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Supplement of

Methane emissions from oil and gas platforms in the North Sea

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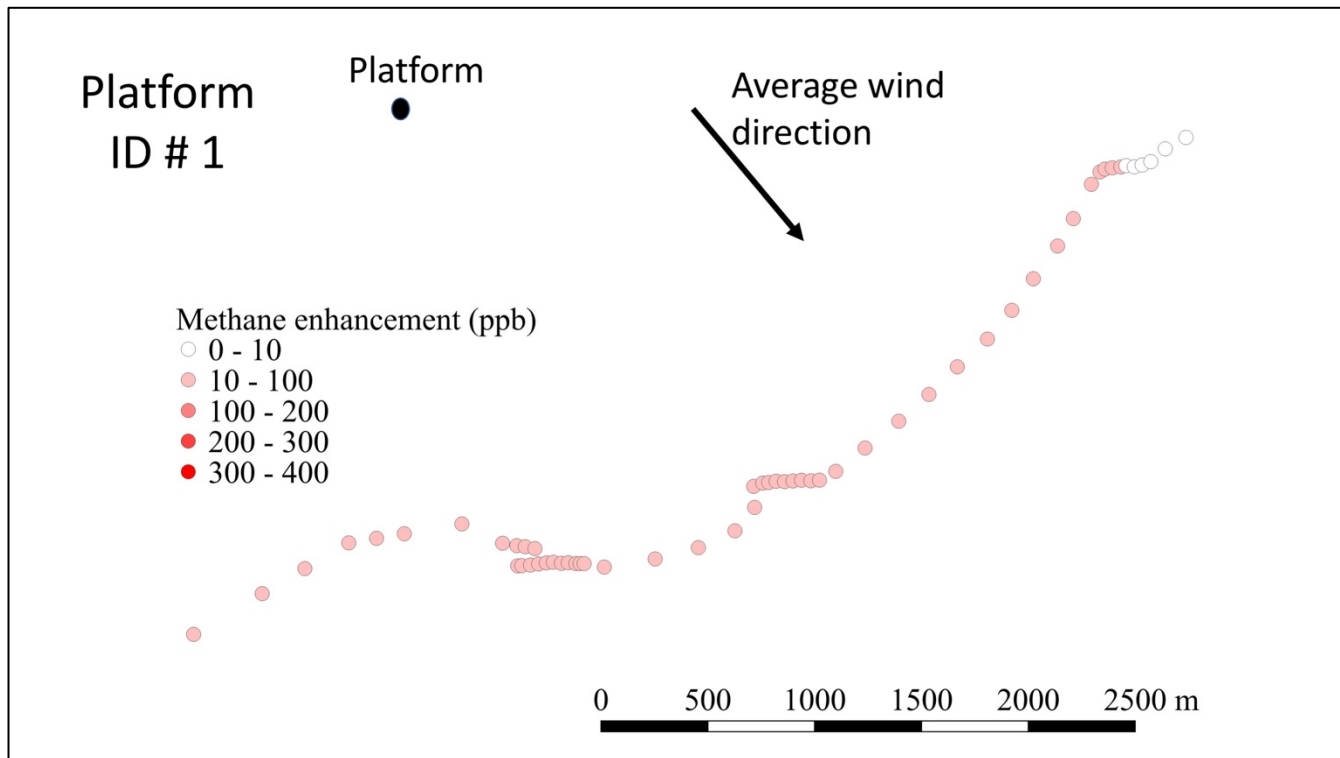
Supplementary Material Section 1

