

Review on:

Proxies and uncertainties for $^{13}\text{C}/^{12}\text{C}$ ratios of atmospheric reactive gases emissions- by Gromov et al.

The paper presents a review of the proxy data on stable carbon isotope ratios and uncertainties of emissions of reactive carbonaceous compounds into the atmosphere, with a focus on CO sources, with the goal to be used in the global modelling of isotope ratio distribution. This is a further valuable contribution to the hitherto scarce studies on in this field. Isotopes deliver important adjunct information which can increase the understanding of the pollution sources and atmospheric processes. Therefore the paper is highly suitable to be published in the journal.

The paper contains yet some weak points which need to be improved before publishing.

Specific comments

Generally, a discussion on the benefits of using isotopes in the atmospheric research is missing. This would be beneficial to convince the reader regarding the impact of this paper. Moreover, it would ease the final discussion on the few trials in the past to use a 3D chemical model to interpret the global distribution of the ethane isotopic composition (I will come back on that). I also see this paper as a perfect platform to discuss the possibilities and current limitations of using isotope ratio measurements for the purpose of gaining additional insight into the source apportionment. The reader shouldn't get the impression, that it is absolutely not important which source delta values are used in the model input, since in the end, due to the emission fluxes, all diversity is anyway flattened out.

Section2.1:

- The paragraph on Page4Lines101to 113 should be revised: if so detailed, then it should be done up to the end (i.e. information on the old and 'new' scale, the PDP and V-PDP $^{13}\text{C}/^{13}\text{C}$ isotope ratios, cite IUPAC paper Brandt et al. 2010). For consistency, the authors should consider to use the same notation in the sentence on Lines 107 to 109 (either 'per mil' or '‰').
- Equation 1: define j. Moreover, - this is a problem of taste – is it necessary to sum the isotopologues multiply carrying a ^{13}C for this relatively low molecular compounds? The error induced when you don't account the **natural** isoprene with five heavy isotopes is definitively insignificant compared to all other sources of uncertainties.

Section3:

This Section should be thoroughly revised. Generally, the readability is not optimal. There are multiple points to be take care of:

- There are too many details which are nowhere else used, such as information on CAM plants or ethyne. Shorten and make it more concise!
- In the same direction: comparing source delta values is at some places very confusing. The reader doesn't get always the information, is it CO, CO₂, a single organic compound, total carbon? As example: Paragraph starting on Page8Line 212: Stevens et al. present total carbon, the rest of the literature is dedicated specifically to CO.
- Page8Line220: from Fig5 in Popa et al., I see a much lower CO delta zero (ca. -29‰)?
- There are cases where the emissions during biomass burning are similar to the parent fuel, not always (see resulting single compounds, Gensch et al. 2014). As a suggestion, this might be the place to make the understanding easier for the reader (e.g. by discussing the accompanying processes and their isotopic fractionation, which is more significant for the reactions of thermal decomposition (KIE) than the one occurring only by evaporation of the compounds of interest from the plant tissues).

- The paper gives a very useful tool to calculate source delta values, where the literature information is missing. On the other side, the authors don't make use of the existing source measurements. For VOC source delta, they should use (and cite) the newer review on using isotopes in the atmospheric research: Gensch et al. 2014.
- Paragraph starting on Page10Line278 should be moved into the Section 3.2.

Section 4.2.

should be completely revised. First of all, Stein et al. 2007 is not the only trial to globally model isotopes. Saito et al. 2011 should be definitively cited here! This will be beneficial for the authors to discuss the importance of a detailed study, using the whole diversity of information the isotope community is owing up to date. Both studies are very good examples of that. The former shows that there might be anthropogenic sources missing in the inventories. This conclusion cannot be gained from concentration measurements. The latter discuss the importance of having accurate KIE of the atmospheric degradation reactions.

Other comments:

Page1Lines25to27: reformulate 'The situation complicates, if the isotope-resolved emissions (i.e., fluxes separated using the information on the isotope ratios of the emitted compounds) are to be used. '

Editorial revisions:

Page2Line49: 'revises' instead of 'revisits'

Page3Line67: 'set' instead of 'determine'

Page13Line372: better 'e.g.' than 'viz.'

Generally: 'and' instead '/' (e.g. Page3Line73 'isoprene and monoterpenes' instead of 'isoprene/monoterpenes')

Replace 'escorting' by e.g. 'associated with' (two times).