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Biogeosciences Discussions

Interactive comment on "Global spatial distribution of natural riverine silica inputs to the coastal zone" *by* H. H. Dürr et al.

Anonymous Referee #1

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This paper reports silica fluxes to the ocean both in dissolved and particulate form. These numbers are extracted from an important data base compiled by the authors from one of their previous data base and from new information collected from individual papers. The fluxes calculated are the natural ones because the anthropogenic impact of dissolved and suspended Si fluxes are taken into account, in particular because the data base contains Si concentrations prior to human perturbations. The major interest of the paper is that the Si budget to the ocean is spatialized. The exorheic part of the continent is segmented in 140 coastal fragments according to the previous study of the second author (M. Meybeck and others). The catchments where Si fluxes are unknown are extrapolated based on what are the controlling factors thought to be important, and by comparison with adjacent basins. The main result of the study is to refine the Si

budget to the ocean and estimate its anthropogenic perturbation as well as the role of regional and marginal seas for intercepting the Si fluxes from the continents.

Even if the first order estimates of Si fluxes to the ocean are not significantly different to those published before, this study is the first trying to spatialized fluxes. Because Si concentrations are not very variable and depend mainly on lithology and runoff, the uncertainty propagated by the numerous unknown informations is probably low and other element fluxes would probably not be as easy to estimate.

This paper represents a lot of work for data collection and spatialization. I doubt of his interest actually and I have no opinion whether BGD should publish it or not. Because this is a new approach for calculating the Si input to the ocean and that Si of great interest for ocean chemistry and the global C cycle, this paper may have some interest for the global change community.

I have listed a number of comments that in case of acceptance should be addressed by the authors.

- It is very difficult to have an idea of the data quality and accuracy. The way data base have been set up poses a number of problems with regards to data quality. If data quality is good when numbers are extracted from peer-reviewed papers of the scientific literature, this may not be the case for data derived from agencies with poor or no control. This included not only the measurement by itself but also the collection of water, conservation, filtration, and conservation processes. As the reader cannot make his own idea about this quality issue, this would be good if the authors could comment of that problem. This is a limitation to the present study.

- In supplementary materials, the list of reference used to elaborate the data base contains a lot of “Meybeck, personnal data” . This is a strange. Why not publishing this data in the present paper. The authors have to make data available. In

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addition, a number of important and recent contributions on river composition are missing. This is a severe drawback of this paper.

- Particulate Si data have been published in a number of papers that are not considered by the authors. This includes papers from various group, on large river systems (Ganges, Amazon, Congo, Niger, Mackenzie, Chinese River) and volcanic islands. A particular study in Iceland (Gislason et al.) addressed the reactivity of river particles once in the ocean. As this only reference for particulate Si data is GLOMET, Meybeck 2009 and that this reference is not given, I got the same " black-box " impression on the quality of data than I had for dissolved Si. It is very difficult for the reader to judge the quality, and representativity of data. Taking finally a mean average of 55.64% of SiO2 to calculate the Psi flux neglects the importance of grainsize (and quartz dilution), carbonate content, and organic matter content. It also gives a great important to the suspended matter fluxes.

- The suspended matter fluxes are taken from Milliman, which is probably the best data base so far. The anthropogenic impact on the modern sedimentary fluxes is not known and therefore, it may be that the Psi flux calculated by the authors could be completely be overprinted by the anthropogenic perturbation of sediment yields. This is not discussed by the authors. In what extent the measured suspended yields (even monitored on long time periods) represent the mechanical denudation fluxes?

- That would be interesting to have an idea of the main controlling parameters of Si concentrations or Si fluxes from catchments: runoff, temperature, elevation, lithology. The data base used by the authors should give this information quite easily. The first order control on the Si fluxes seems to be runoff actually, given the fact that Si concentration does not vary very much from one river to an other (compared to runoff). If the data base contains such an information, it should be stated here.

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- This paper gives the impression that the controlling factors for silicate weathering (and hence Si concentrations in waters) are quite well known, which is far to be the case. Actually, most of the numerous papers aiming at establishing chemical weathering laws are not cited in this paper. This must be acknowledged by the authors that chemical weathering of silicates is a complicated problem and that, to date, no model is able to predict what should be the chemical composition of a given riverwater as a function of climate, mineral assemblages, residence time of soils, ecosystems.

- The relation between fluxes of dissolved Si and particulate Si is interesting and close to the relationship reported by previous authors between physical and chemical fluxes of silicate weathering. No mention is made to these previous studies (Riebe et al., 2001, Millot et al., 2003, Gaillardet et al., 1999, West et al., 2005, Lyons et al. 2005).

- The end of the paper (section 4.4.) is very speculative. The fluxes of river dissolved and particulate Si are the input fluxes to the ocean because of number of transformation involving Silica can potentially occur in estuaries, river plumes... and because of atmospheric deposition. Our knowledge of reverse weathering reactions is so poor that we actually do not know how much silica is sequestered by reverse weathering reactions in the ocean.

- Final remark: Si exists in water as silicic acid not SiO2. This is quite disturbing.

In conclusion, the approach is interesting, but my feeling is that river Si concentrations are not well known so far (and their control) and that the fluxes proposed here still suffer from important uncertainties. A significant volume of new literature geochemical data are is not considered.

Interactive comment on Biogeosciences Discuss., 6, 1345, 2009.