

Authors' response to Reviewer 1's comments for HESS-2025-6244 entitled '*Spatially variable wildfire impacts on sediment mobilization: event-scale evidence from eastern Australian catchments*'

By Qian Wang, Danlu Guo and Peter Hairsine

Note: the review comments are reproduced below in black. Our responses are presented in blue, within which, proposed revisions are underlined.

Overview

The manuscript titled "*Spatially variable wildfire impacts on sediment mobilization: event-scale evidence from eastern Australian catchments*" studies the impact of the fire on C-Q slope and hypothesize that the extreme burning and recent hydro-climatic conditions drive the sediment mobilization in recently burned watersheds. It is an interesting study and the authors have a valuable post-fire dataset. After reading it, however, I think the manuscript requires substantial revision before it can be accepted for publication. The main concerns are presented below, followed by detailed comments. I hope this revision will help guide a stronger analysis.

We appreciate the thorough evaluation of our manuscript and the constructive feedback provided by the reviewer. We include detailed responses to your individual comments and our proposed revisions below.

Major comments

1. **C-Q analysis – methodology used:** The C-Q analysis, in particular on the selection of slope as explanatory variable, would benefit a more detailed methodological justification. Hysteresis index and flushing index are standard metrics used to compare C-Q relationships across sites and studies. The manuscript currently focuses on the slope of the relationship, but this choice is not clearly explained. The authors should justify why the slope is important and which are the mechanisms that could create a change, or they should consider adopting hysteresis and flushing indexes to facilitate comparison with the literature. The authors can Jing et al. (2024) ([https:// doi.org/10.1029/2024WR037216](https://doi.org/10.1029/2024WR037216)) for reference.

Thank you for the constructive comment. As the reviewer has pointed out, the C-Q relationships can be measured by different metrics, including the hysteresis and flushing indexes. Among them, the power-law function has often been used to quantify the C-Q relationship, for which the slope is usually interpreted to understand the biogeochemical processing, and the temporal evolution of source contributions over the course of individual storm event. As such, the C-Q slope can be interpreted to infer key sediment transport processes. Particularly, slopes close to zero are indicative of chemostatic behaviour, whereas negative and positive slopes indicating dilution or mobilisation / enrichment type behaviour, respectively (Knapp et al., 2020). Considering the main aim of our work - to examine how fire and short-term hydrologic conditions interact to shape sediment dynamics, the C-Q slope supports this aim by offering a direct and powerful assessment of event-scale sediment export. We propose adding further clarifications of using the power-law C-Q model and the slope as the explanatory variable in the Methods section 2.2, at

the start of description of the analytical/modelling approach, as:

- “We use the classic power-law C-Q model to represent the relationship between turbidity and flow during each event, and the model parameters are estimated for each event. The values of C-Q slopes between concentrations and flows indicate different types of riverine export dynamics: slopes close to zero indicate chemostatic behaviour, whereas negative and positive slopes indicate dilution or mobilisation / enrichment type behaviour (Knapp et al., 2020; Zhang, 2018). Considering the main aim of our work - to examine how fire and short-term hydrologic conditions interact to shape sediment dynamics, the C-Q slope supports this aim by offering a direct and powerful assessment of event-scale sediment export.”

2. **Fire severity – soil burn severity:** Fire severity (or soil burn severity) measures the magnitude of the impacts of fires on vegetation (and soil). Fire severity is easily obtained by remote sensing images, while soil burn severity needs in situ measurements. The threshold the authors use (0.1% extreme burn), which seems a very low threshold. They use Rhoades et al. (2011) and Marcotte (2024) which don't mention this threshold in their study. I suggest using fire severity – in particular percentage of high severity – as a variable.

Thank you for this helpful comment. We clarify that we do not use in-situ measurements of soil burn severity in this study; instead, we use fire severity obtained from regional mapping (as specified in Section 2.1). We agree that the previously used 0.1% extreme-burn threshold was not sufficiently supported by the cited literature. We have therefore removed this threshold. In response to the reviewer's suggestion, we have decided to use a higher 10% threshold and for total burnt area instead, which is better supported by literature. Accordingly, we propose adding the following clarification and justification of this decision in Methods Section 2.1 as below.

