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Comment on acp-2020-1234

Anonymous Referee #1

Referee comment on "Long-term atmospheric emissions for the Coal Oil Point natural marine hydrocarbon seep field, offshore California" by Ira Leifer et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1234-RC1, 2021

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article

General comments: This paper, written by a team led by someone with considerable experience in this field, concerns natural emissions to the atmosphere of methane and other hydrocarbons. As methane is a more potent Greenhouse gas than carbon dioxide, it is important that studies providing detailed evidence of natural methane emissions are made available to the scientific community. ACP is clearly a suitable vehicle for this paper.

The paper describes a method of long-term monitoring emissions to the atmosphere of methane derived from natural petroleum reservoirs in shallow waters off the coast of California. This is a valuable method, and could be applied to other natural or anthropogenic methane sources. The Introduction also provides a detailed explanation/ description of natural seabed gas seeps in general, citing numerous relevant sources. Similarly, the fate of methane released from the seabed is also discussed. Whilst this provides valuable context, this material is covered by numerous other papers. There is a danger of the 'context' overwhelming the detail of the method, its application and the acquired results.

Whereas the authors have endeavoured to integrate all aspects of a complex study, the paper does not flow well; there are several inconsistencies and other shortcomings that would benefit from more detailed editing. Furthermore, although some important conclusions have been drawn, there is no discussion of long-term temporal emission variations, as might be expected from the title.

Specific comments:

Lines 138-9: It should be pointed out that, whilst the bubbles from the COP seeps may be oil coated, this is not the case in many (?most) other seeps areas worldwide.

Line 212 - Section 2.1: Would it not be appropriate to identify the type(s) of equipment used to acquire these data (especially the THC)?

Section 4.2.2 Methane and non-methane hydrocarbon emissions. This section is particularly interesting in the light of the implication by Hmiel et al (2020) that pre-industrial natural geological contributions to atmospheric methane are practically insignificant. Can any comment be made about emission trends over the three decades covered by the data reported here? It would be interesting to compare emission trends with petroleum production - is reservoir depletion reflected by a reduction in seepage emissions? Such a trend is mentioned (Lines 755-778) but only for the Seep Tent Seep.

Technical corrections:

Line 146: "…. with dissolved plume concentrations decreasing with time ….". Time or distance - or both?

Line 151: what is "water-side turbulence"?

Lines 173-4: "COP seep field sources from the South Ellwood oil field whose primary source rock is Monterey Formation, which is immature to marginally mature." This could be re-cast as "The source of the methane of the COP seep field is the South Ellwood oil field, which contains petroleum from the immature to marginally mature Monterey Formation."Line 191: wet season (singular).

Line 230: There is no verb in this sentence.

Line 250: "The plume inversion model is a three-step process". Surely this should be "The plume inversion modelling is a three-step process".

Line 252: What is C' ?

Line 255: "is fit" should be "was fitted" - although present and past tense seem to be interchangeable in this section.

Line 328: For the benefit of readers, it should be noted that the ‘Seep Tent’ refers to an installation whereby the natural seabed seepage was captured and utilised along with gas produced from nearby petroleum fields. Suggest moving text from Lines 765-769.

Line 367: “almost due south to the”. Surely WCS is almost due north of Coal Oil Point?

Line 373: “allowed far higher values of C and u” - add “ to be measured”

Line 437: “C and u for the seep field direction, useep, and Cseep, respectively” should be: C and u for the seep field direction, and Cseep, and useep , respectively.

Line 450: replace “largely” with “mainly”

Line 579: “A range of approaches are available” - a range … is available!Lines 665-680 is clumsily worded, and units are mixed (tons - should be tonnes and could be abbreviated to ’t’ - Gg, Mg and nmol). All previous multi-authored papers are cited using multiple names, except Römer et al. 2017. e.g. Line 666-8: “e.g., summary Römer et al. (2017) where emissions for 12 different seep areas including for sites in the North Sea, Pacific north west, Gulf of Mexico, etc., were 2-480 tons yr-1, multiple orders of magnitude less than seabed emissions for Coal Oil Point. Römer”. Poorly worded. Suggest: ‘For example, Römer et al. (2017) identified emissions from 12 different seep areas (in the North Sea, Pacific north west, Gulf of Mexico, etc.) of 2 to 480 tonnes yr-1.’ [N.B. the last 12 word duplicate the previous sentence. Römer et al. likely used metric tonnes rather than US (Imperial) tons - why not abbreviate to ’t’?]

Line 670: Tommelieten should by spelled Tommeliten.

Line 693: “emissions were” estimated as …

Section 4.4: to conform to section 4.2.2, emissions should quantified by mass rather than volume.

Line 771: If the Seep Tent Seep is post 1978, how come it was observed in 1970? (Line 768).

Line 783: “WCS seep emissions” - surely you mean measurements, not emissions.

Line 1199: If C is defined, then C’ should also be defined.Fig. 4: Why are the rose diagrams plotted with 0 (presumably representing North) at the bottom, South at the top, and therefore East and West reversed from their intuitive places? Also, it would make interpretation of the rose diagrams easier if they were superimposed on the map; this would enable correlations with seep locations more intuitive.