

***Interactive comment on* “Changes in discharge and solute dynamics between a hillslope and a valley-bottom intermittent streams” by S. Bernal and F. Sabater**

Anonymous Referee #2

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General Comments: In this study, the authors present a two-year record of discharge and solute dynamics in a hillslope (largely bedrock-controlled) stream and a larger, alluvial valley-bottom channel. The data indicate that the hydrologic behaviors of the two catchments are particularly divergent during transitions between the dry and wet periods, presumably due to the influence of large volumes of high-conductivity alluvium on surface-subsurface exchange. Nitrate dynamics are more distinct throughout the year, potentially due to differential assimilation and/or storage within the channel network. The authors also observed decoupling of DOC and DON dynamics that may suggest distinct contributions to these pools from terrestrial and aquatic sources during different

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periods of time and under different hydrologic conditions.

The role of catchment position as a mediator of hydrologic and biogeochemical processes is an important area of current research. Arid and semi-arid watersheds are particularly challenging in this regard because of the dramatic spatial and temporal variation in the direction and magnitude of connectivity among landscape elements. This paper extends previous work at this study site to address these dynamics. As such, this paper has the potential to make a somewhat limited but nonetheless meaningful contribution to the relevant watershed literature, but the contributions of this work are not clearly articulated or defended by this paper. This shortcoming should be addressed if the paper is to be published in HESS.

The primary limitation of this paper is the weak links between the observations within this channel network and broader questions about catchment hydrologic and biogeochemical behavior. The paper presents some interesting patterns, but their broader implications need to be more clearly articulated, particularly in the introduction, as do the novel contributions of this manuscript (either conceptual or methodological). Reading the present manuscript, I had only a limited sense of what data to expect, or what the implications of different potential findings might be. Clearer presentation of the hypotheses to be tested (with more in-depth treatment of the relevant literature) and the predictions that follow from them would make the paper much easier to understand. Essentially, the authors need to be more direct about what they think we have learned from this work. See specific comments below.

In terms of mechanisms and processes that might be important within this (and other) arid catchment, I encourage the authors to consider that the spatial decoupling of various solutes might reflect differential temporal lags within the hillslope and valley-bottom stream. That is, because of the large storage volume associated with alluvium, the water parcels passing the downstream station may be much older than the water sampled in the hillslope location. Differences between these locations may therefore represent either greater transformations within the valley bottom alluvium OR distinct inputs to

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that alluvium resulting from temporal variation in water source and routing. If this is a hypothesis the authors considered, the manuscript does not make that as clear as it could be.

Last, the manuscript would benefit from a thorough edit for grammar and word usage. I have attempted in my specific comments to identify common errors, but cannot guarantee that these corrections address all of the necessary changes. In particular, I occasionally found it difficult to understand whether ‘differences’ referred to spatial variation between the sampling stations or temporal changes in one or both stations over time.

Specific comments: The abstract should more explicitly state the questions and hypotheses under investigation, and the conceptual and methodological contributions .

To re-iterate my earlier comments, I think the introduction would be improved by explicitly stating the questions and hypotheses that this research will address. Revisions should also clearly identify the contributions of this paper in terms of the novelty of the approaches and study site and how these relate to previous studies. What do we expect to learn from this paper that is not already known?

9508.8-10: These are the observations that motivate the work, but how does this study address them? Need to link observations to broader concepts more directly.

9608:20: The authors present expectations based on some imprecisely defined hypotheses, but this section would be more useful if the predictions that follow from alternative hypotheses were also clearly articulated. The author’s a priori expectations are not particularly relevant to subsequent interpretation of the data.

Study Site: In the Study Site description, it would be useful to clarify how this site differs (if at all and if known) or might differ from other studies where similar studies have been conducted.

Methods Overall, descriptions of field measurements and statistical analyses were

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clear. 9511.17: Was time-of-day held relatively constant within and among sampling stations? When were samples collected? Is there any evidence for diel variation in solute chemistry?

Results: I found the results (including tables and figures) to be generally clear and well-constructed.

Discussion: Overall, the discussion is much more effective at conveying the main questions and hypotheses that motivated this project than does the introduction. Consider using some of the same language from the beginning and end of the discussion in the introduction. In terms of organization, the discussion might flow better if the order of sections 5.2 and 5.3 were reversed, since the inorganic solute dynamics seem much more closely tied to the water fluxes dynamics.

9520.10-20: That solute fluxes are closely related to discharge seems intuitive and not particularly noteworthy, unless there is significant reason to expect deviations from that relationship (e.g. evaporation, OM production). Be more explicit about what hypotheses are being assessed via this analysis.

Technical corrections (page.line): 9506.2 (and elsewhere): Should read: “differences in stream water flux as well as in. . .” 9506.4: “Both streams. . .” 9506.5: Use of embraced here and elsewhere is not standard usage. Consider substituting ‘surrounded’, ‘bordered’ 9506.6: Delete ‘We found that’ and begin sentence with “Stream water. . .” 9506.9-11: Consider re-phrasing to clarify whether decreases are spatial or temporal. 9506.22 “reduced” 9507.8: Relevant to what? Catchment-scale export? At what time scales? 9509.15: consider substituting enveloping, surrounding, or underlying for ‘embracing’ 9510.7: It would be helpful if this sentence clearly identified how the catchments are similar and different: ‘. . .draining nested catchments that differed in X, Y and Z’ so that readers can quickly understand the rationale and limitations of this comparison. Results: Discussion: 9517.21: Delete “at the catchment scale and it can modify” and replace with “to” 9518.1: Replace ‘specially’ with ‘specifically’ or ‘only’, as

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differences during other periods seem to be minimal. 9518.22: Delete “contribute to” 9518.23: “disproportionately” 9518.24: ‘downstream of...’ 9519.5-7: This sentence is unclear. 9519.10-11: Replace ‘respond to’ with ‘reflect’ 9519.16-19: Is the implication really limited to these two catchments? Consider rephrasing to broaden this conclusion. 9521.9: See also Lutz et al. 2012 L&O 57(1):76-89.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 9505, 2011.

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