**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Atmospheric hydrogen variations and traffic emissions at an urban site in Finland" *by* T. Aalto et al.

Anonymous Referee #2

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The paper by Aalto et al. presents a one year data set of molecular Hydrogen (H2), measured in Helsinki, Finland. H2 emissions from traffic were estimated by using simultaneously measured carbon monoxide and Radon (222Rn) and deriving deltaH2/deltaCO slopes during morning rush hours. As already mentioned by Referee 1, though this approach is not a noveity, the here presented data are of interest as the measurement site is situated in the high northern latitudes. After a very short introduction, displaying the general background information on H2, the author described the instrumentation, assessed the quality of the data and described the method used to derive the H2 emissions. It is obviously, that substantial and scientifically good work has been done which is relevant to ACP and its scope.

However, the introduction is in my opinion too short concerning the H2 budget and

its annual, seasonal variation, hemispheric differences, sources and sinks. Especially, with the background that the here regarded site is situated in the high northern latitudes. In the following sections the instrument, site, data set and method are presented but in some parts the description leaves open questions. This might be partly due to shortcomings in the English language.

After some revisions the paper can be recommended for publication. Generally, the paper should be cross-read by a native speaker!

Specific comments:

Introduction: In the scope of this paper it might be beneficial to re-formulate the introduction in order to point out the originality of looking at high latitudes (budget of H2, seasonalities and spatial differences, dH2/dCO). E.g. p13918, line 26 . "Variations…" Which variations? Annual, seasonal, diurnal variations? Please, amplify this.

P13920, line 3 : either "is located in the southern part of Finland" or "in southern Finland". Some of the following sentences sound awkward. Please, have the paper checked by a native speaker.

Line 20: "reductive gas detector" - better write "Reduction Gas Detector". Line 22: Reducing gas . . .. is detected via UV Absorption. Well, not exactly, since the reducing gas reduces HGO and the emerging HG vapour is detected by UV absorption. However, it is not necessary to describe the functional principle of RGDs in detail and it is sufficient to refer to the corresponding literature.

P13921, line 23: "The linearity and reproducibility…were sufficient…" How do you come to this conclusion? What were the criteria for this study?

P 13922 line 7ff. Is the wide calibration range from 0 -16ppm sufficient to describe the rather low CO background measurements of a view ppb? What are the errors /precisions of these measurements?

P13922 line 1 and 11: What is the EUROHYDROS project?

P 13922 line 13: Not necessary, and can be omitted.

P 13924 line 1: What does general agreement mean? Please give a number.

P 13924 lines 4ff: What exactly do you derive from the fact, that all these stations exhibit a similar behaviour? How does this benefit your results!?

P13924 line 21: There is a second maximum at 70 to 120 degree – what is the reason therefore?

P13925 Line 13: "removal rate" change to "sink processes"

P13925 Line 13: night time mixing layer? Do you mean the boundary layer? Further, as I understand, high Rn values imply strong influence by the soil. But that would also imply low H2 values? Do you mean here that the sharp increase of H2 and CO in the early morning hours might be (beside traffic emission) also due to the entrainment and mixing with air masses from the free troposphere?

Lines 1- 25: Which data did you use to derive these diurnal cycles? Please amplify the description and explanation of the single seasons.

Line: 24-26: How does it explain the wintertime diurnal cycle?

P13926 Line 10 How did you define these episodes (LT 8:00 – 9:00, wind speeds,...)

P13926, line 12: geometric mean slope? Do you mean the slopes derived by geometric functional regression?

P13926 lines 1- 20: it would be interesting to see a plot of your dH2/dCO results vs time especially as you refer to the seasonality in the conclusions (P13929). In the conclusion you nicely distinguish between corrected and uncorrected values. However, the numbers given here in Section 3.2 .2 are not yet corrected for the soil sink, is that correct? Later on you give corrected numbers, leading to some confusion on my side at this point. Maybe you could already clarify this in this section? What are the errors of your calculations? See also below.

P13927 1-22: What was the dH2/dCO during this event? How does it fit into the general picture of numbers from the literature and your own results? How do you explain the high H2 mixing ratios with long-range transport?

Conclusions P13930, line 24ff: You address uncertainties of the calculation for errors/uncertainties in the CO emissions. How about errors arising from uncertainties in the H2 deposition velocities, measurements, etc.. A short sensitivity study would have been interesting.

FIG 2- 7. Please add the year when the data were measured?

FIG. 3 Might be easier to read the plot and compare the data, if you used a different scale on the y axis.

FIG 4. see also Referee 1

FIG. 6 - caption: Same as Fig.5 but for carbon monoxide.

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