

Manuscript: Estimating lateral nitrogen transfer through the global river network using a land surface model

Major remarks

Reviewer 2 – Major remark 4

It seems that you misunderstood my comment. May be I should have phrased my comment clearer. I was not talking about trends within a 10 years time period, but about that using only a ten-years mean as a reference may be missleading when comparing two 10-year means to determine the differences (i.e. trend) between these two climates. In hydrology, there is substantial decadal variability with wet and dry decades. Hence, if you accidentally compare a wet decade with a dry decade, you will find a difference (i.e. trend) that is not real just because of decadal variability. Usually, to investigate climatological relevant differences in hydrology, you have to compare at least 30-year means to get robust results.

In general, the authors responded well to the reviewers' comments. After adequately addressing one major remark and some minor remarks, the manuscript may be accepted for publication.

Minor remarks

In the following suggestions for editorial corrections are marked in *Italic*.

Sect. 2.1.2

Please note the meteorological forcing data (i.e. GSWP3) and the time period that has been used to simulate the runoff and drainage data. This is relevant information the reader should be able to get directly from the text without searching for it in Table 1.

Line 209-211

As ORCHIEE-CNP2022), *and they ...*

Line 212-214

Therefore, the *differences* inare *relatively small*.

Line 254

... temporal *resolutions* of ...

Reviewer 2 - Minor comment 5

Please be more thorough with shortening unnecessary repetitions. Eq. 2-6 should still be merged into one equation, the same applies to eq. 10-12, and eq. 13-14

Line 380

Tables A1 and A2 provide a ...

Line 516-517

... water *discharge* (Fig. S3b).

Line 589

In *the following*, we ...

Line 693-700

It is written:

“Our results indicate that the spatial pattern of seasonal amplitudes in TN concentrations at river mouths differs from that of TN exports (Fig. 10c, d). This result is important because the ocean biogeochemical modelling community typically uses annual mean TN fluxes derived from Global News to force their simulations (e.g., ...), and downscales these inputs to monthly values under the assumption that the seasonal variability of the flux is entirely driven by river discharge.”

This statement is not very clear to me. Using the approach described, the community assumes constant TN concentrations C_N that are applied to calculate TN exports at the river mouth by multiplying the river discharge Q by C_N . However, then the seasonal amplitude of C_N (constant = zero amplitude) is also different to the one of the TN exports (seasonal amplitude induced by the discharge). In my opinion, to have a valid criticism of the common community method, you have to show that the seasonal amplitude of TN exports is significantly different to the seasonal amplitude of river discharge.

Line 712

... (b) *rates of denitrification*; (c) *TN exports to oceans*; ...