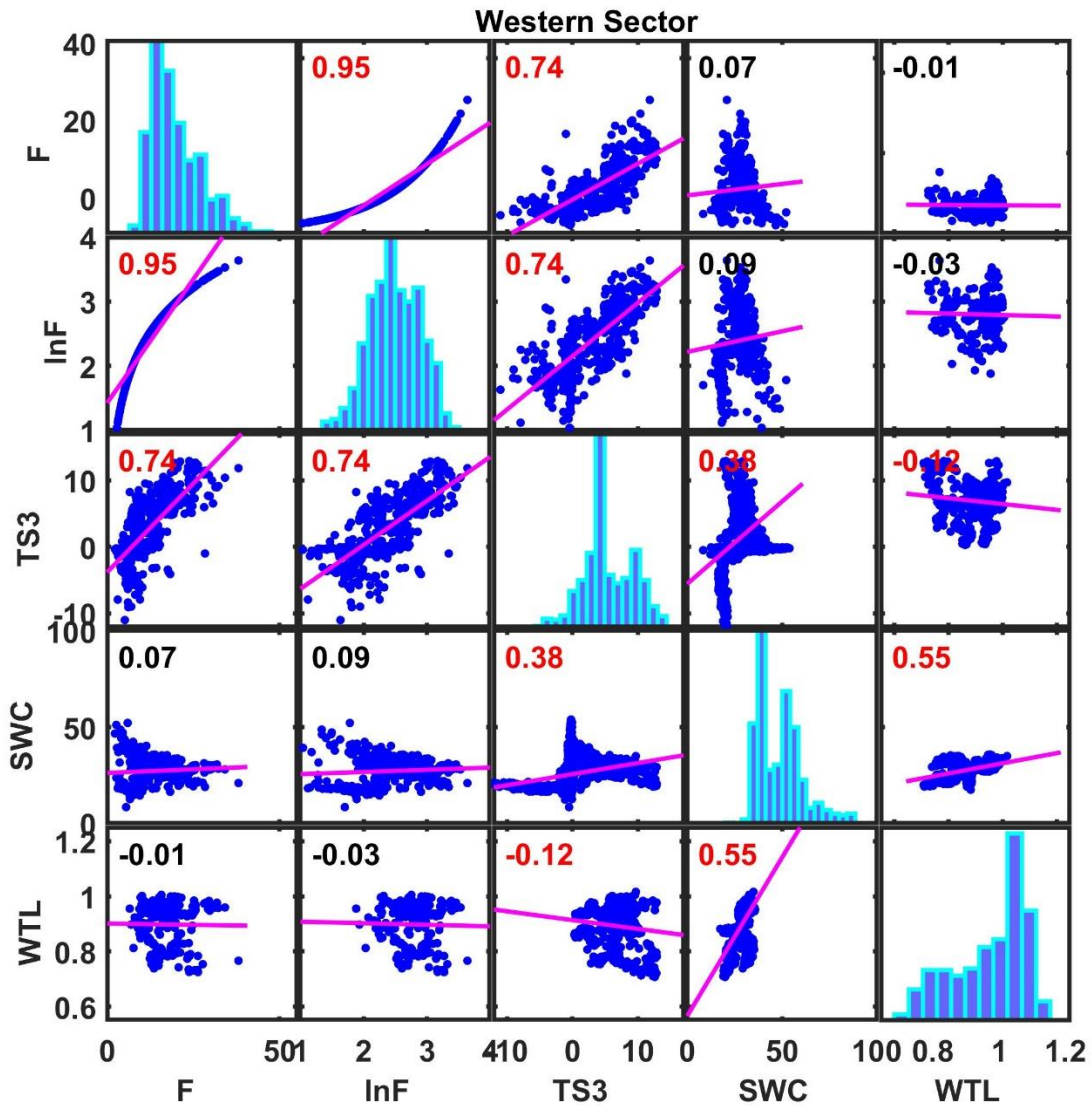


Figure S2. Correlation matrix for daily averages of methane fluxes (F), its logarithm (lnF), and chosen environmental variables (soil temperature at 10 cm (TS3), 30 cm (TS4), soil water content (SWC), and water table level (WTL)) for the western sector (top panel) and eastern sector (bottom panel) for years 2014-2016. The number in the top corner of each subplot is R^2 . The red color for this number shows a significant correlation. The black color of this number shows that the correlation is not significant.



