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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measuring methane emissions from oil and gas platforms in the North Sea" *by* Stuart N. Riddick et al.

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GENERAL COMMENTS:

The study describes the quantification of methane emissions from eight offshore oil and gas production platforms in the North Sea during summer 2017. The motivation for the study is that (1) anomalously high coastal methane enhancements have been observed in the UK under meteorological conditions that imply possible transport of emissions from the North Sea, (2) previous research indicates that methane emissions from oil and gas production facilities are often underestimated in bottom-up inventories, and (3) methane emissions from offshore oil and gas platforms are poorly constrained. The authors use isotopic analysis to confirm that the high UK coastal enhancements

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Discussion paper

are thermogenic in origin. In conjunction with a Gaussian plume model, they use in situ boat-based measurements of near-surface (2m) methane concentrations and meteorology to estimate emission rates from the eight offshore facilities. Key conclusions are that (1) the measurements of methane emissions from the platforms do not explain the anomalously high UK coastal methane enhancements, (2) the platform emissions are larger (as a fraction of gas production) than reported by the UK Department for Business, Energy, and Industrial Strategy (BEIS), (3) the emissions are associated not with operating processes like venting and flaring, but with ambient leakage, which is not included in the UK National Atmospheric Emission Inventory (NAEI), and (4) this leakage could make a significant contribution to the total emission of methane from global oil and gas operations.

My view is that the study is scientifically sound, clearly written, and wholly within the scope of ACP. It contributes to a well-documented and growing body of work on the quantification of methane emissions from individual point sources based on in situ and remote sensing observations of local methane concentrations. The authors present measurements of a small sample (N = 8) of offshore platforms, but they draw valuable conclusions nonetheless and rightly call for further study of these facilities. I would recommend acceptance of the manuscript for publication in ACP after minor revision based on the specific comments and technical corrections below.

SPECIFIC COMMENTS:

Page 2, Lines 13-14: To my knowledge, the studies cited (Zavala-Araiza et al., 2015 and Schwietzke et al., 2017) do not directly discuss methane emissions from offshore platforms. Perhaps this sentence could be broken into two sentences or parts, the first citing these studies as evidence that public inventories often underestimate methane emissions, and the second suggesting that the same may be true for offshore oil and gas platforms.

P2, L17-19: Nara et al. (2014) quantified methane emissions from offshore platforms

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in Southeast Asia using a mass balance approach, but the authors describe that study as qualitative rather than quantitative. It would be helpful to clarify this comparison in the manuscript.

P3, L19-20: I would recommend removing this novelty claim, because the study is clearly original. Targeted measurement of methane emissions from individual oil and gas platforms is an impressive contribution. This sentence could be replaced with a one- or two-sentence comparison to the previous work of Nara et al. (2014).

P4, L24: The maximum horizontal distance from the platforms is reported to be 1500 m, but some platforms in Table 1 have distances of 2000 m.

P8, Figure 3: Peak enhancements (2160-2230 ppb) do not match the value reported in Table 1 (2290 ppb). Can the authors clarify in the table caption (or elsewhere in the manuscript) whether the downwind methane concentrations reported in Table 1 represent peak concentrations, or something else?

P8, L11-14: The total emission from the 8 platforms should not be compared to the total production from only 6 platforms unless there is good reason to believe that the missing production rates are small. Indeed, if one of platforms #1 or #2 produced as much gas as platform #4, the calculation would be quite different. One solution to this problem would be to compare emissions and production rates only for platforms #3-#8. Another option would be to impute the production rates for platforms #1 and #2 from the average (or median) of the other platforms' rates.

P9, L12-15: Why might the Pasquill-Gifford stability classes used to infer emissions from the platforms be too stable? What would cause the difference between stability at the receptor and stability at the source? Is it the difference in wind speed between the surface and 40-90 m altitude? If so, would this not suggest that the stability class as assessed at the surface might be too unstable (due to the winds being faster at altitude)? One additional sentence would probably clear this up.

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P10, L8: Why are the estimated platform emissions larger than BEIS reported emissions of 0.13% by a factor of 2, but similar in magnitude to NAEI emissions? From page 6, line 1, it seems like the BEIS and NAEI figures should be similar, since the BEIS data "form the basis for emissions reported under category 1B2 within the National Atmospheric Emissions Inventory (NAEI; BEIS, 2018)." This can also probably be clarified in a sentence.

P10, L25-31: I am a bit hesitant to draw broad conclusions about global methane emissions from the oil and gas sector based on results from a small number of offshore platforms. It is interesting that the Oil and Gas Climate Initiative does not include ambient emissions in its global estimates when these emissions seem to be significant (as the authors illustrate), but I would expect their magnitude to vary greatly across geographies and industries. Indeed, the authors make note of this variability on page 2, line 15, and mention also the particularly harsh environment of the North Sea on page 10, line 20. I would recommend that the authors more clearly qualify their extrapolation of ambient emissions from North Sea offshore platforms to ambient emissions from global oil and gas activities.

TECHNICAL CORRECTIONS:

Page 1, Line 4: The words "onshore" and "offshore" are spelled differently throughout the text, both with and without dashes.

P2, L10: The acronym "OGA" is not defined.

P3, L11: The acronym "EEMS" is not defined.

P7, L10-11: Redundant use of the word "example."

P9, L8: It seems like there might be a missing word here.

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