

BG manuscript review
Fate of mercury in tree litter during decomposition
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General comments.

This paper entitled “Fate of mercury in tree litter during decomposition” is well-written and complete. It describes a key component of the Hg cycle in terrestrial ecosystems, which is the dynamic of Hg at the interface between atmosphere and soils. This interface is also the place of organic matter-mercury complex formation that is of great scientific interest in environmental sciences.

The authors show that emissions, retention and sorption of Hg are dependent on litter type, which is a result that will be of interest for scientists who work on terrestrial Hg cycle but also on terrestrial-aquatic linkage of this cycle. Finally these results are unique and will be of interest to the Biogeosciences audience.

I have few general and specific comments that are listed below. I think that this article shouldn't present any difficulty for publication after minor corrections.

In the materials and methods you mention that woody litter component were removed. Why do you choose to do so? Do you think that Hg associated with these types of debris could represent an important part of Hg dynamic in litter?

I also have concern about the fact that litter samples were homogenized. I'm not sure of what does it mean (mixing/crushing the litter?). I wonder if the homogenization process will not enhance the degradation process of organic matter and emission of gaseous mercury. Finally, you used ultrapurified Millipore water in your controlled laboratory study. Is this water representative of rainwater? Do you think that rainwater composition (without Hg) could change something about the results obtained (I'm thinking about pH, chemical composition...).

I think that you should find a better way to present results of the field litter decomposition study. As you didn't present the results in table 1 (although you are referring to this table in section 3.3) and mix these results with the laboratory study in fig.3, it is very difficult for the reader to have a comprehensive vision of these data. You should add a figure or a table with initial and t=12 month values of all measured parameters during field study. The section 3.3 appeared quite confuse for me and I didn't really understand the way you calculate the Hg enrichment of field sample (lines 16 – 20 page 2605) and what is the difference with enrichment presented just above (lines 10-11 page 2605).

Under the controlled laboratory study, you worked under dark conditions. In the discussion section, you didn't talk about the role of solar radiation on both Hg and SOM degradation/mineralization. These processes can explain differences between the field and the controlled conditions of the study. What can be the role of photodegradation of soil organic matter on Hg cycling in soils? This parameter may also explain differences

of litter degradation observed with other studies (page 2607) (see selected paper below).

The C/N ratio section (page 2607) will gain of being enhanced with further readings (selected paper below).

The paragraph on Hg solubility is quite interesting and some aspect of the discussion may be related to studies that assessed the fate of mercury between terrestrial and aquatic ecosystems and more particularly the role of organic matter quality. Some authors have suggested that Hg sorption increased with increasing terrestrial organic matter degradation state (see selected paper below).

Specific comments.

- From line 27 page 2596, to line 7 page 2597. This section should not be included within the introduction and should be removed. This information is already available in the Materials and Methods section. The introduction should end with objectives and hypotheses of research.

- Line 3, page 2597. Please define "N". I wonder why you didn't mention nitrogen or C/N ratio in the abstract?

- Sampling site description: A better way to present collection site may include a table with site description, location, elevation and precipitation.

- Lines 3-5 and 12-14 page 2599, repetition. Please simplify.

- Lines 3-4, page 2600 : Concentrations are measured, ratios are calculated. Please remove ratio from sentence.

- Table 1 is quite difficult to read and huge amount of data is presented. Maybe you should present first data on C, N and C/N data and then Hg data. There is also a repetition between table 1 and Fig 1, 2 and 3. In the table you also present Dry mass/C concentration/C mass but in fig 1 you present Dry mass/C mass/C concentration. If you keep the table (maybe in annex) please be consistent.

Technical corrections.

- Line 21 page 2604 : Bonferroni

- Line 16 page 2606 : Bonferroni

- Line 9 page 2615 : Driscoll

Additional lectures

C and N

Côté L, Brown S, Pare D, Fyles J, Bauhus J (2000) Dynamics of carbon and nitrogen mineralization in relation to stand type, stand age and soil texture in the boreal mixedwood. Soil Biol Biochem 32:1079-1090

Finzi AC, Van Breemen N, Canham CD (1998) Canopy tree-soil interactions within temperate forests: species effects on soil carbon and nitrogen. *Ecological Applications* 8:440-446

Smolander A, Lojonen J, Suominen K, Kitunen V (2005) Organic matter characteristics and C and N transformations in the humus layer under two tree species, *Betula pendula* and *Picea abies*. *Soil Biol Biochem* 37:1309-1318

Organic matter decomposition and mercury

Grondin A, Lucotte M, Mucci A, Fortin B (1995) Mercury and lead profiles and burdens in soils of Quebec (Canada) before and after flooding. *Can J Fish Aquat Sci* 52:2493-2506

Teisserenc, R., Lucotte, M., Houel, S (2011) Terrestrial organic matter biomarkers as tracers of Hg sources in lake sediments. *Biogeochemistry*. 103, 235-244

Photodegradation of OM

Austin, A. T. et Vivanco, L (2006) Plant litter decomposition in a semi-arid ecosystem controlled by photodegradation. *Nature*. 442, 555-558.

R. G. Zepp, D. J. Erickson, N. D. Paul and B. Sulzbergerd (2011) Effects of solar UV radiation and climate change on biogeochemical cycling: interactions and feedbacks *Photochem. Photobiol. Sci.*, 10, 261-279

Photoreduction of Hg

Graydon, J, St. Louis, V, Hintelmann, H, Lindberg, S, Sandilands, K, Rudd, J, Kelly, C, Hall, B, and Mowat, L (2008) Long-Term Wet and Dry Deposition of Total and Methyl Mercury in the Remote Boreal Ecoregion of Canada. *Environ Sci Technol* 42:8345-8351