Eastern Sector

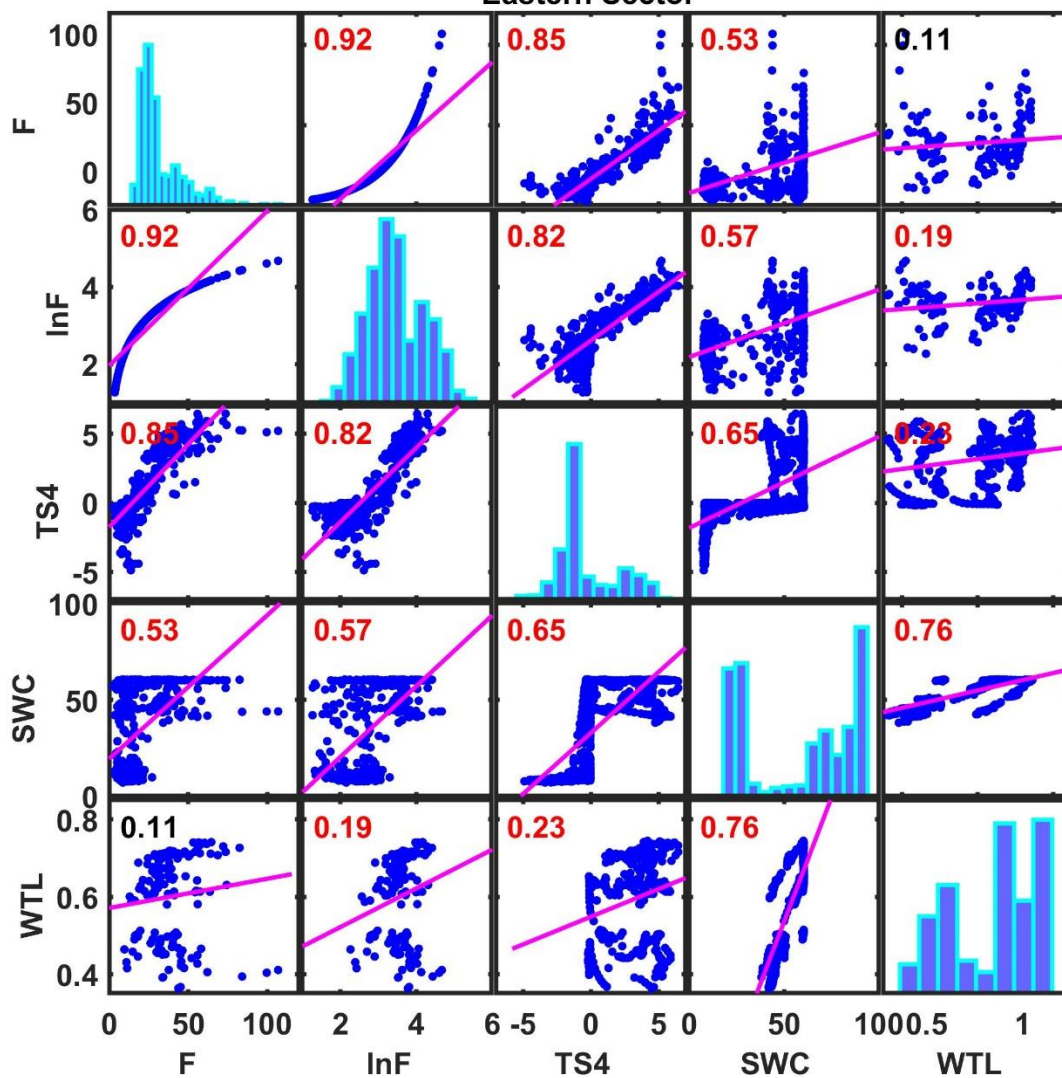


Figure S3. Monthly average of peat temperature for each layer for the western and eastern sector for years 2014-2016

