

Interactive comment on “Coupling global models for hydrology and nutrient loading to simulate nitrogen and phosphorus retention in surface water – description of IMAGE-GNM and analysis of performance” by A. H. W. Beusen et al.

Anonymous Referee #2

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The manuscript “Coupling global models for hydrology and nutrient loading to simulate nitrogen and phosphorus retention in surface water – description of IMAGE-GNM and analysis of performance” by Beusen et al. describes the functionality and performance of their new addition to the IMAGE model complex. The paper is well written and clearly describes the model, which is a promising addition to existing lumped models, given its spatially explicit nature. Apart from two things, I have only minor aspects to comment and thus recommend minor revisions before the manuscript should be published in GMD.

C2734

My first comment regards the used input data, most of which are outdated. Newer datasets are available for - Soil data: <http://www.isric.org/content/soilgrids> - Lithology: Hartmann, J., Moosdorf, N., 2012. The new global lithological map database GLiM: A representation of rock properties at the Earth surface. *Geochemistry Geophysics Geosystems*, 13(12): Q12004 - Hydrology: Hydrosheds, SRTM water bodies The used data are not only of coarser spatial resolution, but also include sometimes substantial thematic shortages. Please discuss the effect of adding up-to-date datasets as model inputs, and please consider updating your input data in the future.

The second main comment aims at the calibration examples. The model aspires to represent global fluxes to be used at global scale, yet only three temperate rivers were used to evaluate the performance. I urge the authors to include datasets from rivers of different climates and regions.

Minor comments: P7480L28-P7481L21: That section already dives deep into the methodology – perhaps move it there.

P7486L17: Why do you use the slope/runoff classification only of unconsolidated sediment – should that not be different for other lithological classes?

P7506L121: Check model performance not just against individual rivers but against the weighted mean of all rivers in the EEA database

Table 1: What is the reference of the porosity values? How do they compare to those provided in Gleeson, T., Moosdorf, N., Hartmann, J., van Beek, L.P.H., 2014. A glimpse beneath earth’s surface: GLobal HYdrogeology MaPS (GLHYMPS) of permeability and porosity. *Geophysical Research Letters*, 41(11): 3891-3898. ?

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