

Interactive comment on “In-situ observations of the isotopic composition of methane at the Cabauw tall tower site” by T. Röckmann et al.

Anonymous Referee #2

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This paper describes a field comparison of two new instruments for measuring the two major stable isotopes of methane in the atmosphere. The instruments are groundbreaking, the paper is well written and the interpretation is interesting. I recommend it for publication in ACP with relatively minor suggestions for changes.

Specific comments:

- Bag samples from the Royal Holloway University of London laboratory are presented in Figure 2, but not referenced anywhere that I can find in the main text. I think these measurements should either be discussed in the body of the manuscript, or removed from Figure 2.

- I don't know if this is a convention in the literature, but my understanding of the nomenclature used in this paper is that "isotopic signature" is used to describe the isotope ratio

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of the CH₄ emitted from a particular source, whereas "isotope source signature" or just "source signature" is used to describe the combined isotopic signature of the sources that might have contributed to a measured air mass. I found this a very confusing (e.g. see L378 - 380), and perhaps not the most descriptive set of terms. Perhaps I am confused, but I wonder whether the authors could come up with a naming system that describes these terms more clearly. Mainly, when I read the term "source signature" I think that it must refer to the delta value that is the property of a particular source. This does not seem to be its use in this paper.

- L51: "representative of"
- L94: Shouldn't this be "Pee Dee Belemnite"?
- L159: What does "limited air conditioning mean"?
- L162: Define "o.d" in this section.
- L271: "a lower offset in d¹³C of 1.58permil". I think this statement would benefit from spelling out a little more clearly. What was the offset before, and how has it changed?
- L286 - 288: What adjustments were made? Can you provide general details?
- L318: ERA interim
- L334: I presume this is following some spin up period? Are the delta-values at ~steady state before the model run?
- L369: This sentence is a little confusing and doesn't quite follow from the previous one. What was "done separately" for the SNAP categories?
- L385: "This method allows ... to be determined"
- L429: I don't think "Inter-calibration" is the correct term here. I think you mean "Inter-comparison"? This section doesn't describe a calibration exercise.
- L466 and Figure 3: It looks to me like there is some non-linearity in the comparison

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between the two instruments for delta-D? The values at the lower end of the scale appear to be significantly lower for the TREX-QCLAS. Is this true? E.g. if a 2nd order polynomial were fit, it looks to me like it would come out with some curvature. I think this deserves a comment.

- L498 - 499: TM5 does indeed seem to perform very well. However, I think this line is somewhat subjective (e.g. use of the term “remarkable”) and should be removed.

- L508: I’m a little unclear what this line means. Do you mean simply that this offset is seen globally?

- L520: “showed, that” . . . I don’t think the comma is needed.

- L569 and Figure 7: I’m a little concerned about the points in Figure 7. My understanding of the MKP is that it is an hourly “running” 12-hour Keeling plot. Each point in Figure 7 is then the 6-hourly average of the “12-hour running intercepts”. Therefore, it seems to me that what we’re seeing at each point is a doubly smoothed estimate of the source signature during some ~ 18 -hour period. Wouldn’t this analysis be more transparent if a “normal” Keeling plot were calculated during a block 6 or 12-hour period? Otherwise it becomes more difficult to understand what these points really show and what time period they correspond to.

- L644 - 645: delete “even”

- L654: This is a good example of where the term “source signatures” is confusing. I’m not sure whether you’re referring to the particular isotopic ratio of the methane emitted from a source, or of something about the bulk source mix that you’ve inferred from the air mass.

- Figure 7: At the point where this Figure appears and is referenced, it’s not clear what the “a” and “b” refer to in the event labels. I think the Figure caption should be expanded to explain when these events were.

- Figure 7: I think these points should have error bars.

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- Figure 7: The reference to Rigby et al. (2012). The original “mean” values are from Snover et al (2000), which I think should be cited. The ranges are those assumed (somewhat arbitrarily) for the inversion in Rigby et al (2012).

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