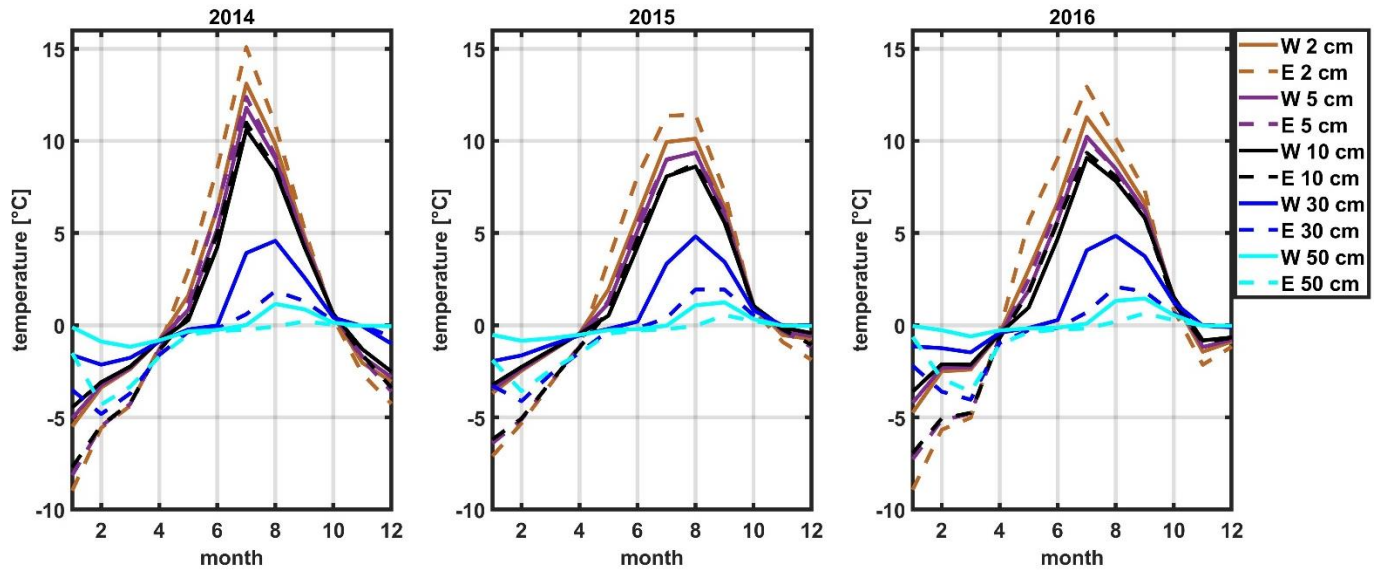
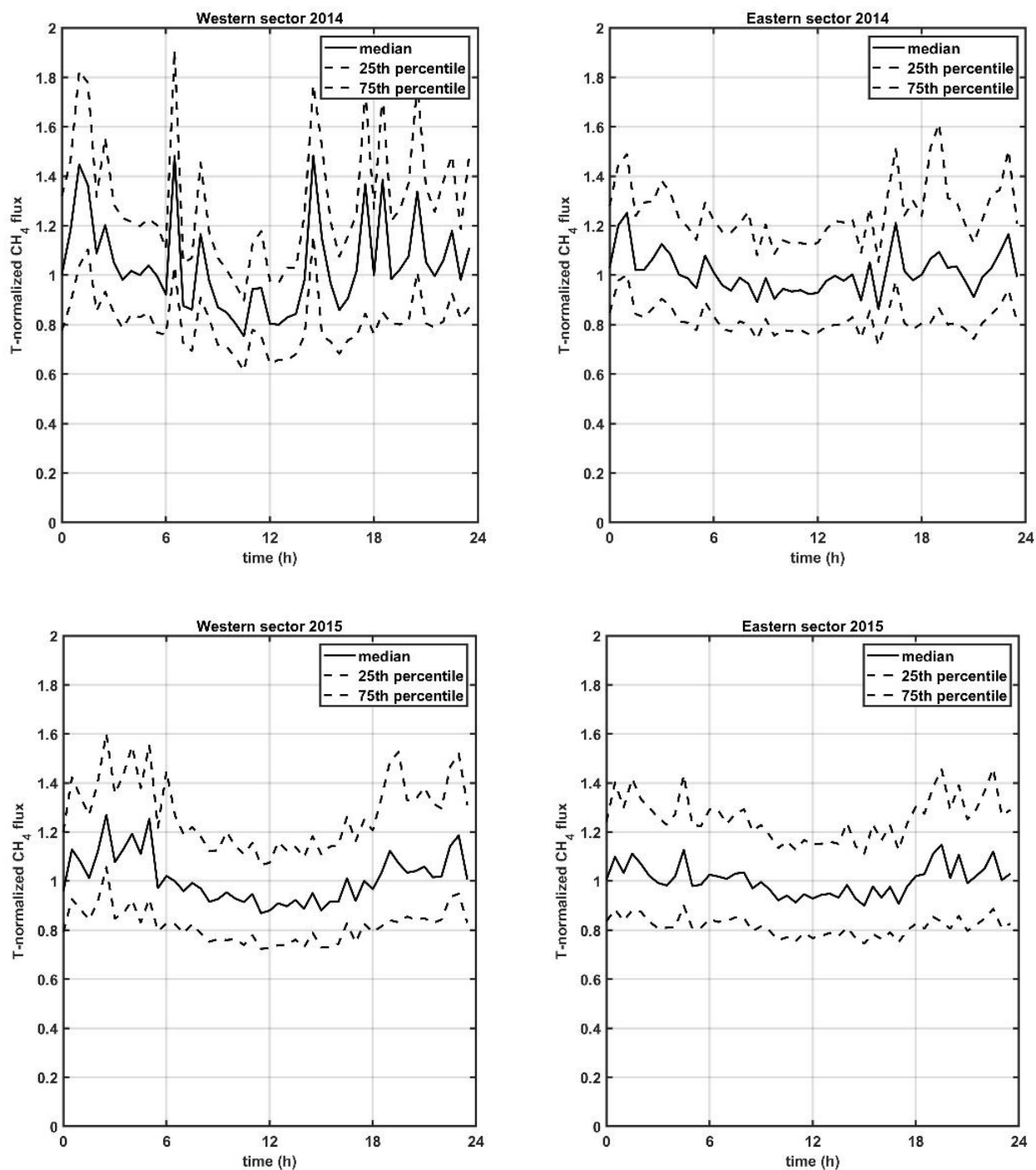


Figure S4. The diel cycle of CH₄ fluxes for the western and eastern sector for years 2014-2016



