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Discussions

Interactive comment on "Si cycling in a forest biogeosystem – the importance of anthropogenic perturbation and induced transient state of biogenic Si pools" *by* M. Sommer et al.

Anonymous Referee #3

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The story presented here is very stimulating. This case-study of a climate wheathering-limited biogeosystem is an interesting example for studying the impact of the Si biocycling on the transfer of DSi from land to ocean, but also the impact of phytoliths on Si dynamic in soils. The new data about the pool and fluxes of the zoogenic Si pool are important for a better understanding of the Si biogeochemical cycle. The main research questions are well established and innovative. The introduction is comprehensive and well documented. The methods are appropriate and results are clear. My principal concern with the paper is that the good data set is not sufficiently discussed and some assumptions are not sufficiently supported by the data. Please find here below detailed comments:

- P2; Lines 17-21: this conclusion is not supported by your data. These observations aren't compared to a system with no land use change, ie a pine forest. So you cannot talk about anthropogenic perturbations. With your dataset you aren't able to know wich type of phytoliths (from pine or beech forest) govern the DSi concentration in aqueous phase. - P3; line 2: Could you please very briefly explain why many studies are currently focusing on the biogeochemical Si cycle? - P3; line 3: please replace "quantification of Si pools" by "understanding of Si pathways" - P3; lines 4-7: I don't get why you mention Si isotopes here? What's the link with the objectives? Furthermore, could you explain briefly why natural Si fractionation is useful to understand the Si pathways in soil-plant systems? - P3; line 12: Could you please refer also to the Struyf's studies on the impact of land use on ASi pool - P3; line 14: Please insert also the studies in forest ecosystems. - P4; lines 3-5: could you further explain the four scenarios. How the definition of these scenarios is important for your study? Moreover, it might be a good idea to explain in more details the terminology used in Cornelis et al. 2011 and the meaning of climate weathering limited system. I think you're more between soil weathering-limited and climate-weathering limited systems as the weathering ability of the biogeosystem is low due to climate and low content of weatherable minerals (>95% quartz). - P5; line 15: replace "podsolization" by "podzolization". - P6; line 2: a personnal communication is allowed by BG? - P6; line 8: "assuming a principally similar sediment layering" How can you assume this? - P6; line 14: How did you estimate BD for sediments? And what do you mean in line 15? - P7; line 8: What is that you extract? Is it similar to the plant-available Si extracted using CaCl2 solution or DSi measured using lysimeter? - P7; line 20: please replace "pedogenic silica" by amorphous silica (=pedogenic opal + phytoliths and microorganisms remains). What about the dissolution of imogolite-type materials which are not suspected to be present in your soil given the soil pH < 4.9. - P9; line 1: Are you able to quantify with a microproble of SEM/EDX? - P9; line 19. . .: please rephrase without using paragraph. Could you be a little more critical about the method as some authors showed that the gravimetric separation using heavy liquid is not accurate, albeit this method is helpful for microscopic analysis.

- P12; lines11-13; Did you avoid measuring Aeolian dust deposit on the surface of leaves? - P14; line 14: this oxalate extractable Fe and Al contents could reveal other soil components such as organo-metallic complexes. - P14; line 18: ... . And given the pH value in the subsoil (<4.9). However how can you explain the increase of Siox between 0-25cm? Adsorption onto Fe oxides? - P14; lines 23-24: that's an interpretation for the discussion. Could you please further explain? - P15; line 1: "uppermost meter" What do you mean? Besides the differences in terms of mineral solubility in the soil profile, is it plausible to explain this observation by an active Si uptake in the topsoil with high content of roots? - P15; line 6: that's for the discussion... need to be detailed - P15; line 7: that's surprising given the high content of ASi in topsoil... but BD is lower. - P15; line 10: could you please clarify how you quantify phytoliths? - P15; line12: you're talking about Si pools in your tables and introduction(...) and presenting results in SiO2 here. Could you be consistent? - P15; lines 16-21: this part must be clarified. In my own opinion, 2.4 and 4.4 g/kg cannot be compared. - P16; line 1: replace Table 2 by Fig 2. - P16; line 5: maybe due to weathering/partial dissolution of beech phytoliths in soils, which become morphologically indistinguishable, compared to pine phytoliths. The 50-75% unrecognized phytoliths should be due to weathering features - P16; line 21: cite a reference - P18; line 5: Is it possible that this short-time scale Si pool significantly influences the Si isotopic signature in soil? - P18; lines 11-13: very surprising. Could you further discuss this in your discussion? - P 18; lines 15-17: That's for the discussion. Could you please further discuss these observations - P19; lines 12-14: Could you please make the relation with the DSi concentration in soil solution. - P20; line 9: Could you please further discuss this observation and its impact on Si dynamic in soil, and more particularly in your biogeosystem? - P20; line 12: Why specifically kaolinite? And not other crystalline or poorly-crystalline aluminosilicates? - P20; lines 17-18: and what about adsorption/coprecipitation of organo-Fe complexes or neoformation of Al-Si phases on the surface of quartz grains. - P20; lines 22-23: How can you conclude this? A low proportion of weatherable minerals doesn't mean that this pool of minerals in the climate & soil weathering-limited system cannot signif-

icantly influence Si dynamics. - P21; line 4: "pedochemical environment" Could you specify which environmental conditions can influence acidolyse/acidocomplexolyse? - P21; lines 1-7: I'm not really convinced by your assumptions... - P21; lines 15-17: I agree but could you please further explain a little more in term of a likely impact on Si dynamic and pedogenesis. - P22; line14: "parallel increase..." except in deep soil where we observe an increase of Si(H2O). - P23; lines 9-10: how can you conclude this? We know that pine uptake is lower and so could influence the ASi pool in soil through litterfall. The dissolution of beech phytoliths can also play a key role. - Figure 2: the EDX spectra is not discussed - Figure 5 upper: I don't see the arrows pointing to amoebae. How can you say that's a Fe oxide or clay coating in figure b? What about OC coating or organo-Fe coating?

Interactive comment on Biogeosciences Discuss., 9, 18865, 2012.