- “As the objective of this study was to examine sediment dynamic changes associated with the 2019/2020 fire season, candidate catchments were screened to minimise potential interference from substantial fire disturbance during preceding years. We did not require catchments to have experienced no previous burning, as small or spatially limited fires would not necessarily produce a detectable catchment-scale response. Instead, catchments where $\geq 10\%$ of their area had burned during the preceding fire seasons were not included. This value was used as a pragmatic screening criterion for substantial prior fire disturbance rather than as an assumed threshold for the onset of post-fire sediment responses. Evidence for post-fire hydrological change indicates that catchment responses can occur following relatively modest disturbance extents: effects on streamflow have been detected at disturbance levels as low as $\sim 7\%$ of catchment area (Buma and Livneh, 2017), although changes in annual water yield are more commonly reported when approximately $\geq 20\%$ of a catchment

is disturbed. Evidence specifically for post-fire sediment and water-quality responses likewise demonstrates a strong dependence on burn extent and severity. For example, Rhoades et al. (2011) found that post-fire turbidity increased with both total burnt area and the proportion burnt at high severity, with catchments having >45% high-severity burning exhibiting approximately fourfold higher turbidity than less severely affected catchments; Wilson et al. (2021) similarly found increasing hillslope-to-stream sediment delivery and channel change with the proportion of catchment burnt at high severity. Reflecting this evidence, Murphy et al. (2023) recommended a minimum of 10% of drainage area burnt at moderate-to-high severity when selecting catchments for investigating post-fire water-quality responses. Collectively, these studies support the use of 10% burnt area as a conservative screening criterion for prior fire disturbance that could plausibly influence subsequent sediment dynamics, while also demonstrating that the magnitude of response depends strongly on fire severity and other catchment and hydroclimatic controls. We therefore did not impose a separate numerical threshold for high- or extreme-severity burning, for which a generally applicable catchment-scale threshold is not well established. Importantly, the 10% criterion was used only to screen for potentially confounding prior fires and was not imposed in the statistical model. Spatial variation in model-inferred post-fire sediment responses to the 2019/2020 fires was subsequently evaluated against continuous measures of catchment burn extent and severity (Section 2.4).”

We also clarify that the 10% burnt area threshold is used only to screen catchments for potentially confounding fire disturbance in preceding years; it is not imposed as a threshold for post-fire sediment response in our modelling. Instead, burning extent and severity for the 2019/2020 fire season studied are instead considered as continuous variables for explaining variation in the model-inferred sediment responses. These were also clarified in the proposed additional text above.

3. **Results:** The results section is currently confusing and should be reorganized. In addition, the authors make several interpretative claims (a variable “increase” or “play a critical role”) without presenting statistical evidence. A form of statistical analysis is necessary to support those statements. The authors should conduct appropriate statistical tests and clearly present the results, acknowledging any limitations of the approach.

Thank you for this comment. We will add an overview paragraph at the start of the Results to better clarify the purpose of each subsection, as:

- *“This section presents results from both our preliminary analysis before applying the Bayesian Hierarchical Model (Section 3.1), and the model inference (Section 3.2). Specifically, the former focuses on statistical analyses of the flow and turbidity data pre- and post-fire. The latter looks at the modelled*

effects of fire occurrence and short-term hydrological drivers on the event-scale C-Q slopes, and a comparison between them (Sections 3.2.1 and 3.2.2); the spatial patterns of the fire effects were further explored to understand how they change with catchment characteristics (Section 3.2.3)."

Further, we will also add specific clarification and evidence especially in Sections 3.2.1 and 3.2.2, and ensuring all model inferences (e.g., descriptions of effects) are supported by corresponding statistical tests, such as the 95% confidence interval values. We will also acknowledge limitations of these tests accordingly.

4. **Discussion:** The discussion is currently short and presents only a handful of references. The authors should expand the discussion and interpret their findings with the existing literature on post-fire impacts on sediment yield, water balance, and C-Q dynamics (right now they are citing only three references). The Discussion should also address what the results reveal about the hydrological and erosion consequences of fire, how these compare with findings from similar catchments internationally, and what mechanistic explanations can be offered.