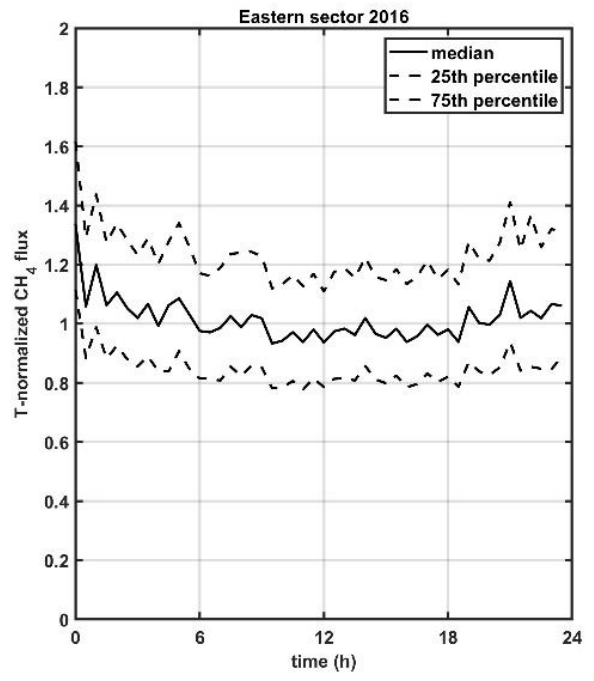
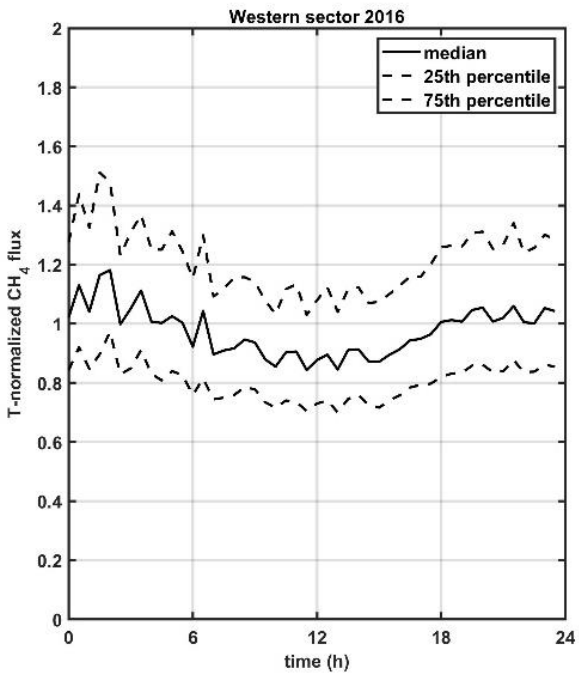
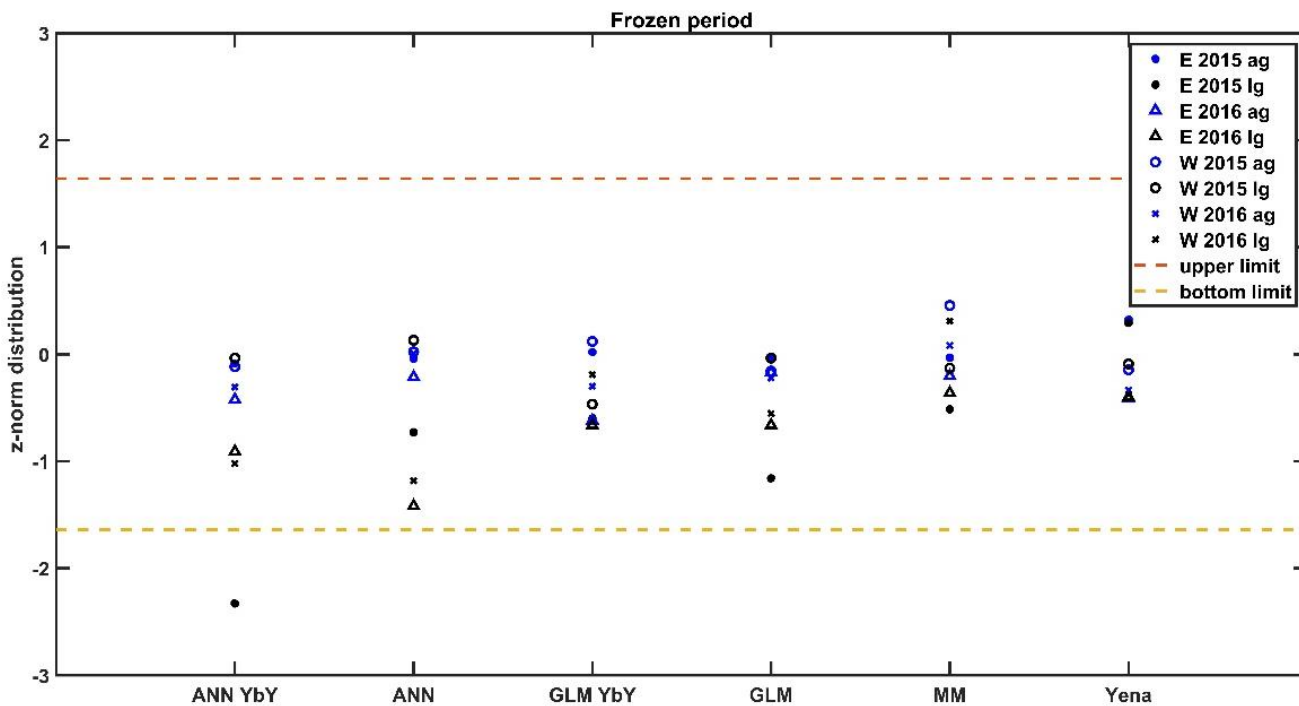
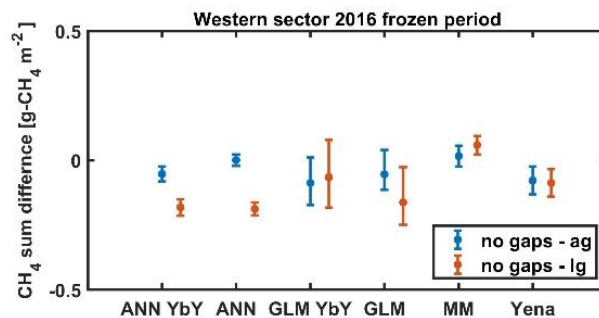
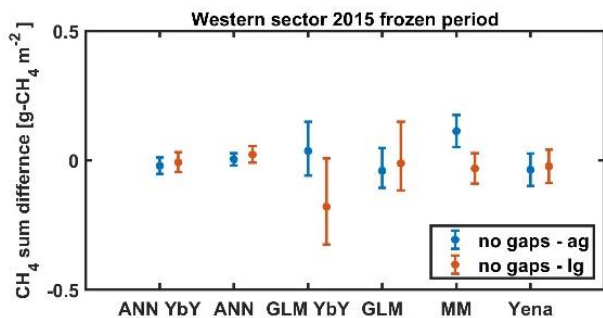
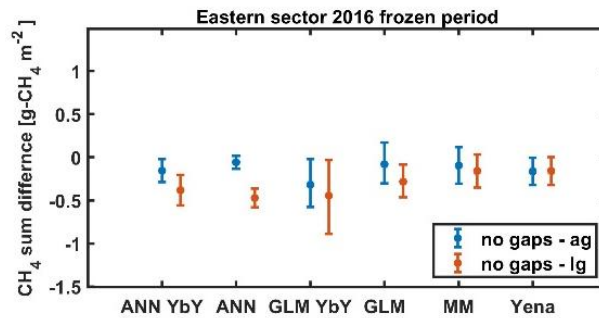
