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Interactive comment on “A novel source of atmospheric H₂: abiotic degradation of organic material” by H. Lee et al.

Anonymous Referee #2

Received and published: 10 August 2012

Review of “A novel source of atmospheric H₂: abiotic degradation of organic material”
by H. Lee, T. Rahn, and H. L. Throop

General Comments

The paper by Lee et al. deals with the abiotic formation of molecular hydrogen from organic matter. The authors describe two abiotic processes that lead to the release of H₂ from organic matter: photodegradation and low temperature thermal degradation. Based on their results they suggest that abiotic release of H₂ during organic matter degradation is ubiquitous in terrestrial ecosystems. I found the manuscript to be well written and the results are clearly presented. I consider the manuscript to be almost publishable in its current form. I have only a few comments which I hope the authors might consider in their revised manuscript.

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Specific comments and technical corrections

Page 8642, line 18, Abstract: add “degradation” after “Our results suggest that abiotic release of H₂ during organic matter. . .”

Page 8643, line 20/21: regarding methane formation from plant litter a reference should be made to Keppler et al. (Methane emissions from terrestrial plants under aerobic conditions. *Nature* 439, 187-191, 2006) as this study was the very first that showed methane formation from plant matter both under thermal treatment and solar radiation. Furthermore, the two studies by Derendorp et al. (2011 and 2012) dealing with chloromethane formation from plant litter did not investigate the effect of photodegradation. Both studies focused on formation of chloromethane from plant litter during thermal treatment. This reaction was first described by Hamilton et al. (Chloride methylation by plant pectin: An efficient environmentally significant process. *Science* 301, 206-209, 2003.) These references would better fit into the next sentence (release of trace gases in the absence of solar radiation).

Page 8644, 12-16: The authors speculate that H₂ might be produced during abiotic degradation of plant litter possibly as a byproduct of partial oxidation of methyl groups. This suggestion is quite interesting and might get support by a recent study describing the isotopic composition of H₂ from wood burning (Rockmann, T. et al. Isotopic composition of H₂ from wood burning: Dependency on combustion efficiency, moisture content, and delta D of local precipitation. *Journal of Geophysical Research-Atmospheres* 115, doi:10.1029/2009jd013188, 2010.). In this study it is shown that the isotopic composition of the bulk biomass is slightly depleted relative to the water, and both methoxyl groups and H₂ from wood burning are strongly depleted. The similar degree of fractionation of methoxyl groups and H₂ relative to bulk biomass might be a coincidence, however, this observation could also hint that methoxyl groups provide a fraction of the produced H₂ .

Results: It would have been nice to also see the effect of varying UV-radiation intensi-

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ties on the release rates of H₂ from organic matter.

Page 8660, Figure 1, Y-axis: Replace “concentrations” by “mixing ratio”

Interactive comment on Biogeosciences Discuss., 9, 8641, 2012.

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