Thank you for the constructive comment on Discussion. We propose revising the Discussion with the following changes:

- (1) We will restructure both the Introduction and Discussion Section 4.1 to allocate/revise materials appropriately.
- (2) We will substantially expand the discussion of our main findings in the context of previous studies of post-fire hydrological and sediment responses, including both Australian and international evidence. For post-fire hydrology, we will draw on studies reporting changes in streamflow and water balance following wildfire, while recognising the important influence of post-fire hydroclimatic conditions (e.g., Khaledi et al., 2022; Brucker et al., 2025). We will separately discuss the more directly relevant evidence for enhanced post-fire sediment mobilisation, concentrations and yields, including Australian and international studies (e.g., Smith et al., 2011; Wilson et al., 2021; Johnston & Maher, 2022). This literature will provide context for interpreting the increases in discharge and turbidity observed at most of our burnt sites, including the potential combined influence of wildfire and the subsequent flooding period.

We will also expand the comparatively limited discussion of post-fire changes in sediment C-Q relationships. Previous studies using sediment rating curves or C-Q relationships have reported systematic post-fire changes and subsequent recovery, including studies from southeastern Australia and the 2019/2020 Black Summer fires (Johnston & Maher, 2022), as well as recent international studies (e.g., Clow et al., 2024; Richardson et al., 2024). We will use these studies to contextualise our finding that, despite increases in turbidity at most burnt sites,

the inferred fire effects on C-Q slopes vary in both magnitude and direction among catchments. We will discuss possible mechanisms underlying this heterogeneity, including interactions among fire severity, sediment availability and connectivity, catchment geomorphic and vegetation characteristics, and event hydrological conditions. We will also discuss the implications of this inter-catchment and inter-event variability for understanding and managing post-fire water-quality responses. The revised Discussion will recognise the continuing scarcity of high-frequency post-fire water-quality observations as an important constraint on such comparisons (Murphy et al., 2023).

- (3) Second, we will expand Section 4.2 to more explicitly compare the catchment and fire characteristics associated with variation in post-fire sediment responses in our study with those identified previously. This will include hydroclimatic and antecedent conditions (Marcotte et al., 2024), vegetation and soil characteristics (Hall et al., 2022), spatial configuration of burnt and unburnt areas (Brown & Hunt, 2025; Raoelison et al., 2023), burn extent and severity (Richardson et al., 2024; Wilson et al., 2021), sediment connectivity (Clark et al., 2024), and time since fire (Johnston & Maher, 2022). These comparisons will be used to interpret the catchment characteristics identified as important in our analysis and to discuss why post-fire sediment responses may differ substantially among catchments.

Specific comments

1. Line 13: Underline divers. Is it divers the correct word?
This should be ‘drivers’ – we will revise it accordingly.
2. Line 32-38: The sentences are redundant.
We will revise sentences 29-38 to reduce redundance while keeping key messages summarized from the literature, as:
 - *“Wildfires – commonly regarded as extreme events – are occurring with increasing frequency and intensity (Cunningham et al., 2024). These events can alter the hydrological and biogeochemical processes in forested catchments, including reduced canopy interception, increased soil erodibility, and loss of surface cover, which enhance runoff and sediment mobilization (Meyer et al., 2001; Shakesby, 2011; Nolan et al., 2014). These effects can together lead to changes in river water quality conditions (Smith et al. 2011; Mast et al. 2016; Chen and Chang 2023; Marcotte et al. 2024), such as the elevated levels of exports and concentration metrics (e.g., maximum and average values) of suspended sediment and nutrients (e.g., total nitrogen and total phosphorus) (Hampton et al. 2022), particularly in the first year after fire (Smith et al. 2011).”*
3. Line 72: The 0.1% threshold used to classify extremely burned appears very low and lack of justification. The references used to support this don’t report the threshold in their studies. In particular, Rhoades et al. (2011) report a high-

severity burned area of 45% with significant impacts on nitrate and turbidity. I also don't see any references in Marcotte et al. (2024) and Khaledi et al. (2022). Please rephrase it. Please provide an explicit citation and a brief justification for its use in this context. If it is an independent choice by the authors, a clearer rationale is needed.

Thank you for this comment. Please find relevant clarification and proposed revision detailed in our response to your Major Comment #2.

4. Line 119-123: I think it is not necessary to report that initially you were applying 1.5 years before and after the fire. I think you can explain why pre-fire and post-fire periods are different length directly.

Thank you for the helpful comment. We propose revising the text as follows:

- *“The pre- and post-fire periods use 2.5 and 1.5 years, respectively, given that the 1.5 years generally resulted in too few events pre-fire relative to the post-fire period across all catchments”*

5. Line 133 – Can you spell out NSW and BFI?

NSW and BFI will be spelled out accordingly in the revised manuscript as New South Wales (NSW) and Baseflow Index (BFI).