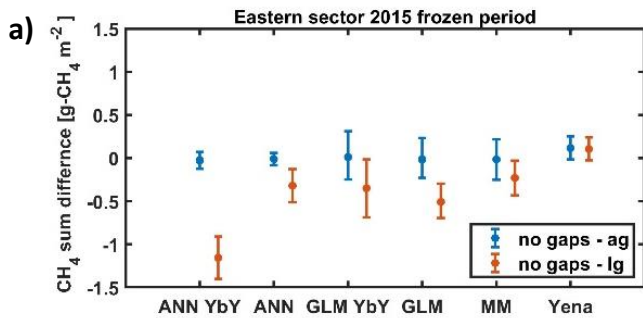
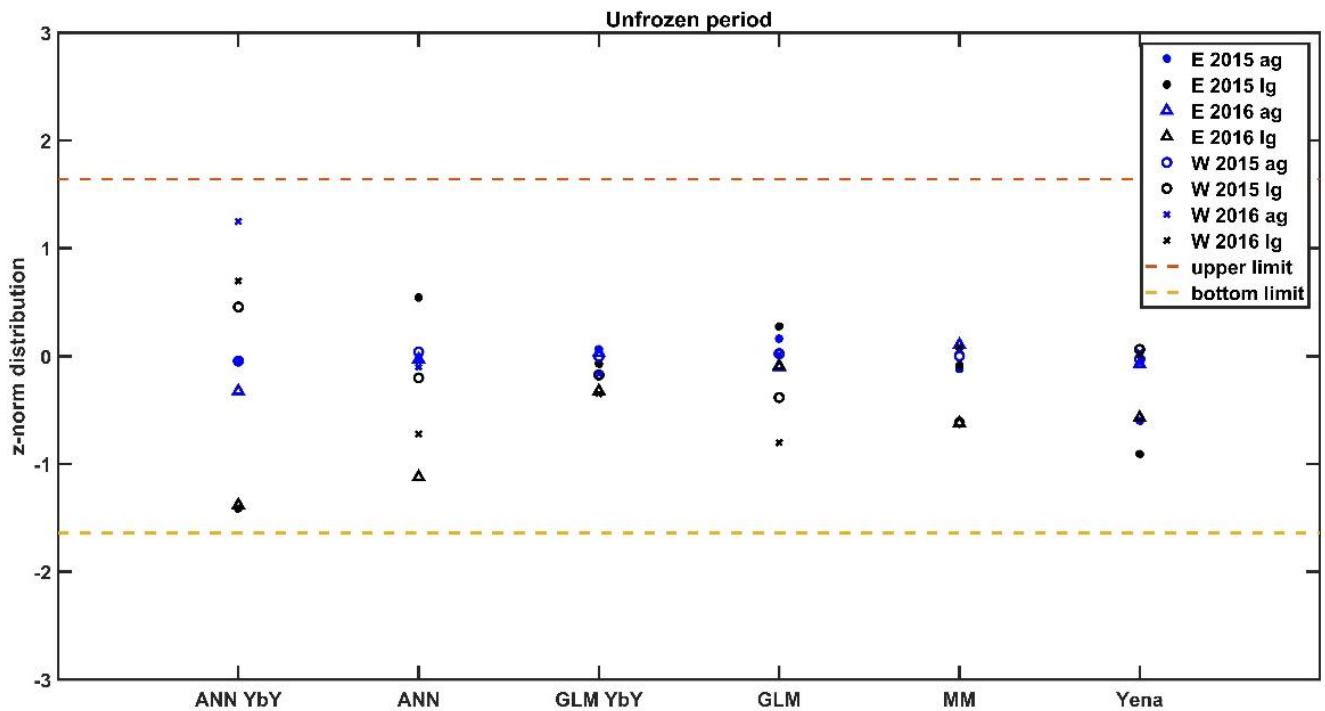
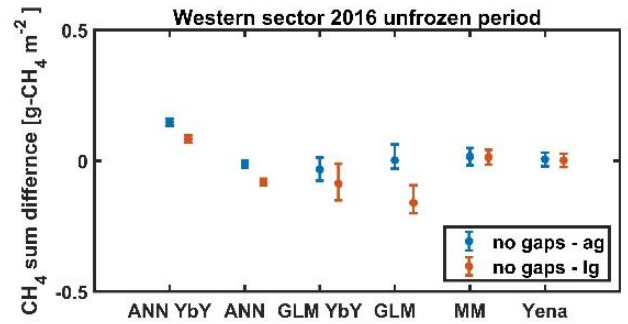
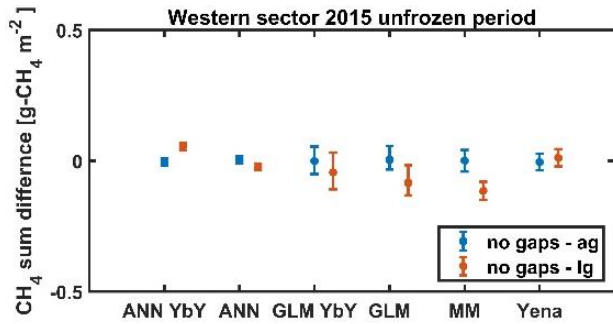
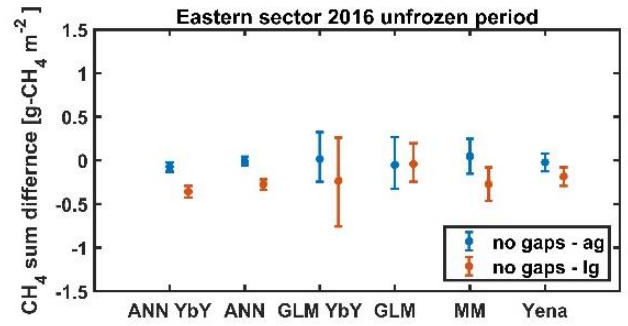
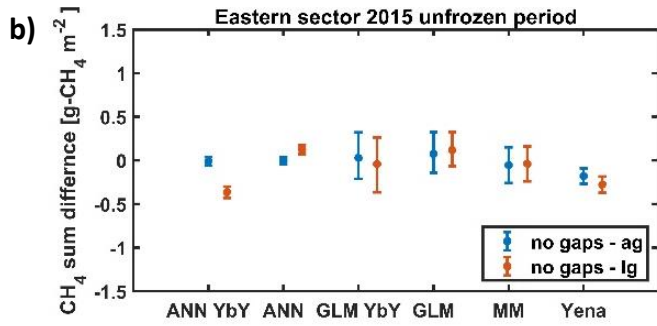


