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Biogeosciences Discussions

Interactive comment on "Tracing the origin of dissolved silicon transferred from various soil-plant systems towards rivers: a review" *by* J.-T. Cornelis et al.

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We would like to thank the referee for their constructive and helpful comments. All the suggestions of the reviewer will be taken into account in the final revised version of the manuscript (please find below our responses). We hope that the revised version will be considered as responsive to the concerns of the reviewer and suitable for publication in Biogeosciences.

Comment 1: "This review covers the literature broadly and presents the high points without getting involved in the details of the processes involved". We fully agree that is

perhaps a blessing when dealing with the complexities of the terrestrial system and we recognize that considerable complexity exists in the use of the emerging tracers, such as δ30Si and Ge/Si ratios. In the manuscript, we note the importance to combine tracers with mass balance and that the tracers are affected by a number of potential side reactions (adsorption onto Fe oxides, neoformation of secondary minerals) besides the major ones of interest (biocycling and hydrological mobilization). In the revised version of the manuscript, we will stress the importance of a full physico-chemical characterization of the soil-plant system before the use of tracers to understand the sources and fates of Si in the terrestrial biogeochemical systems. In the manuscript, we already deal with the identification of fractionation factors for Ge and stable Si isotopes: plant uptake, primary mineral dissolution, secondary mineral neoformation, adsorption onto oxy-hydroxydes, and transfer in the plant (chapter 4; p 5895-5896). For stable Si isotopes, we explain that multiple processes fractionate in the same direction (plant uptake, adsorption and clay neoformation are three processes favoring light Si isotopes). However, secondary clay minerals and biogenic opal display contrasting Ge/Si ratios since clay-sized weathering products are enriched in Ge, and biogenic silica (BSi) polymerized in plants as phytoliths is depleted in Ge. Thus, we suggest that comparing Ge/Si ratio with Si isotope data may provide a better understanding of the origin of dissolved Si exported from various soil-plant systems towards rivers. We will explain the different sources of dissolved Si in the 4 scenarios of the chapter 5 using the interpretation of the two tracer behavior in each specific environments of each study. Moreover, in the revised version, we will not exclude the hydrological and atmospheric sources to explain the signature of dissolved Si in the hydrosphere.

Comment 2: "The reviewer hungered for fewer general statements and more detail on the linkages among individual studies conducted in varying parts of the world". As suggested by the reviewer #1, we will synthesize the accumulated knowledge for the different scenarios in order to make profit of the link between the various studies.

Comment 3: "Figure 3 is a creative effort to develop a synthesis but its discussion is not as well fleshed out as is necessary to really make a significant contribution". In the revised version, we will define the quantitatively means of "optimal climate and soil conditions". We will also compare the impact of the two different rock types (granite and basalt) on the expected export of dissolved Si. Furthermore, the part (d) of the Figure 3 will now be integrated in the discussion of the scenario 3 and the scenario 4 (Earth's dry land) will be added in the Figure 3 and discussed as boundary condition in more details. As suggested by the reviewer #1, the analysis of each domain will be related on the literature about DSi contributions to rivers presented in the Chapter 4 of the review paper. We thank the reviewers for addressing the very important comment about studies (chronosequence, climosequence, trends occurring with changing climate) that cross between scenarios. We agree with the reviewer that many soils sequences studied overlap between scenario 1 and 2, since an increasing soil weathering degree will drive from a high to a low mineral reserve. We will explain this in more detail in the revised version, saying that the scenario are like "end members" but that natural conditions oscillate between those cases. We will emphasize on the fact that natural conditions are not as simplified as in the scenario, but the scenario help to understand the processes.

Interactive comment on Biogeosciences Discuss., 7, 5873, 2010.