PRELIMINARY ReadMe Notes for autochamber flux data 180411

more detailed metadata file under construction. Need to go through the log books carefully

Data start in Spring 2002 until end of 2017 - Really, two datasets

2002-2012

Small chambers (dimensions below) - flip tops - tops removed in winter
see Bäckstrand et al. 2008 a,b) for description
Total Hydrocarbon flux - i.e. reduced C in headspace measured with a THC analyzer (naked FID)
calibrated against CH4 and manual grab sample fluxes taken daily to weekly for CH4 fluxes
NO dependable CH4 numbers from ca day 2900 (2010) to day 3700 (2011)
the CO2 flux during this period looks suppressed but I have no way to dump the numbers

CO2 flux measured with a variety of IRGAs (LI 6252, LiCor gashound, Vaisala GMP 343)
The J-CO2 at night looks ok but I am worried that the limited number of plants in the smaller chambers might have affected the uptake
numbers for the fen chambers 7 and 8
Chamber 9 is odd man out - The chamber was put over an E. vaginatum tussock and it acted like a little greenhouse
with the tussock just about filling the chamber - it looked different.

2012-2017

Larger clear chambers built based on previous designs. Lifts the entires chamber off the frame. Some rain shadow from north
but weather is East-West in the Mire. Clear extneders used in tall vegetation
see Bubier et al. Hydrol. Process. 16, 3667–3682 (2002)

CO2 and CH4 in headspace measured with an LGR beginning 2012
Ch9 is again odd - placed on a hummock (with sphagnum and palsa veg) in the fen 2012 - the hummock has transitioned since

Palsa chambers are threatened by expanding fen
Ch 1 moved **ddmmyy**
The boardwalk, originally to the west of the chambers between them and the fen
was moved to the east side **ddmmyy**
Ch3 now (2018) looks in trouble - strongly tilted

2003	484.756	4	17	119.756	0.755903	1 p	1
2003	484.768	4	17	119.768	0.768403	2 s	2
2003	484.781	4	17	119.781	0.780903	3 p	1
2003	484.793	4	17	119.793	0.793403	4 s	2
2003	484.806	4	17	119.806	0.805903	5 p	1

note 180409
For Average Calculations uses AC_Jdata_02-17_allFiltrd:csv
In AC_Jdata_02-17.xlsx
CH4 NA = 55676
CO2 NA = 6169
In AC_Jdata_02-17_allFitrd.csv.xlsx %n
CH4 NA = 60649 0.25
CO2 NA = 32408 - mostly Low PAR uptake fi 0.13
0f n=240417

LGR installed 4 june 2012

	start	stop						
2002		147.706				31-Dec-16		
2003	119.756	241.606	121.9	132.6216	avg start day	12-May-17	1-May-17	121
2004	147.256	329.481	182.2	301.7994	avg end day	28-Oct-17	1-Nov-17	305
2005	148.506	290.506	142.0	169.1778	avg length			
2006	123.618	261.529	137.9					
2007	153.100	326.106	173.0					
2008	109.100	337.793	228.7					
2009	110.006	287.843	177.8					
2010	149.631	339.531	189.9					
2011	142.556	218.857	76.3					
2012	Continous							
2013	Continous							
2014	Continous							
2015	Continous							
2016	Continous							
2017	Continous							

Flux calculation

R=0.08206 l atm/deg mol = 0.00008206 m3 atm/deg mol = 0.08206 ul atm/deg umol
0.000001 l/ul P= 1 atm

Vc= Total vol above Ac = 0.16 m2 (all collars)

CH4 flux= rate ppm/min(P/R*16g/mol)*1/T*Vc/Ac*(l000mg/g*1440min/d)=mg/m2 d
=0.000001*(1/0.00008206)*16*(1/(273.15+t))*(1000*1440)*(1/0.16)*Vc*rate
=6424.359 min mg l/ ul m5 d * rate * Vc

CO2 flux = rate ul/l min * P/R *1/T * Vc/Ac * 1000 l/m3 * 1 min/60 sec = umol /m2/s
=(1/0.08206)*(1/273.15)*(1/0.16)*1000*(1/60)*Vc*rate
=4.64725 min umol l/ ul m5 sec * rate * Vc
umolCO2/m2/s

OLD CHAMBERS NEW CHAMBERS until 15 Jul 11
Total vol new chambers (check operational time in Notes)