Figure S5. Differences for a) frozen b) unfrozen and c) whole period between the estimation of annual sums of CH₄ fluxes for models with and without artificial gaps with the length of 35-days and 80-days (Panels 1-4). Panel 5 shows a test if these differences are significant. ANN - the artificial neural network for all years, ANN YbY - artificial neural network each year separately, Jena - Jena online gap-filling tool, MM - moving mean with 5-day moving window, GLM- the general linear model for all years, GLM YbY - the general linear model for each year separately. The shaded light blue area is frozen period (see chapter 2.8). Ag- gaps of 35-days length and Lg – gaps of 80-days length.





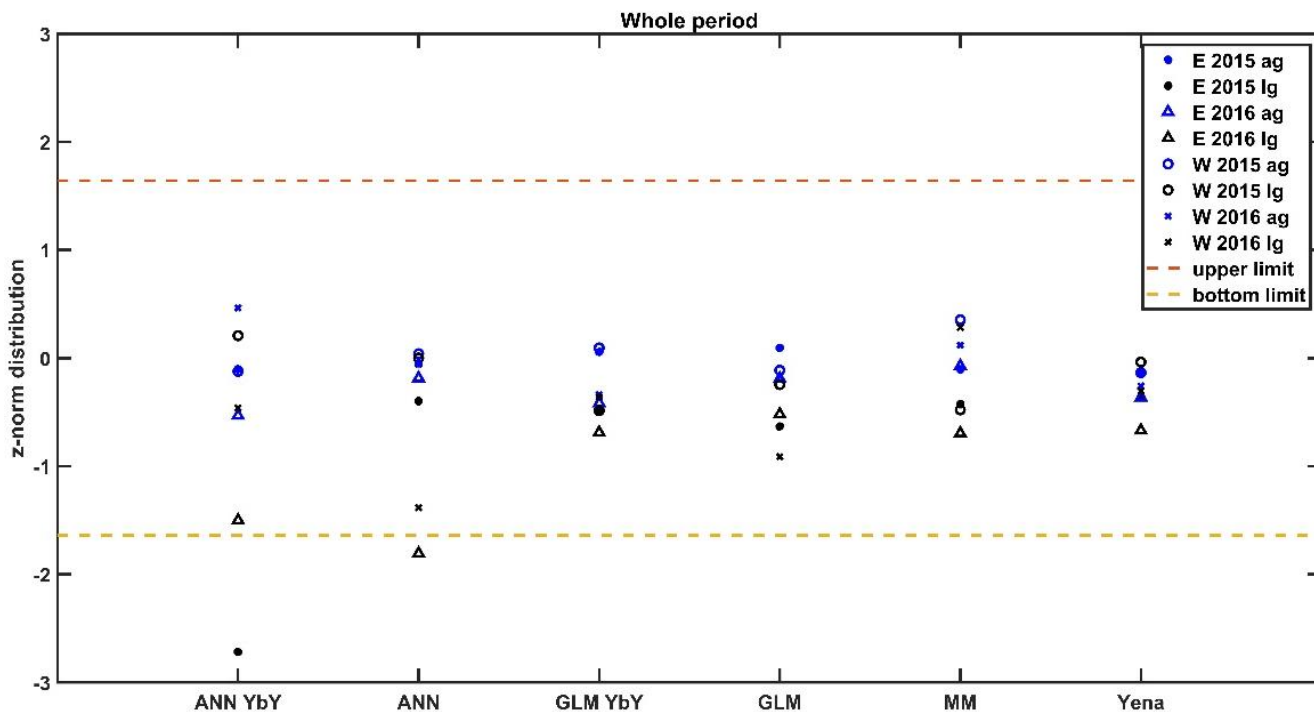
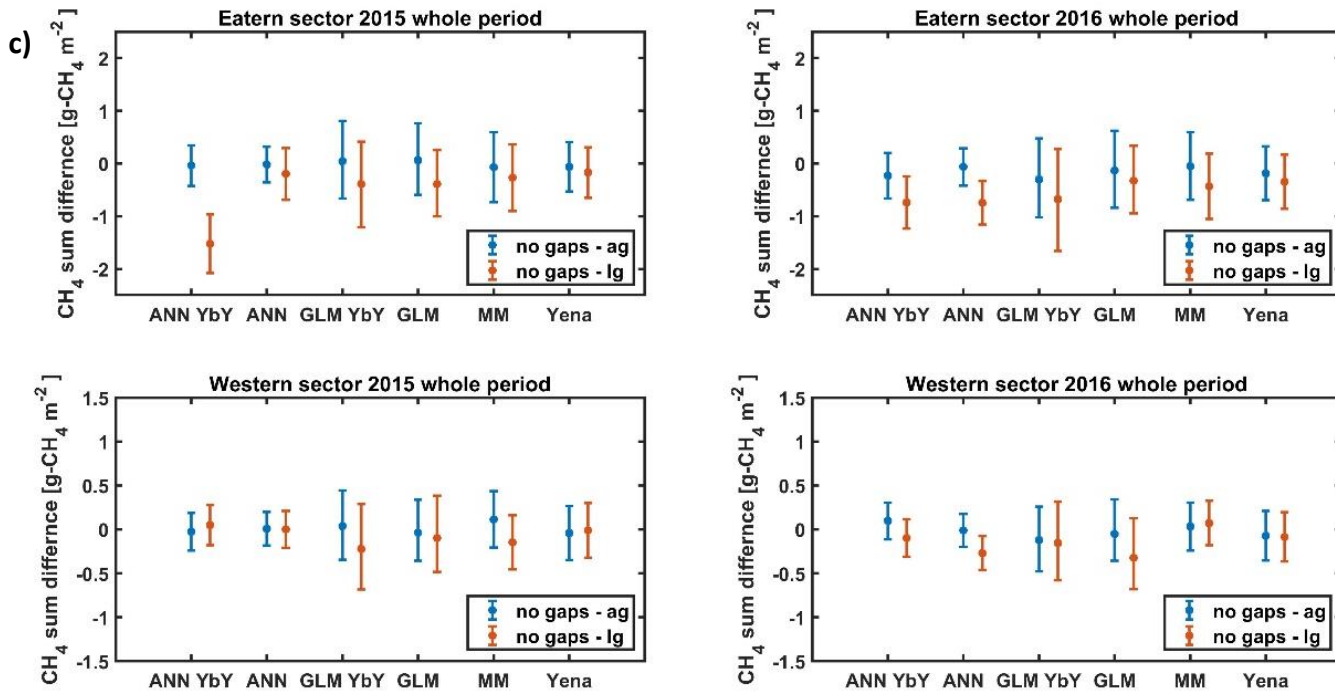


