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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hydrogen soil deposition at an urban site in Finland" *by* M. Lallo et al.

Anonymous Referee #2

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Lallo et al. calculated H2 soil deposition velocities for the region of Helsinki, Finland with three different methods. They derived deposition velocities directly from chamber measurements, by applying the 222Rn tracer method and with a two-dimensional model. All three methods are described and results are compared with each other also with respect to soil temperature, air temperature, and soil moisture content. Though there have been a few recent studies with a similar scope, this paper is of interest as the soil deposition is the largest sink process for molecular hydrogen and due to the variety of soil types, climates the global and seasonal picture still not completely understood. The paper is scientifically sound and within the scope of ACP. After some minor corrections, I recommend this paper for publication in ACP.

Some specific comments:

P 14874 L 5 : "...estimate the vd [space character ??] in ..."

L6 : "... concentrated in the shallow boundary layer ..."

L11-12 : maybe better ? " ... (2D model) ...".

L 13 : "...revealed a relation between the one week...".

L15 : maybe better? When precipitation events occurred a few days before the chamber measurements, lower vd values were observed.

Introduction: Please add some information concerning H2, seasonality (latitudinal differences!) , budget, sources and sinks. Just to point out the importance of the soil sink especially for the northern hemisphere! Furthermore, maybe you could give some more background information on recent findings about the H2 deposition velocities (dependence on temperature, snow cover, soil parameters, for example you already mentioned Schmitt et al., Lallo 2008), just like you did for the radon exhalation (see P14875, L 22 ff).

P14875 L 22 "... which depends mainly...soil porosity. High soil moisture.....(Levin et al.). The latitudinal distribution..."

P 14876 L 5 ff: maybe better: The closest roads with a high traffic volume, Hämeentie (44700 cars per day) and Mäkelänkatu (45000 cars per day), were in a minimum distance of 350 m and 700 m, respectively.

L 9 : "... the soil texture of the measurement site ... provided by the Geological Survey..."

L12 ff: "The detailed ... determined in laboratory studies (Soil...) to be ..."

Concerning your measurement technique with the syringes: How do you account for the "missing air mass" in the closed chamber? Does it not generate negative pressure when you draw the air sample from the chamber?

P 14877 L14 "... with a residence time of ca. 1 s."

L 15 ff : "A side flow . . .. . .filtered with a 1.0 . . .. and flushed through a stainless. . .to a flow restrictor. . . . . 200 cm3 min-1 to the analyzer."

L19 : ". . .molecular hydrogen passes through the mercury. . .(HgO)" L 20 : H2 reduces HgO to gaseous Hg which is then detected by UV absorption.

At some time you could introduce H2 instead of molecular hydrogen.

L 24 – 28 check the time, you switch between present tense and past tense.

L 28: What is the precision of the instrument at ambient levels of H2 ?

P 14878 L 1 : Is it really linear ? In my experience the RGD often exhibits a non-linear behaviour. What did you correlate here ? height / area versus mixing ratio ?

L7: ". . . radioactive equilibrium . . ."

L 8: "... is similar as described. . ."

L 16: ". . . follows an exponentially . . ." In the following lines some more articles, indefinite and definite, are missing – please check the paper!

L24. Would it not be 0 ppb H2 in the chamber without a H2 source ?

P 14 879 L6 : ". . . originates . . ."

L 9: ". . . the nocturnal boundary layer"

L 13: Switch position of sentences.1.) "The photochemical reaction. . . during nighttime." 2) "Thus, the major sink is ...., while the only source process for 222Rn is the exhalation from the soil. The H2 flux can be calculated. . .."

P 14880 L 5: "the model is based on a three-dimensional atmospheric model described in Aalto et al. (2006)."

L7: What does it mean that you describe the topography by "one specific type" ?

L13-15: What is the model resolution?

L25: ". . . radon tracer model . . ." Do you mean method ? ff: maybe re-formulate the description on how you calculate the deposition velocities ? To my understanding: You solve the equations for H2 vd and the Rn exhalation rate (in the model) in order to minimize the differences between the observed H2 / Rn profiles and the model out put – is that correct ?

You use BL as an abbreviation for boundary layer, that is ok, however, you should introduce the first time you mention it.

P14882 ff: How did you determine your error bars? I am missing sensitivity study for all methods.

When you refer to your Figures please add some information on which data you are referring to (describe the symbols, colours etc.) in the text and in the caption of the respective Figures (1-6). Furthermore, when you refer to single dates, could you maybe mention or highlight the respective points in the Figures (if it is possible) ?

P14885 L 14 ff : What does this imply for the comparability of your data ?

P14886 L20 "However, it is not probable. . ." Maybe you could illustrate this more in a kind of sensitivity study (see comment above).

P14887 L 21: ". . .dependency above zero. . ."

L 26 ". . .is capable of drying the top soil. . .."

P14888: Can instrumental problems be ruled out for the different H2 vd values on August 24, 2007 and October 30, 2007 ?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 14873, 2009.