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Atmospheric Measurement Techniques Discussions

Interactive comment on "Local and regional scale measurements of CH_4, $\delta^{13}CH_4$, and C_2H_6 in the Uintah Basin using a mobile stable isotope analyzer" *by* C. W. Rella et al.

Anonymous Referee #1

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Rella et al., Local and Regional Scale Measurements of CH4, d13CH4, and C2H6 in the Uintah Basin Using a Mobile Stable Isotope Analyzer

General.

This paper is a detailed account of the function and testing of a CRDS instrument for mobile field measurement of d13C in CH4. Rapid isotopic analysis, using a vehicle-mounted analyser deployed in the field, of methane emissions from both anthropogenic and natural sources is an extremely valuable technique: this paper thus represents a major advance in our ability rapidly to identify sources of methane emissions in the

field.

The work is well detailed and well argued, and fully deserves to be published.

Specific Comments. 1. General comment. The paper is presented by the instrument manufacturer. Though there could be conflict of interest, the origin of the work is clearly stated, the study is factual and carefully detailed, and the paper thus stands solely on its scientific merits. L25. Trivial but annoying – Uinta / Unitah basin? Many times in the paper. . ...Choose one spelling? – or like Lawrence of Arabia, when confronted on this by his publisher, add many more spellings and make it interesting. You in Terra? L39 – GWP 28-86x – explain this more fully: it means over differing timescales but as written here looks like error. The Howarth paper is probably not the best to cite on the fraction equivalence. Also maybe mention in more detail that gas displaces coal, but gas leaks at Unita percentages make the greenhouse benefit very dubious. L74 – maybe cite Dlugokencky et al 2011 here? L81 – maybe cite Lowry et al. 2001 on early use of d13C to constrain London methane emissions L90 – use of isotopes: should probably cite Fisher et al., 2006 and 2011 here – GC-CF-IRMS technique is the clear option compared to CRDS and needs comparision somewhere in the paper. Both methods have their uses – CRDS gives moderate precision but is rapid and field-deployable, while GC-CF-IRMS involves the limitations of bag sampling for offline analysis but has 0.05 per mil precision. Looking forwards, it is likely that both techniques would have their future place in a good field campaign. L100 – probably it would help to add two or three lines as a brief overall explanation of CRDS, for those new to the technique. L112 – give metric equivalents, as many readers might actually be from outside the USA or the gas industry. L272 – 1% 'more than sufficient' – can that be substantiated by a few lines in the supplementary material? L289-313 and also L369-382 – I have not had time to work though this algebra carefully. It looks OK, but my experience is that triple checking subscripts is useful. L314 – model, vendor?? L432 – high degree of stability – could we have some numbers on this? – long periods of time? i.e. days? months? In constant temperatures or in large diurnal variations in field deployments when the

instrument is in the sun and bumped up and down? L450 – Oxygen and Argon: yes, but natural gas wells can leak helium and argon – could get unexpected local effects close to wells before mixing takes place? maybe it's too small to be significant? L474 – a little more detail on CO? L497 – driving speeds? In Utah maybe 90mph, but in Europe can you do 10kph and traverse plumes slowly or even stop and creep back and forth through them? The custom flow system is excellent and innovative – may prove to be very useful in rapid field mapping of plumes of all origins. This is a major merit of the paper. L528 – here or later in Fig 16 maybe a separate paragraph in discussion to introduce Keeling and Miller/Tans plots and perhaps cite Pataki et al, 2003 as well as Miller and Tans? L581-603 – again, haven't checked the subscripts line by line. . .looks OK but.. L611 – modified Air Core system - very nice. . . L679 – maybe some more detail here? L700-710 – valuable conclusions that demonstrate the power of the technique. L739 – update needed??? Figures are generally clear, if pedestrian in presentation. In Fig 15 the scale needs units. Overall, the figures could be brushed up a little.

Conclusion

This is an important presentation of the use of what will likely become a widely used instrument in the field. The implications both for atmospheric science and the natural gas industry are significant, and should lead to identification and thus to reduction of emissions.

The paper should be published with minor revisions.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4859, 2015.