Table S1. Ancillary measurements at SE-Sto

Measured variable	Measurement height	Sensor type	Parameters type
	(m a.g.l.)		
peat temperature at 5 levels	-0.02, -0.05, -0.10, -0.30, -0.50	Campbell Thermocouple, Type E (chromel-constantan)	Peat/soil
soil heat flux	-0.05	Hukseflux HFP01SC	
volumetric soil water content (SWC)	0.00 to -0.06	Delta-T ML2x, vertical	
ground water level (WTL)	0	Campbell CS450	
incoming shortwave radiation, pyranometer	4.71	Kipp&Zonen CMP21	Meteorological
net shortwave radiation, net radiometer	3.82	Kipp&Zonen CNR4	
net long-wave radiation, net radiometer	3.82	Kipp&Zonen CNR4	
net radiation, net radiometer	3.82	Kipp&Zonen CNR4	
incoming shortwave radiation, net radiometer	3.83	Kipp&Zonen CNR4	
outgoing shortwave radiation, net radiometer	3.8	Kipp&Zonen CNR4	
incoming long-wave radiation, net radiometer	3.83	Kipp&Zonen CNR4	
outgoing long-wave radiation, net radiometer	3.8	Kipp&Zonen CNR4	
air pressure	1.65	Vaisala PTB210	
incoming photosynthetic active radiation, quantum sensor	3.92	Apogee SQ-110	
outgoing photosynthetic active radiation, quantum sensor	3.82	Apogee SQ-110	
incoming photosynthetic active radiation, sunshine sensor	4.68	Delta-T BF5	
diffuse incoming photosynthetic active radiation, sunshine sensor	4.68	Delta-T BF5	
sunshine duration, sunshine sensor	4.68	Delta-T BF5	
target surface temperature	3.88	Apogee SI-111	

air temperature (Ta)	2.5	Rotronic MP102H
relative humidity	2.5	Rotronic MP102H
precipitation	1.83	Geonor T200BM
snow depth	1.5	Campbell Scientific SR50 ATH