6. Table 3 – Normalized distance to outlet – please clarify how it was determined for watersheds in which no extreme burn pixels were identified. What value was assigned in these cases?

In the analysis, the calculation of normalized distance to outlet was only applied to the burnt catchments for studying the impacts of catchment characteristics on how C-Q slopes vary after the fire. This has been specified in the paragraph above the table, specifically with ‘As a final investigation, we explored how the effect of fire changes across the burnt catchments which have greater than zero area burnt’.

7. Line 224 – Please be more specific about which catchments behave differently and why. Alternatively, if catchment-level detail is not the focus of this analysis, consider normalizing flow and sediment yield by catchment area and presenting merged boxplots grouped by category (e.g., extreme burn, non-extreme burn, unburned). This would facilitate a cleaner comparison across sites.

The two catchments behaved differently are catchments 215215 and 213211, and we propose adding such details in the revision. Figure 2 presents that discharge experienced significant changes at most burnt and unburnt sites, while unburnt sites did not show significant turbidity changes. The focus is not on a single site but the comparison between burn and unburn catchments. Given that fire is not the only driver to C-Q slope changes, other catchment characteristics (e.g. catchment area, forest formation types) are also important drivers to investigate, the catchment details are kept. This figure intends to compare pre-

/post-fire flow and sediment responses across burning and unburnt catchments, but also observe cross-catchment differences; as such, we prefer to keep the current figure configuration to satisfy both visualization purposes. As highlighted in our response to your major Comment #3, we will add an overview section of the Results to better clarify the purpose of each Results subsection, which we believe will help resolve this confusion.

8. Do C-Q relationships vary by season?

Yes, the C-Q relationships vary by season, which can be reflected by the slope and intercept of the power-law C-Q model. The seasonal variation has been incorporated in our model for the event-specific C-Q slopes by inclusion of predictors reflecting the short-term hydrological conditions (Equation 3).

9. Figure 3 –The figure is difficult to interpret because it is unclear how post-fire changes in C-Q relationships can be assessed from it. Please revise figure.

We will revise the figure to show changes in C-Q relationships. We acknowledge that this figure is intended to demonstrate our point that ‘there is no universal post-fire increases in the C-Q slopes for the extremely burnt catchments’ – and our revision will demonstrate this point more clearly.

10. Figure 4 – Which beta are you referring to? In equation 2 the slope is denoted as $b_{s,e}$, whereas beta are the slopes in equation 3. In addition, the justification for using the slope of C-Q relationship is unclear.

The y-axis label in Figure 4 refers to the event-specific C-Q slope, $b_{s,e}$ in Equation 3. As mentioned in the response to the first major Comment (#1), we propose adding justification of using the slope of C-Q relationship in the Methods section.

11. Line 251 – The sentence is unclear, please revise it.

We propose revising the sentence to “The above results indicate that post-fire periods are associated with both higher flows and changed sediment mobilization”.

12. Line 258 – Log space or log scale? Please replace 'log space' with 'logarithmic scale', which is the standard terminology in this context, or describe the reason of using log space.

Thank you for this comment. Here, “log space” referred to the analysis being performed after base-10 log transformation, rather than simply displaying the data on a logarithmic scale. To avoid ambiguity, we will revise the terminology to explicitly state this:

- “Figure 5 compares all posterior simulations of turbidity from the Bayesian hierarchical model with observed turbidity in log10-transformed space”.

13. Figure 5 - Please replace the current legend with a continuous chromatic legend spanning the full range of values (1 to 245,100) to allow easier visual interpretation. Additionally, you don't need three decimal places for NSE values. Thank you. The figure will be revised accordingly.

14. Line 270 – Please clarify what do you mean by “negative” and “positive” effect? Does “negative effect” refer to a decrease in the C-Q slope?
Thank you for the comment. We propose revising this sentence with the following additional clarification:

- “Specifically, a positive effect will steepen the C-Q slopes – increasing the positive slope or decreasing the negative slope; in contrast, a negative effect flattens the slope. So a confidence interval not overlapping the zero line indicates either a steepening or flattening effect of fire on the C-Q relationship.”

15. Line 276 – The sentence refers to C-Q slopes derived from observed data. This information would be appropriate to present in section 3.1 rather than in the modelling section.

Thank you for the suggestion. The sentence focuses on the finding revealed by Figure 6 i.e., C-Q slopes inferred from the Bayesian hierarchical model; therefore, we think it suits better it in the current section. Instead, we propose revising the sentence for a clearer statement.

