

Interactive comment on “Spatialized N budgets in a large agricultural Mediterranean watershed: high loading and low transfer” by L. Lassaletta et al.

Anonymous Referee #1

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Review of “Spatialized N budgets in a large agricultural Mediterranean watershed: high loading and low transfer”, by L. Lassaletta et al.

This paper represents a potentially strong contribution to the literature of watershed-scale nutrient accounting and its relationship to nitrogen export to coastal waters, which would be particularly valuable as an analysis in an arid, Mediterranean region. The authors suggest that the arid climate of the region is conducive to high N retention and long residence times, an interesting and significant observation for nutrient management. The paper is generally clear and well-written. Overall, I would rate the scientific and presentation quality of the paper as good to excellent, but incomplete. In its current form, the study is difficult to evaluate fully because critical details of calculations are lacking, as indicated in specific remarks below.

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Comments on the text:

P 8725, line 13: replace “augmented” with “grown”

P 8729, line 1: Schaefer et al 2009 and Schaefer and Alber 2007 could be added to the list of NANI studies. In particular, they report on effects of temperature in Southeastern and Western US watersheds which might be relevant to the discussion here and elsewhere in the text. Schaefer, S.C., Hollibaugh, J.T. and Alber, M. 2009. Watershed nitrogen input and riverine export on the west coast of the U.S. *Biogeochemistry*. 93(3):219-233. Schaefer, S.C. and Alber, M.A. 2007. Temperature controls a latitudinal gradient in the proportion of watershed nitrogen exported to coastal ecosystems. *Biogeochemistry*. 85:333-346.

Page 8729, lines 5-10: The language describing N deposition is somewhat confusing. The authors seem to say that they are including only net reduced N in the estimate of deposition, though it seems to be clear on p 8734 that they are including both reduced and oxidized N terms. Can the authors justify this detail given that the total (net) N deposition estimate is a relatively minor input in general (4-9% of N inputs)? (there seems to be little further discussion in the results and discussion, beyond indicating that oxidized forms represent a source and reduced forms a net loss of N. Why aren't these terms included individually in table 2?)

Lines 19-21: Why include ICEP? While I understand that the N and P watershed fluxes are put in the context of nutrient limitation in coastal waters by examining the Redfield ratio with respect to Si, the discussion seems a bit distracting in a paper primarily about watershed N budgets (and which does not claim to estimate P or Si fluxes). It seems like a companion or followup paper would be a better place to discuss the relative importance of N and P loads to coastal waters, and their relationship to Si fluxes.

P 8730, lines 21-28: The discussion of the estimate of N fixation refers to an equation “that relates crop yield, N fertilization, and crop residues” but is otherwise unspecified, ie there is no mathematical formulation of the N₂ fixation relationship.. It is impossi-

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ble to evaluate the validity of this estimate without a more precise statement of the relationship used.

P 8731: The authors state that they have compiled data on livestock numbers, human inhabitant-equivalents, and wwtps in order to estimate the manure N and N inputs to streams from human sources, but they do not specify the details of these calculations. It is impossible to evaluate the assumptions used in the calculations unless details are provided. Actual parameters, etc could be provided in supplemental materials.

P8733, lines 13-14: The authors state that the effect of fraction of watershed dammed and irrigation channel density on N retention was “statistically analyzed”, but no details are given. More information is needed to evaluate this.

P 8735: annual N input to TU1 is characterized as “moderate (4361–6368 kgNkm⁻² yr⁻¹)”, but the abstract characterizes the overall average new N input to the Ebro basin as “relatively high. . . (5118 kgNkm⁻² yr⁻¹)”. Isn't this inconsistent? What do “high” and “moderate” mean?

P 8736: Discussion immediately following section 4.3 – I assume that the sample of 21 catchments is the same as the 21 catchments discussed in section 3.4, and that they were chosen on the basis of available data at monitoring stations. The relationship between retention and fraction of area dammed was evaluated using a Spearman rank order test, though the explicit mathematical form selected (eq 1) was not evaluated – how well does the model in eq 1 fit the observations? Why are these data not presented in a table or supplemental materials? Were other relationships for retention evaluated (eg watershed area?) Is the proportion of area dammed a particularly strong predictor of retention compared to others? What is the basis of the criterion of 0.05 km/km² irrigation drainage density for separating catchments into irrigated or non-irrigated categories? Was there some analysis involved, or can a reference be cited? P 8736, eq 1: ω appears to be a superscript font, and should instead be regular size

Supplementary material:

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The supplementary material consists of a table consisting of columns specifying N output(%), and Yield \pm SD for rainfed crops, irrigated crops and greenhouse crops (kg/ha) for each crop considered in the study. I believe that “N output (%)” is actually the percentage (by mass) of nitrogen in harvested biomass in each case, and should be stated as such, so that the actual N output (kg N/ha harvested area) associated with each crop and category is the product of yield and “N output (%)”/100. Is this correct? Given that the authors have chosen to provide this level of detail in the supplementary materials (for which I commend them), I think it would make sense to provide corresponding information for some other calculations, eg livestock & manure N calculations, etc

Figures

Fig 2 The legend reads “Spatialized crop N outputs in the Ebro River Basin. Similar maps have been created for all N inputs.” This is good, but what is the point of announcing that these additional maps have been created if they are not presented? Will they be available in the supplemental materials, or in some published reference? Fig 5a “pastures” is missing from the “rainfed and pastures” label in the figure Fig 6 (and associated discussion) What explanation do the authors offer for the increased N retention in watersheds with higher irrigation density? One might argue that this would decrease retention time, and thus reduce retention rather than increase it. Is there a relationship between irrigation density and hydraulic residence time across these watersheds?

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