Table S2. Summary of GLM selected parameters

Eastern sector 2014				
Row	Estimate	SE	tStat	pValue
(Intercept)	-4.79687	0.05968	-80.37284	0.00000
TS	0.11525	0.01885	6.11419	0.00000
SWC	0.00689	0.00187	3.69087	0.00032
TS^2	0.02410	0.00384	6.28377	0.00000
Eastern sector 2015				
Row	Estimate	SE	tStat	pValue
(Intercept)	-4.84989	0.06301	-76.96779	0.00000
TS	0.14034	0.02082	6.74142	0.00000
SWC	0.00602	0.00153	3.93493	0.00012
NetRad	0.01860	0.00567	3.27898	0.00127
Swin	-0.00664	0.00059	-11.30990	0.00000
SWC:NetRad	-0.00018	0.00009	-2.05366	0.04157
TS^2	0.01825	0.00443	4.12108	0.00006
Eastern sector 2016				
Row	Estimate	SE	tStat	pValue
(Intercept)	-4.4443	0.0850	-52.3046	0.0000
GPP	0.3464	0.0558	6.2090	0.0000
TS	0.1812	0.0224	8.0865	0.0000
SWC	-0.0220	0.0084	-2.6130	0.0098
Swin	-0.0065	0.0005	-11.9590	0.0000
VPD	0.8146	0.2345	3.4734	0.0007
GPP:TS	-0.0414	0.0113	-3.6811	0.0003
SWC:Swin	0.0001	0.0000	5.4787	0.0000
SWC^2	0.0004	0.0001	3.1690	0.0018
Eastern sector 2014-2016				
Row	Estimate	SE	tStat	pValue
(Intercept)	-4.7637	0.0374	-127.3934	0.0000
GPP	0.3352	0.0477	7.0349	0.0000
TS	0.1489	0.0146	10.2026	0.0000
SWC	0.0050	0.0010	4.9221	0.0000
NetRad	0.0006	0.0010	0.5656	0.5719
Swin	-0.0052	0.0005	-10.5466	0.0000
VPD	-0.2456	0.3177	-0.7731	0.4399
GPP:TS	-0.0840	0.0116	-7.2297	0.0000
TS:Swin	0.0004	0.0001	3.4080	0.0007
SWC:NetRad	0.0001	0.0000	4.0959	0.0000
TS^2	0.0249	0.0030	8.2302	0.0000
VPD^2	0.5832	0.2826	2.0640	0.0396
Western sector 2014				

Row	Estimate	SE	tStat	pValue
(Intercept)	-4.35994	0.11600	-37.58597	0.00000
TS	0.06075	0.00472	12.86436	0.00000
SWC	-0.01839	0.00436	-4.21854	0.00006
Western sector 2015				
Row	Estimate	SE	tStat	pValue
(Intercept)	-5.00736	0.03709	-134.98976	0.00000
GPP	0.16341	0.04013	4.07229	0.00007
TS	0.06886	0.01007	6.83508	0.00000
NetRad	0.00309	0.00073	4.22764	0.00004
Swin	-0.00436	0.00055	-7.96662	0.00000
Western sector 2016				
Row	Estimate	SE	tStat	pValue
(Intercept)	-5.14195	0.05709	-90.06116	0.00000
GPP	0.57642	0.10960	5.25945	0.00000
TS	0.05311	0.01013	5.24318	0.00000
Swin	-0.00495	0.00085	-5.84729	0.00000
GPP^2	-0.07372	0.02213	-3.33163	0.00106
Swin^2	0.00001	0.00000	2.58708	0.01051
Western sector 2014-2016				
Row	Estimate	SE	tStat	pValue
(Intercept)	-5.0698	0.0345	-146.9896	0.0000
GPP	0.4286	0.0692	6.1946	0.0000
TS	0.0589	0.0065	9.0416	0.0000
Swin	-0.0031	0.0002	-14.9783	0.0000
TS:Swin	0.0002	0.0000	5.5386	0.0000
GPP^2	-0.0777	0.0159	-4.8855	0.0000

Table S3. Summary of annual emissions by different models

	Annual emission [gCH ₄ /m ²]	Range of emission [gCH ₄ /m ²]	Annual emission [gCH ₄ /m ²]	Range of emission [gCH ₄ /m ²]	Annual emission [gCH ₄ /m ²]	Range of emission [gCH ₄ /m ²]
	2014 E		2015 E		2016 E	
ANN YbY	7.3	[6.7, 7.9]	6.6	[6.4, 6.9]	8.2	[7.9, 8.4]
ANN	6.8	[6.5, 7.1]	6.8	[6.5, 7]	8.1	[7.9, 8.4]
GLM YbY	7.3	[6.7, 8.0]	6.5	[6, 7]	8.0	[7.5, 8.7]
GLM	6.6	[6.1, 7.2]	6.9	[6.4, 7.4]	7.9	[7.4, 8.4]
MM	7.7	[7.2, 8.3]	6.8	[6.3, 7.2]	8.2	[7.7, 8.6]
Jena	7.1	[6.7, 7.6]	6.7	[6.4, 7]	8.2	[7.8, 8.5]
	2014 W		2015 W		2016 W	
ANN YbY	5.3	[5, 5.7]	3.8	[3.7, 4]	4.1	[4, 4.3]
ANN	3.9	[3.7, 4]	4	[3.9, 4.1]	4.2	[4, 4.3]
GLM YbY	4.5	[4, 5]	3.7	[3.5, 4]	3.8	[3.6, 4.1]
GLM	3.8	[3.5, 4.1]	3.8	[3.5, 4]	3.9	[3.7, 4.2]
MM	5	[4.7, 5.3]	3.9	[3.6, 4.1]	4.2	[4, 4.4]
Jena	4.9	[4.4, 5.3]	3.8	[3.6, 4]	4.2	[4, 4.4]