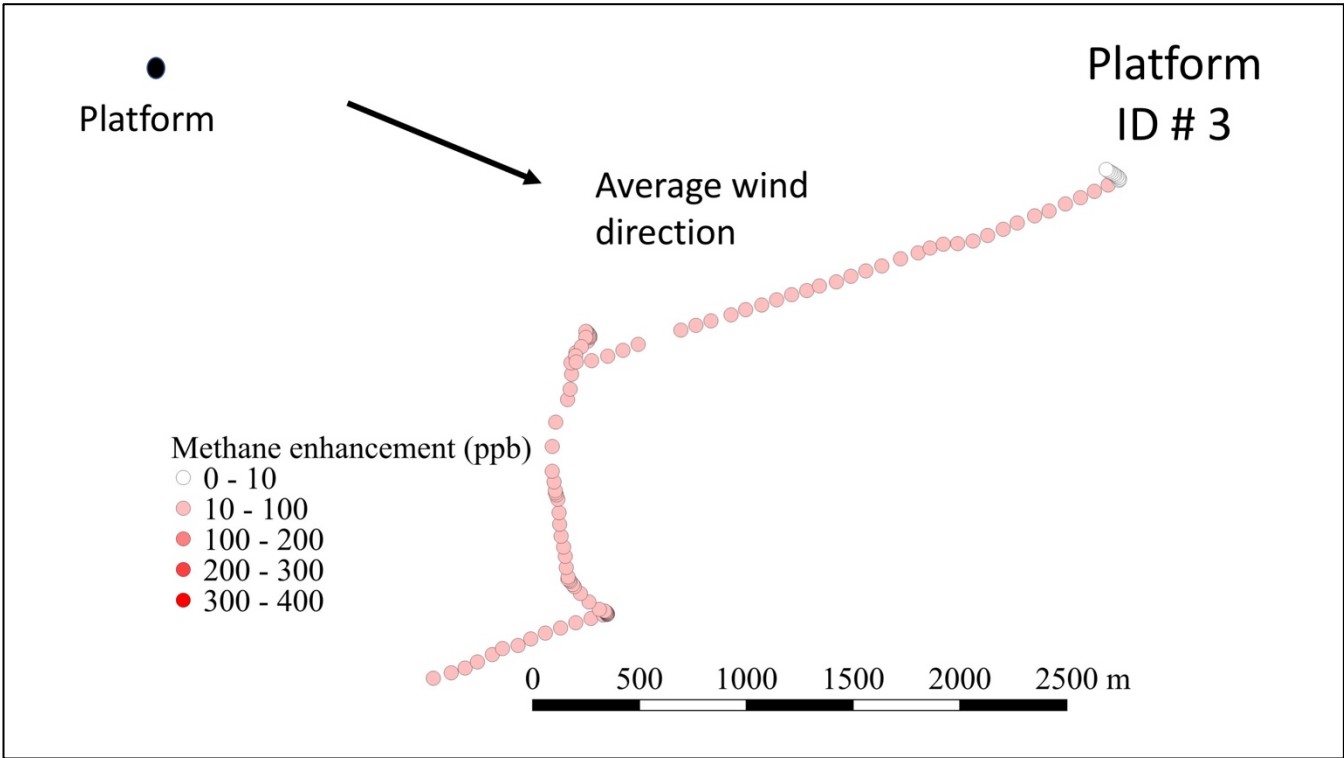
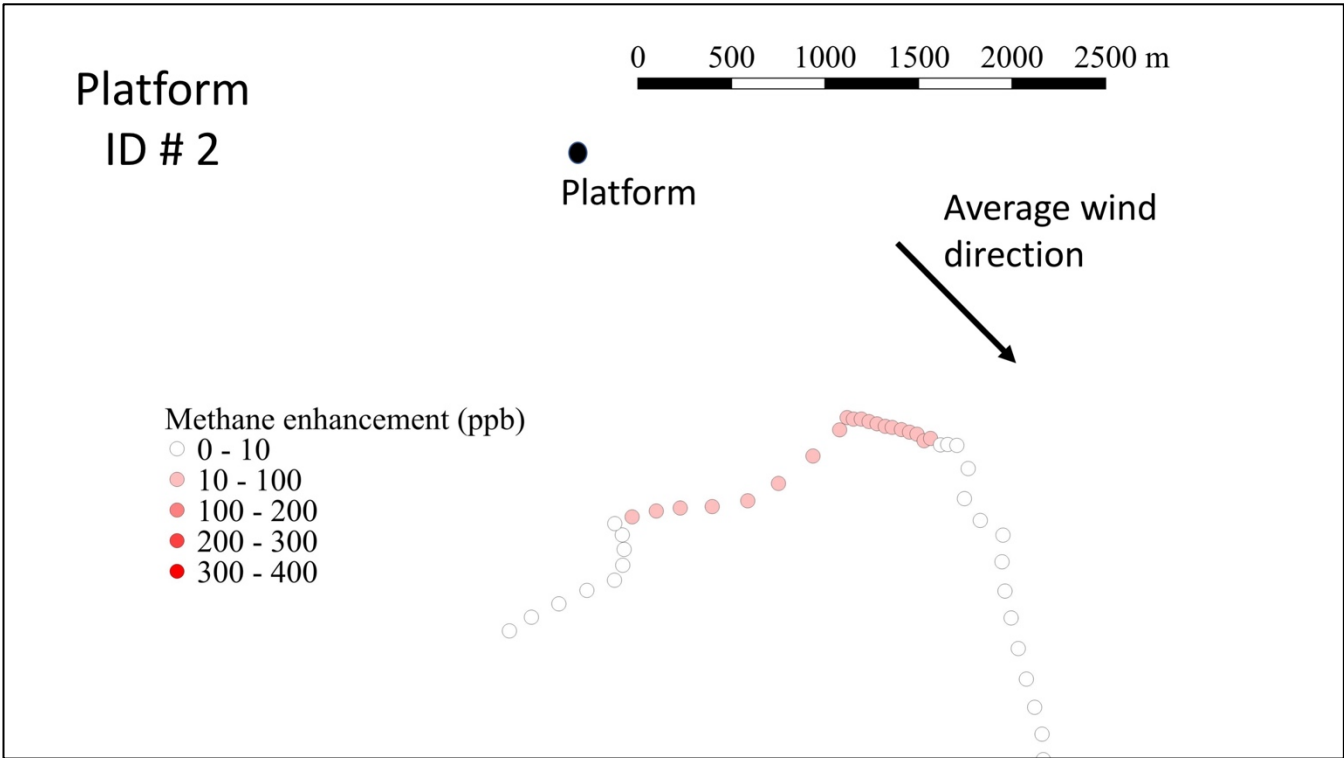
Meteorological, position and mole fraction data taken during the boat-based measurement campaign around production platforms in the North Sea between 6th June and 25th August 2017. Emissions were calculated for two scenarios: 1. Lower estimate where the source was at the working deck level; and 2. Upper estimate where the source was the top of the flare stack. Numbers in parentheses indicate lower and upper bounds for the indicated variables. “D (m)” indicates the distance to nearest platform. “H_{wd} (m)” indicates the height of the working deck. “H_f (m)” indicates the height of the flare. “H_{PBL} (m)” indicates the height of the PBL. “Bgd CH₄ (ppb)” indicates the background CH₄ mixing ratio (ppb). “Peak CH₄ (ppb)” indicates the peak CH₄ mixing ratio at the centre of the plume (ppb). “Em_{wd} (g s⁻¹)” indicates the emission from the working deck only. “Em_f (g s⁻¹)” indicates the emission from the flare only.

