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Biogeosciences Discussions

Interactive comment on "Nutrient dynamics, transfer and retention along the aquatic continuum from land to ocean: towards integration of ecological and biogeochemical models" *by* A. F. Bouwman et al.

Anonymous Referee #1

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General review Delivery of sediment, nutrients, carbon, etc. by rivers to the global ocean is the final integrated product of all the biological/ecological, hydrological, geochemical and physical processing that occurs in river catchments. In a changing world where human perturbations to aquatic systems become ever stronger, there is a clear need to understand and predict impacts, and as such many conceptualisations and approaches for the modelling of nutrient transport from land to ocean can be found in the literature.

However, many processes govern river delivery, and they operate and interact across

a huge range of spatial and temporal scales. This therefore presents a problem for process-based modelling efforts. Here, Bouwman et al. attempt to summarise this body of work and make connections between the sometimes disconnected fields of terrestrial and aquatic biogeochemistry. As such, this is a paper which has potential to be important useful to a huge range of scientists and is appropriate for inclusion in Biogeosciences. The manuscript is generally very well written in clear and concise language. The schematic figures, whilst fairly rudimentary, are clear and support the manuscript well. The authors generally do an excellent job of bringing together and synthesising different approaches. However, I think the manuscript would benefit from some minor revisions to the structure and emphasis before final publication.

Specific comments Section 2. This section, reviewing historical approaches to conceptualising and/or modelling river ecology, seems relatively comprehensive but is extremely poorly referenced, at least in the main text. Representative references should be included after specific examples of the application of the various concepts, so the interested reader can go further.

Section 4. A key issue I have with the manuscript is the usefulness and applicability of the framework the authors purport to present in section 4. This is the stated aim of the manuscript ("to develop a comprehensive, modular concept for the description of carbon and nutrient biogeochemistry in river basins." Pg 8737, line 30). However, where is the 'framework' actually introduced? Section 4 reads more like a list of parameters that should be included in a river-basin model (assuming data and computational power allow). Simply identifying models that could potentially be coupled in a modular fashion does not make a framework – this requires coherency, internal consistency and a common language. In my opinion, the manuscript would be stronger if the references to 'in our framework. . .,' etc., were removed. However, this should not detract from the most useful and important part of section 4, which is the thorough review of the state-of-the-art of modelling efforts of various components of river basin hydrology and biogeochemistry.

Finally, even accepting the review cannot (and should not) be exhaustive, more coverage in certain sections would be beneficial and is needed to make the manuscript representative of current thought/work. The role of weathering as a source of nutrients (section 4.2.3) is inadequately covered, despite the vast literature that surrounds it. Section 4.2.5 (Biogeochemistry in riparian zones) is mostly about the problems of defining the riparian zone, rather than actual biogeochemical processing with it. And lastly, the retention of nutrients along the aquatic continuum (in dams and reservoirs) is not given adequate coverage. Recent work has begun to formulate models to address this, e.g. with regards to sediment, nitrogen and dissolved silicon.

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