Atmos. Chem. Phys. Discuss., 13, C3140–C3142, 2013
www.atmos-chem-phys-discuss.net/13/C3140/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emission ratio and isotopic signatures of molecular hydrogen emissions from tropical biomass burning" *by* F. A. Haumann et al.

Anonymous Referee #2

Received and published: 5 June 2013

General This is an important and useful paper, that certainly should be published after minor revision. The paper reports measurements of H2 mixing ratios and D/H isotopic ratios in ambient air samples collected by aircraft sampling over southern Amazonia during the low-southern latitude dry season. This was a time of active biomass burning and the paper achieves the target to quantify the H2 emission signal and isotopic ratio, and assess the relationship of H2 to CO and CH4, etc. This information is important both to local process understanding and to global and regional modelling and thus the paper strongly deserves publication.

Analytical methodology

The paper is commendably honest about its methodology and problems (e.g. p 11221). This is good careful work. It might help to have a slightly more detailed assessment of the stability of CO and H2 in the flasks, which were kept for up to 300 days. While such delays are normal in all labs, they can have significant effects and the point needs to be treated at a little more length. How linear is the RGA in the range of the high end sample that is a significant drive to the Keeling plot? I've probably missed it in the text but are the data to be deposited publicly somewhere?

Specific questions on results

1. It is interesting there is no correlation between H2 and CH4 – this is presumably in the dry season and it will be interesting to consider the results of the wet season flights. Note: my experience of tropical fires and wetlands is based on Africa, not Amazonia, and my travel to South America is limited to a brief trip to Venezuela, so the comments here are those of an interested outsider, not from direct experience.

2. page 11224 – my observation of large grassfires in Africa in dry season is that the fires frequently pierce the dry season inversion and plume upwards to >1000m above ground level – indeed they can often be smelled at regional passenger jet altitude. But in the quiet weather of the dry season this is more a consequence of the natural upward pluming of the fire itself, making its own chimney which pierces the inversion, rather than being driven by the daily mixing of the broader convective mixed boundary layer during diurnal afternoon heating.

3. page 11226. Rainforest?? – is this really closed canopy rainforest fire? Surely these emissions are from grass fires dominantly? C4, not C3 plants. The figures seem to show fires in the areas that are either dominantly savanna or wholly or partly cleared ex-forest, rather than in the rainforest proper. What proportion of the fire pixels are in virgin closed canopy forest? Could the use of wind vectors be explained in a little more detail in Fig. 1? In Fig 1a is the red mainly in the grassland, not the closed-canopy forest? I'm not fully clear how the red patterns in the box of Fig 1a scale across to

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the rather different distribution pattern in Fig 1b – can this be explained in a little more detail?

4. It might be interesting to use NOAA Ascension Island data as a background for the Amazonian Keeling plots, as all this air has come from the little-varying SE Trades that previously passed over Ascension. The transit time to South America is probably a few days so not much H2 chemistry will occur before landfall (and which could be factored in to mixing ratios).

5. page 11244 Fig 3 pink dot TM5 Region – is this -265 per mil (text implies -262)?

6. page 11245 Fig 4. Intense green box at about 12S 55W in the heavily agricultural Mato Grosso state – is this cerrado grassland? – the area is now significantly deforested and a world-class producer of agricultural crops.

The most obvious general question is whether this the main bulk of the H2 and D/H, and CO, signatures are from burning rainforest or burning grass and crop waste? Perhaps the grass may be in clearings in forest, but nevertheless is the main source C4 grass, not C3 trees?

Concluding comment

Overall this is a valuable and strong paper and should be published with minor revision.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 11213, 2013.