ID #	Lat	Lon	Date	WS (m s ⁻¹)	T (°C)	PGSC	D (m)	σ_y (m)	σ_z (m)	H _{wd} (m)	H _f (m)	H _{PBL} (m)	Bgd CH ₄ (ppb)	Peak CH ₄ (ppb)	Em _{wd} (g s ⁻¹)	Em _f (g s ⁻¹)
1	52.98	2.23	June 6	5.10	20	D	2000	133	50	40	60	896	1930	1980	4.9	7.3
2	52.94	2.16	June 6	5.00	20	D	2000	133	50	40	60	896	1930	1981	4.9	7.3
3	53.00	1.88	July 5	4.40	21	D	2000	133	50	40	60	0	1916	1950	1.1	1.7
4	54.59	0.41	Aug 16	6.50	15	D	600	42	21	50	90	394	1931	1961	5.7	2,657
5	58.10	-1.45	Aug 24	5.10	20	C	600	63	38	50	90	128	1920	2290	22.3	149.0
6	58.30	-1.73	Aug 24	5.00	20	C	550	58	35	50	90	128	1920	2232	18.1	167.6
7	57.97	-0.91	Aug 25	6.70	14	D	600	42	21	50	90	170	1944	1979	6.8	3,168
8	57.82	-0.97	Aug 25	6.80	14	D	550	38	20	50	90	170	1944	1955	2.9	3,319