- “The other catchments with less extreme burning (<10% catchment area), along with the non-extremely burnt catchments, did not see a consistent post-fire positive impact increase in the modelled event C-Q slopes.”

16. Line 277 – “Fire has not had a clear impact on sediment export” cannot be adequately support using the C-Q slope alone. The slope of the C-Q relationship does not capture information about changes in sediment source dynamics. To assess whether the dominant erosion source has changed (for example from in-channel to hillslope erosion following fire), the hysteresis index and flushing index are required, as they characterize the direction and shape of the relationship. Without these metrics, I think that an important component of the post-fire sediment response remains unexamined.

Thank you for the insightful comment. We first clarify that we are not inferring on sediment sources, but instead on sediment export patterns. Further, based on the response to your major Comment #1 above, we will add justification to the manuscript on why the C-Q slope is a suitable indicator for revealing changes in sediment export patterns. In addition, we propose revising this sentence for a clearer finding demonstrated by the results, as: “Fire has not had a clear one-directional (i.e. positive or negative) impact on the sediment export”.

17. Line 282 – Add reference to Figure 6c.

Thank you for noting it. We propose adding the reference as suggested:

- “The last event volume ($\beta_{5, Q_{lastvolume}}$ in Eq. 3) has clear positive effects on C-Q slopes for 5 out of the 14 catchments, and clear negative effects for another 6 catchments (Fig. 6c)”

Likewise, we will add the corresponding reference to Figure 6d for the next sentence.

18. Line 293 – Where can I see this information? Are there any statistics supporting the increase?

The values of 95% confidence interval represent the effect of drivers on C-Q slope as clarified in Section 3.2.1 that “In particular, a 95% confidence interval that does not cross the zero line indicates that the corresponding driver has a clear positive or negative effect on the C-Q slope (i.e., it either steepens or flattens the relationship)”.

To make the supporting information clearer, we propose revising these sentences as:

- *“For example, the third most severely burnt catchments (212042) did not even experience an increase in the post-fire C-Q slopes as the negative 95% confidence interval is below zero line; in contrast, some less severely burnt catchments (208004, 208011, 208009) demonstrated clear increases in the post-fire C-Q slopes, with the entire 95% confidence interval being positive.”*

19. Figure 7 – why do you think the eucalyptus medium open has the highest correlation?

Thank you for flagging this. We propose revising our modelling in response to several comments received (e.g., major Comment #2 from you, detailed Comment #17 from reviewer 2), which will likely result in updating of this figure. We will add clarification and discussion of possible explanations for the updated figure.

20. Line 335 – Discussion 4.1. The content of this section reviews background knowledge from the literature. This material would be more appropriate in the introduction section. In the discussion, the authors should instead focus on interpreting their own results in relation to existing findings.

Thank you for the suggestion. We will investigate a restructuring of both the Introduction and Discussion Section 4.1 to allocate/revise materials appropriately.

21. Line 367 – The sentence beginning with “while..” is incomplete. Please revise it. rephrase.

We propose removing “while” from sentence.

22. Discussion 4.2 + 4.3 – Those sections together are ~40 lines and cite only 3 references. This is insufficient for a meaningful discussion of the results. The authors should use these sections to interpret their findings, explain the mechanisms underlying the observed patterns, compare their results with those from other studies, and acknowledge uncertainties and limitations.

Thank you for the constructive comment. We propose expanding the Discussion section with more relevant references included, together with a more comprehensive discussion of our results in the context of existing literature.

23. Figure A2 – what do the grey crosses represent?

The grey crosses represent non-significant correlations. We will add this clarification to the figure caption.

References

Brucker, C.P., Livneh, B., Rosario-Ortiz, F.L. et al. Wildfires drive multi-year water quality degradation over the western United States. *Commun Earth Environ* 6, 489 (2025). <https://doi.org/10.1038/s43247-025-02427-6>

Buma, B., & Livneh, B. (2017). Key landscape and biotic indicators of watersheds sensitivity to forest disturbance identified using remote sensing and historical hydrography data. *Environmental Research Letters*, 12(7), 074028.

