**Hydrology and
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Comment

Interactive comment on **"Modeling nutrient in-stream processes at the watershed scale using Nutrient Spiralling metrics"** *by* **R. Marcé and J. Armengol**

Anonymous Referee #1

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OVERVIEW: This manuscript is a modeling exercise where the HSPF modeling code for in-stream phosphorus dynamics is changed from a more explicit process-based algorithm to a more simple nutrient spiraling configuration. The model is applied to the Ter River basin in Spain where the spiraling metrics are calibrated. The results from the modeling are compared to field measurements in the same basin. Spiraling uptake length and discharge data are mined from many previous studies to show that impacted streams show a power law between S_w and Q. The S_w v. Q relationship for impacted streams is compared to the same relationship from unimpacted streams.

GENERAL COMMENT: This manuscript is technically good, and covers an interesting

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topic. There is some similar prior work by Wollheim et al. (2006 and a few others) that should be included in the context and may help explain some of the dynamics that are being seen in this manuscript. Also, the S_w v. Q relationship may be the most notable result, but I question the validity of the relationship because of spurious correlation. There are other specific points that should be addressed, which are listed below.

SPECIFIC COMMENTS: (I use page and line number in the following way to indicate where the comment is directed: 503(12) is page 501 and line 12)

502(24): Remove last sentence on circular reasoning. This same idea comes up at the high-visibility points in the manuscript. It is a point to make once in the manuscript in the Methods section. Find something more supportive of the work to state at the end of the abstract.

503(27): 'cultural eutrophication' is a confusing term. Is the culture being eutrophied? I recommend cutting the word 'cultural'.

503: I would also note that methods mentioned in the first paragraph use real data to arrive at process. The modeling mentioned in paragraph 2 has the drawback that it is an abstraction of reality - probably less realistic than the data-driven approaches in paragraph 1.

503(27): I would replace 'However, the fundamental problem' with 'A problem'. Upscaling is a problem in modeling, but it is only one problem (not 'the' problem). You hit on other equally important issues with modeling in the previous paragraph.

506(3): I think this sentence minimizes the manuscript. See my earlier recommendation for these ideas on circular reasoning.

506: More study site information is required: temperature, precipitation, seasonality, soils, what type of industry.

507(4): What does the term 'semi-distributed' specifically mean? I see others use it, but I think it is a very poor description of a model. 'Distributed' means that the model

uses partial differential equations. 'Lumped' means that the model uses ordinary differential equations. I think HSPF uses ordinary differential equations, thus it is a lumped model. I don't think lumped means anything bad, it just describes the mathematical formulation. I suggest not using the term 'semi-distributed' because it does not mean anything specific about the model structure.

508: The correction factor is confusing. It should be better explained.

515(15): The relationship between S_w and Q has some spurious correlation, thus I question the validity of discussing any correlation. S_w can be stated as $S_w = u/k_c$ and Q can be restated as $Q = uA$ if A is stream cross-sectional area. Thus, this relationship may be simply due to the fact that u is a term in both variables. Can this be reanalyzed as $1/k_c$ versus A? A strong correlation in that relationship would be much more interesting.

517(1): Look at modeling work by Wollheim to put some context around what you are doing.

517(5): Put the Marti comparison into the Results. I was waiting for this to come up when I was reading the Results.

517(25): This is not very clear at all. This is a very important paragraph - clarify your message. I think you are suggesting that the impacted streams are showing efficiency loss. If so, look at Mulholland et al. (2008) Nature and consider where the similarity between their results and yours.

518(3-6): Again, I do not like the 'circular reasoning' idea ending all of your most important sections. Mention it one place in the manuscript - probably in the methods. And, I think the idea of models being good heuristic tools is not a strong enough point to bring it up in three places in the manuscript. I think there is a stronger statement from this research that can be mentioned in these places.

TECHNICAL COMMENTS:

504(15): This whole paragraph could be cut. It adds little and makes reading the Introduction more cumbersome.

504(26): Put this paragraph into the methods.

506(10): Sentence starting 'Thus,...' should just state the basin size. It is confusing as currently structured.

507(7): Do not tail of with '...'. Say which factors are used to simulate the basin hydrology.

507(26): First sentence can be cut. It is redundant with the section title.

508(1): What is ACA? Spell it out.

508(16): Cut 'a' from 'a power dilution dynamics'.

508(20): What do parameters a and b represent? Explain that they are parameters of the power law. Equations 1a and 1b need the b show in superscript.

510: In equations 3 and 4, show that the terms are equal to $-k_c TP$.

511(1-6): The many sentences starting with 'nonetheless' and 'however' makes the paragraph harder to understand. It sounds like you are contradicting yourself.

511(24): Change 'these data was' to 'these data were'.

512(1): 'first decimal place'. Do you mean one significant digit? The first decimal place may be quite precise depending on the number of significant digits.

514(23-24): Merge the first two sentences.

514(26): Does it 'imply' or does it say something directly? I think the latter.

515(5): Remove parentheses. Let the two sentences exist outside the parentheses.

518(2): What is the coincidence that you are referring to?

Table 2 and all Figure Captions: These captions should be understandable without the text in the body of the manuscript. Spell out the terms: S_w, TP, TPc, ACA, etc.

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