Supplementary Material Section 2

Minute-averaged CH₄ mole fraction measurements made near production platforms ID # 1 to 8.



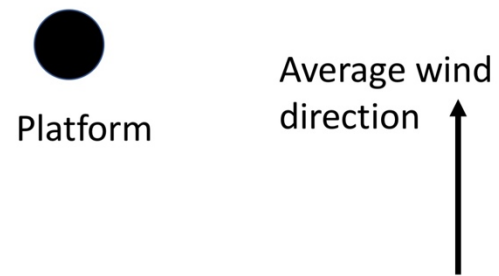


Platform
ID # 4

Methane enhancement (ppb)

- 0 - 10
- 10 - 100
- 100 - 200
- 200 - 300
- 300 - 400

0 250 500 750 1000 1250 m

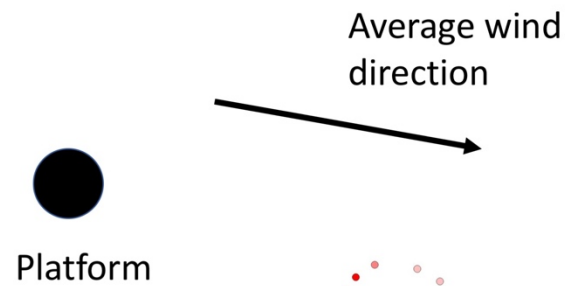


Platform
ID # 5

Methane enhancement (ppb)

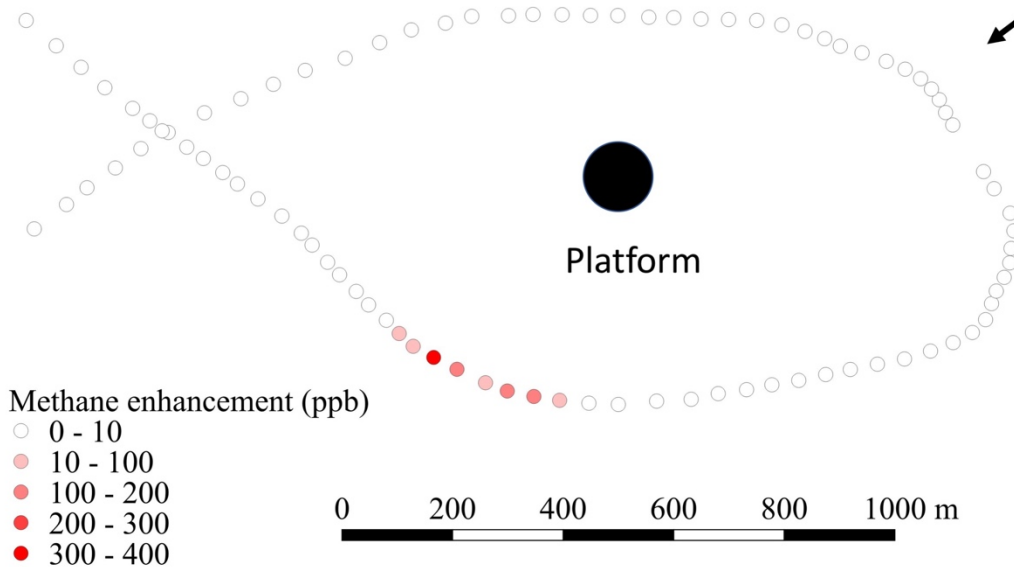
- 0 - 10
- 10 - 100
- 100 - 200
- 200 - 300
- 300 - 400

