#### **Supplementary Information for**

# Evaluation of emissions and spatial distribution of methane from offshore oil and gas platforms in the Liaodong Bay of China based on

### shipboard measurement

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#### Section S1. Changes in Wind Characteristics of Three Platforms

Wind rose diagrams of the three platforms clearly indicated the significant fluctuation in wind speed and wind direction. As shown in Fig. S1, prevailing wind direction was identified as NW when the ship was 15 km away from the O1. Then it gradually approached the platform from the southeast, with a average wind speed of  $7.2\pm3.3$  m/s. However, prevailing wind direction was found to turn to SW during the circle cruise period. And the average wind speed increased to  $11.3\pm2.1$  m/s.



Fig. S1. Variation of wind direction and wind speed during the monitoring period of O1

As shown in Fig. S2, prevailing wind direction was identified as NE when the ship was 15 km away from the O2. Then it gradually approached the platform from the southwest, with a average wind speed of  $6.5\pm2.8$  m/s. However, prevailing wind direction was found to turn to NW during the medium term of circle cruise, and

eventually stabilized to SW during the zig-zag monitoring. The average wind speed was  $9.6\pm4.3$  m/s.



Fig. S2. Variation of wind direction and wind speed during the monitoring period of O2

As shown in Fig. S3, prevailing wind direction were identified as N and NE when the ship was 15 km away from the O3. However, due to the influence of other surrounding platforms on the south side, straight cruise was constrainedly conducted from the northwest of the platform, with a average wind speed of  $9.2\pm1.8$  m/s. However, prevailing wind direction was found to turn to E during the circle cruise period. And the average wind speed decreased to  $2.8\pm0.7$  m/s.



Fig. S3. Variation of wind direction and wind speed during the monitoring period of O3

Wind speed (m/ s)	Wind direction from north(°)	CH₄ (ppb)	Horizontal wind speed (m/s)	Distance downwind (km )	σz(m)	σy(m)	CH₄ emissions (kg/h)
9.5	298.3	2330	8.1	4.95	86.50	281.50	121.63
4.6	280.7	2406	4.5	4.62	82.82	264.80	160.53
9.2	296.8	2411	8.0	4.46	81.07	256.96	244.10
8.8	295.6	2437	7.7	4.25	78.60	246.01	263.18
8.9	295.4	2459	7.8	4.04	76.12	235.18	281.26
9.1	291.9	2471	8.3	3.83	73.56	224.12	290.71
10.2	300.1	2487	8.6	3.61	70.89	212.77	296.42
9.3	301.6	2499	7.6	3.39	68.12	201.18	262.38
9.6	299.1	2484	8.1	3.17	65.30	189.58	235.89
9	299.5	2490	7.6	2.95	62.39	177.80	208.53
9.4	300.4	2499	7.8	2.72	59.26	165.37	201.18
9.5	301.6	2515	7.8	2.51	56.34	154.06	193.00
7	307.7	2674	5.1	2.46	55.70	151.60	226.72
7.7	310.2	2679	5.4	2.29	53.14	141.87	217.73
8.8	304.4	2662	6.9	2.09	50.23	131.09	224.86

## Section S2. Dataset: Site CH<sub>4</sub> Emissions

Table S1. Calculation parameters and CH<sub>4</sub> emissions of reasonable sites for O1

Wind speed (m/ s)	Wind direction from north(°)	CH₄ (ppb)	Horizontal wind speed (m/s)	Distance downwind (km )	σz(m)	σy(m)	CH <sub>4</sub> emissions (kg/h)
6.3	214.0	2620	6.2	5.12	88.39	290.17	85.66
4.4	210.2	2620	4.3	5.15	88.76	291.89	71.09
7.6	226.2	2616	7.5	4.96	86.67	282.27	83.45
5.4	174.6	2618	2.6	4.81	84.98	274.54	48.96
6.8	215.6	2618	6.8	4.74	84.19	270.97	77.37
7.4	208.5	2618	7.2	4.53	81.83	260.34	75.19
7.6	204.3	2616	7.2	4.34	79.62	250.53	66.34
6.9	215.0	2612	6.9	4.13	77.21	239.92	54.76
6.6	208.0	2618	6.4	3.93	74.77	229.33	56.58
6.6	206.3	2617	6.3	3.72	72.26	218.60	51.72
6.5	209.9	2617	6.3	3.51	69.70	207.76	47.35
7.2	211.3	2618	7.1	3.31	67.14	197.13	49.11
7.2	218.8	2617	7.2	3.10	64.42	185.98	43.91
6.6	211.4	2620	6.5	2.89	61.56	174.48	39.96
6.9	214.6	2620	6.9	2.68	58.75	163.38	37.73

Table S2. Cal	culation paramete	rs and CH <sub>4</sub> emiss	sions of reasonal	ole sites for	02

Wind speed (m/ s)	Wind direction from north(°)	CH₄ (ppb)	Horizontal wind speed (m/s)	Distance downwind (km )	σz(m)	σy(m)	CH₄ emissions (kg/h)
4.6	98.7	2125	3.7	5.18	89.08	293.36	24.36
5.0	98.8	2122	4.1	4.92	86.25	280.35	18.80
4.5	100.7	2122	3.7	4.66	83.35	267.20	17.38
4.4	100.6	2123	3.6	4.40	80.38	253.89	17.19
4.9	104.4	2122	4.3	4.14	77.32	240.40	16.15
4.0	101.9	2121	3.4	3.88	74.20	226.89	11.77
4.4	100.3	2123	3.6	3.62	71.02	213.32	12.62
4.9	101.8	2123	4.2	3.36	67.76	199.70	13.01
4.1	102.5	2123	3.5	3.10	64.38	185.84	10.34
4.2	101.5	2122	3.5	2.84	60.93	171.98	8.64
4.2	99.4	2123	3.4	2.58	57.29	157.69	7.86
3.8	111.9	2124	3.6	2.31	53.49	143.20	7.61
3.5	117.0	2123	3.4	2.04	49.35	127.88	5.98

Table S3. Calculation parameters and CH<sub>4</sub> emissions of reasonable sites for O3