Clark, G.D., Murphy, S.F., Skalak, K., Clow, D.W., Akie, G., Carpenter, K.D. et al. (2025) Hysteretic response of suspended-sediment in wildfire affected watersheds of the Pacific Northwest and Southern Rocky Mountains. *Earth Surface Processes and Landforms*, 50(1), e6067. Available from: <https://doi.org/10.1002/esp.6067>

Clow, D. W., Akie, G. A., Murphy, S. F., and Gohring, E. J. (2024): Dynamic water-quality responses to wildfire in Colorado, *Hydrological Processes*, 38, e15291, <https://doi.org/10.1002/hyp.15291>.

Hall, N., Rust, A., Hogue, T. S., and Singha, K. (2022): Analysis of watershed parameters controlling turbidity following the West Fork Complex fire, *Journal of Hydrology*, 609, 127712, <https://doi.org/10.1016/j.jhydrol.2022.127712>.

Johnston, S. G. and Maher, D. T. (2022): Drought, megafires and flood - climate extreme impacts on catchment-scale river water quality on Australia's east coast, *Water Research*, 218, 118510, <https://doi.org/10.1016/j.watres.2022.118510>.

Khaledi, J., Lane, P. N. J., Nitschke, C. R., & Nyman, P. (2022). Wildfire contribution to streamflow variability across Australian temperate zone. *Journal of Hydrology*, 609, 127728. <https://doi.org/10.1016/j.jhydrol.2022.127728>

Knapp, J. L. A., von Freyberg, J., Studer, B., Kiewiet, L., and Kirchner, J. W. (2020): Concentration–discharge relationships vary among hydrological events, reflecting differences in event characteristics, *Hydrol. Earth Syst. Sci.*, 24, 2561–2576, <https://doi.org/10.5194/hess-24-2561-2020>.

Marcotte, A. L., Limpens, J., Nunes, J. P., Howard, B. C., Hurley, A. G., Khamis, K., Krause, S., Croghan, D., Kourmouli, A., Leader, S., Singh, T., Stoof, C. R., Ullah, S., and Kettridge, N. (2024): Enhanced Hydrologic Connectivity and Solute Dynamics Following Wildfire and Drought in a Contaminated Temperate Peatland Catchment, *Water Resources Research*, 60, e2023WR036412, <https://doi.org/10.1029/2023WR036412>.

Murphy SF, Alpers CN, Anderson CW, Banta JR, Blake JM, Carpenter KD, Clark GD, Clow DW, Hempel LA, Martin DA, Meador MR, Mendez GO, Mueller-Solger AB, Stewart MA, Payne SE, Peterman CL and Ebel BA (2023) A call for strategic water-quality monitoring to advance assessment and prediction of wildfire impacts on water supplies. *Front. Water* 5:1144225. doi: 10.3389/frwa.2023.1144225

Raoelison, O. D., Valenca, R., Lee, A., Karim, S., Webster, J. P., Poulin, B. A., & Mohanty, S. K. (2023). Wildfire impacts on surface water quality parameters: Cause of data variability and reporting needs. *Environmental Pollution*, 317, 120713. <https://doi.org/https://doi.org/10.1016/j.envpol.2022.120713>

Rhoades, C. C., Entwistle, D., & Butler, D. (2011). The influence of wildfire extent and severity on streamwater chemistry, sediment and temperature following the Hayman Fire, ColoradoA. *International Journal of Wildland Fire*, 20(3), 430-442.

Richardson, C., Montalvo, M., Wagner, S., Barton, R., Paytan, A., Redmond, M., and Zimmer, M. (2024): Exploring the complex effects of wildfire on stream water chemistry: insights from concentration-discharge relationships, *Water Resources Research*, 60, e2023WR034940, <https://doi.org/10.1029/2023WR034940>.

Smith, H. G., Sheridan, G. J., Lane, P. N. J., Nyman, P., and Haydon, S. (2011): Wildfire effects on water quality in forest catchments: A review with implications for water supply, *Journal of Hydrology*, 396, 170–192, <https://doi.org/10.1016/j.jhydrol.2010.10.043>.

Wilson C, Kampf SK, Ryan S, Covino T, MacDonald LH, Gleason H. Connectivity of post-fire runoff and sediment from nested hillslopes and watersheds. *Hydrological Processes*. 2021; 35:e13975. <https://doi.org/10.1002/hyp.13975>

Zhang, Qian. "Synthesis of nutrient and sediment export patterns in the Chesapeake Bay watershed: Complex and non-stationary concentration-discharge

relationships." *Science of the Total Environment* 618 (2018): 1268-1283.