0 100 200 300 400 500 m



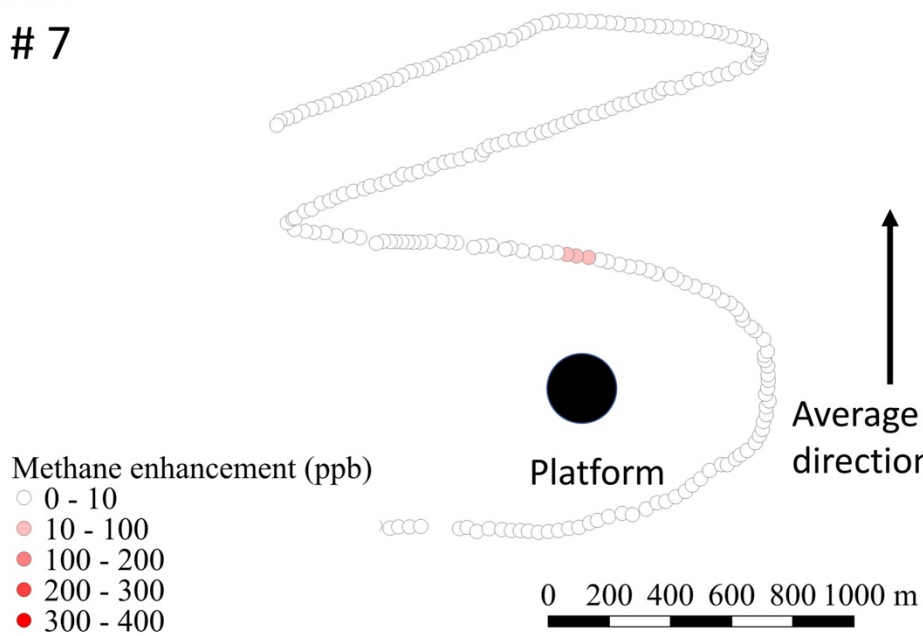
Platform
ID # 6

Average wind
direction



Platform
ID # 7

Average wind
direction



Platform
ID # 8

Average wind
direction



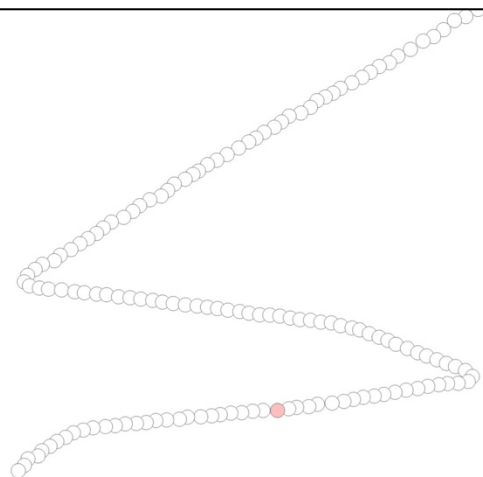
Methane enhancement (ppb)

- 0 - 10
- 10 - 100
- 100 - 200
- 200 - 300
- 300 - 400



Platform

0 500 1000 1500 2000 2500 m



Supplementary Material Section 3

Uncertainty analysis conducted on the average methane emission from offshore platforms #4 to #8 as calculated using the Gaussian Plume model.

Variable	Change to variable	Median emission (g s ⁻¹)	Mean emission (g s ⁻¹)	Uncertainty (%)
Baseline		6.8	11.2	
Distance from platform to sensor	+ 50 m	5.7	10.8	-3.6
	- 50 m	8.8	12.1	8.0
UGGA instrument	+ 2 ppb	7.2	11.5	2.7
	- 2 ppb	6.4	10.9	-2.7
Thermometer	+ 0.1 °C	6.8	11.2	0.0
	- 0.1 °C	6.8	11.2	0.0
PGSC	+ 1 PGSC	2.8	15.8	41.1
Wind speed	+ 0.6 m s ⁻¹	7.4	12.4	10.7
Wind speed	- 0.6 m s ⁻¹	6.2	9.9	-11.6
			Total	± 45.0