	m3			old chmbrs		m3	m	old	operational		hts	
1	0.0273	1	0.031594	m3		total vol	vol/area	vol/area				
2	0.0326	2	0.028025	0.0273	3	0.0311	0.1745	0.1789	15-Jul-11	15:00	196.625	
3	0.0286	3	0.0311	0.0326	4	0.0412	0.2308	0.2013	15-Jul-11	15:00	196.625	as of 17 Aug
4	0.0322	4	0.0412	0.0286	6	0.0356	0.1995	0.1478	15-Jul-11	15:00	196.625	as of 17 Aug
5	0.0310	5	0.032932	0.0322	8	0.1226	0.6870	0.3391	15-Jul-11	15:00	196.625	as of 17 Aug
6	0.0236	6	0.0356	0.0310	1	0.031594	0.177045	0.1704	15-Aug-11	11:46	227.490	
7	0.0562	7	0.123942	0.0236	5	0.032932	0.184545	0.1938	15-Aug-11	12:33	227.523	
8	0.0543	8	0.1226	0.0562	2	0.028025	0.157045	0.2035	15-Aug-11	14:04	227.586	
9	0.0543	9	0.113829	0.0543	7	0.123942	0.694545	0.3511	17-Aug-11	12:32	229.522	as of 17 Aug
				0.0543	9	0.113829	0.637878	0.3391	17-Aug-11	16:15	229.677	as of 17 Aug

old Area=0.16 m2 new area=0.17845 m2

Calculation routine
Chambers are static closed systems. Two manifolds control the chamber closing and sampling
One system of air piloted 4 way slider valves opens and closes the chambers
Using the second manifold which routes the air from a specific chamber to the instruments
Each chamber is selected every 3 hours (p,s,p,s,p,s,e,e,e then outside air at 2m)
Every flux routine takes 18 minutes
chamber is selected and flow is pulled from the sample line and pushed to the instruments then back to the chamber
the line is rinsed for 10 min before chamber is closed (we **have concentrations** during this time)
chamber is closed for 5 minutes
chamber is opened and rinsed for 3 minutes before the next chamber is selected.

Timing control and data acquisition is with a Campbell CR10x
Instruments are queried every 3 seconds and 15 second averages are stored
Air pressure gauge (Vaisala PTB), LiCor quantum sensor (NOT well calibrated - consistent with other radiation measurement in the mire)
then T-107 (temperature of the AM416 surface where the chamber thermometers are attached)
T_air and T_grnd are rubber paint coated Type T thermocouples - they are NOT SHIELDED - these temperatures cannot be used to derive biophysics
used for calculating haedspace gas volumes. I take them to be accurate to roughly 0.5 C.
then the analog out signal for dry CO2 and dry CH4 from the LGR (Carrie also takes data off the isotope lasers)
data files are transferred and appended daiy to an external computer. These data files are used for the calculation and then archived.

Use the concentration changes with time, the chamber headspace temperature and the chamber geometries
to calculate fluxes
chamber closure is recognixed (flagged in the data file) then 30 seconds after that record a series of eight 2.5 min linear
slopes are calculated. The slope/line with the best fit (r2) is taken for the CH4 fluxes and for CO2 emissions
IF there is uptake of CO2 (negative slope) then we take the steepest slope (worried about leaf level saturation)

First level of QA/Qcis a check after calculation. Obvious temperature errors can be fixed.
E.g. if the T-air is -6999 then the flux can often be corrected using the temps just before and just after the run
For stor_j_YYYY.xlsx files all CH4 fluxes below -10 mg/m2/d removed (assuming this is the physical limit of diffusion
all CO2 fluxes above 15 and below -20 umol/m2/s removed
all 0 CH4 fluxes removed
all -6999 temps corrected (except ch 10)
all PAR<0 set to 0 (Sometimes)
some uncorrectable fluxes (e.g. Known chamber closure problems, pump issues, whacky concentrations, etc.) removed
Summary files made from stor_j_YYYY files.

I add filter flags to the archived summary files.

DATA FLAGS
Chamber flag chambers were switched 2011
1 small flip tops - Area = 0.16 m2
2 large clear chambers Area = 0.18 m2

Questions CO2; Questions CH4
1 OK
2 NA
3 Less confidence (see notes)
4 either CO2 or CH4 look wrong; other looks ok
5 Both CO2 and CH4 look wrong (see notes)

r2 flag NEE, r2 flag CH4
1 r2>0.399, 95%
2 0.399 < r2 > 0.301, 90%
3 r2 < 0.301, 90%
4 NA
Two tailed significance level for r
Table A10, Snedecor and Cochran, 1989

Day/Night filter 23-1 average PAR values from Palsa
2012 86
2013 4.6 Low values assigned 0 this year
2014 42 Low values assigned 0 this year
2015 90
2016 89
1 avgPAR<90
0 avgPAR>90

		number
Lo PAR Uptake	2012	1123
1 if negative and avgPAR<90	2013	1877
0	2014	1068
	2015	1121
CO2 removed	2016	1483
	2017	1525

		number (includes "NA")	
Hi CH4 filter			
1 if ppm CH4>2.7 ppm or NA	2012	1728	
0 if ppm CH4<2.7 ppm	2013	313	
	2014	433	
	2015	815	
	2016	2705	period of broken pump on LGR
Both CO2 and CH4 removed	2017	767	

Hi CO2 filter

1 if ppm CO2>400 ppm or NA

0 if ppm CO2<400 ppm or NA

These two filters are problematic in that during stable nocturnal periods CH4/CO2 can be substantially enhanced.

Both CO2 and CH4 removed