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*Supplement of*

## **Application of open-path Fourier transform infrared spectroscopy (OP-FTIR) to measure greenhouse gas concentrations from agricultural fields**

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## Supplements

**Table S1.** Reference spectra of N<sub>2</sub>O, water vapour, and CO<sub>2</sub> used in CLS models were generated from the HITRAN database at 30 °C.

Spectra #	N <sub>2</sub> O	Water vapour	CO <sub>2</sub>
		(ppm*m)	
1	35	2631500	2000
2	50	3289400	5000
3	75	3947300	10000
4	70	4605200	20000
5	100	5263000	30000
6	150	6578800	40000
7	105	7894600	50000
8	150	9210400	100000
9	225	7894500	150000
10	140	9868200	200000
11	200	11841900	250000
12	300	13815600	300000
13		10526000	350000
14		13157600	400000
15		15789200	450000
16		18420800	500000
17			550000

**Table S2.** Sixty mixed-gases calibration spectra were collected from the lab FTIR joined with the multi-pass gas cell (optical path length = 33 m) to build partial least squares (PLS) models for N<sub>2</sub>O quantification. The information of spectra and PLS models was shown in (a) concentrations of N<sub>2</sub>O and water vapor, and (b) the number of optimum factors used in models.

(a) N<sub>2</sub>O/water vapor concentrations

Spectra#	N <sub>2</sub> O (ppm)	N <sub>2</sub> O (ppm*m)	Water vapor (ppm)	Water vapor (ppm*m)	Spectra#	N <sub>2</sub> O (ppm)	N <sub>2</sub> O (ppm*m)	Water vapor (ppm)	Water vapor (ppm*m)
1	0.31	10.23	7330.60	241909.89	31	0.31	10.23	20720.00	683760.00
2	0.31	10.23	7334.38	242034.64	32	0.31	10.23	20720.00	683760.00
3	0.31	10.23	7344.42	242365.75	33	0.31	10.23	20720.00	683760.00
4	0.40	13.20	7345.97	242417.03	34	0.40	13.20	21166.00	698478.00
5	0.40	13.20	7335.69	242077.81	35	0.40	13.20	21166.00	698478.00
6	0.40	13.20	7384.26	243680.45	36	0.40	13.20	21166.00	698478.00
7	0.50	16.50	7425.25	245033.38	37	0.50	16.50	21352.00	704616.00
8	0.50	16.50	7435.31	245365.38	38	0.50	16.50	21352.00	704616.00
9	0.50	16.50	7428.77	245149.42	39	0.50	16.50	21352.00	704616.00
10	0.60	19.80	7472.43	246590.20	40	0.60	19.80	22409.00	739497.00
11	0.60	19.80	7561.33	249524.05	41	0.60	19.80	22409.00	739497.00
12	0.60	19.80	7561.16	249518.13	42	0.60	19.80	22409.00	739497.00
13	0.70	23.10	7428.18	245129.78	43	0.70	23.10	25814.00	851862.00
14	0.70	23.10	7387.42	243784.78	44	0.70	23.10	25814.00	851862.00
15	0.70	23.10	7359.32	242857.45	45	0.70	23.10	25814.00	851862.00
16	0.31	10.23	15367.62	507131.41	46	0.31	10.23	26786.16	883943.19
17	0.31	10.23	15372.82	507303.06	47	0.31	10.23	26584.12	877275.94
18	0.31	10.23	15360.80	506906.44	48	0.31	10.23	26597.24	877708.81
19	0.40	13.20	15595.24	514643.03	49	0.40	13.20	30446.93	1004748.69
20	0.40	13.20	15704.48	518247.72	50	0.40	13.20	30738.75	1014378.88
21	0.40	13.20	15708.70	518387.22	51	0.40	13.20	30386.46	1002753.19
22	0.50	16.50	15521.94	512224.06	52	0.50	16.50	29310.16	967235.44
23	0.50	16.50	15678.90	517403.75	53	0.50	16.50	28955.07	955517.25
24	0.50	16.50	15771.27	520452.06	54	0.50	16.50	28851.81	952109.88
25	0.60	19.80	15766.92	520308.47	55	0.60	19.80	28499.03	940467.94
26	0.60	19.80	15707.03	518332.09	56	0.60	19.80	28247.49	932167.31
27	0.60	19.80	15859.43	523361.28	57	0.60	19.80	27876.50	919924.50
28	0.70	23.10	16033.97	529121.00	58	0.70	23.10	28584.89	943301.38
29	0.70	23.10	15967.60	526930.88	59	0.70	23.10	29724.95	980923.31
30	0.70	23.10	15887.32	524281.53	60	0.70	23.10	29897.34	986612.19

(b) The number of factors in PLS models

Analytical window (cm <sup>-1</sup> )	No. of factors in PLS	
	N <sub>2</sub> O	water vapor
W <sub>N</sub> 1: 2170.0 - 2223.7	3	5
W <sub>N</sub> 2: 2188.5 - 2223.7	4	4
W <sub>N</sub> 3: 2188.5 - 2204.1 + 2215.8 - 2223.7	4	4
W <sub>N</sub> 4: 2188.5 - 2204.1	5	4

**Figure S1.** Measurements of the 30-min averaged  $N_2O$  and  $CO_2$  concentrations (measured by OP-FTIR and S-OPS), wind velocity, wind direction, the ambient water vapour content, and temperature from 9 to 19 June 2014.

