UNIVERSIDAD DEL BÍO-BÍO

Interactive Discussion: Author Response to Reviewer 01

Variability and persistence of scour at bridges using stochastic simulations

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RC: ***Reviewer Comment***, AR: Author Response, □ Manuscript text

Dear Reviewer 01 (Panayiotis Dimitriadis),

Thank you for taking the time and effort to review this manuscript. Surely, incorporating your suggestions will improve the manuscript's readability and overall quality. Please find our responses to your comments below. These should be considered as preliminary (part of the interactive discussion) since the actual implementation of changes depends on the editorial decision. Below, we list reviewer's comments verbatim in bold, followed by responses to these comments in blue.

Thank you again for your helpful feedback!

Kind regards,

Alonso Pizarro, Oscar Link, and Demetris Koutsoyiannis

RC 1: ***In this study, the Authors analyze the observed variability of the scour effect at bridges using stochastic simulation tools and schemes, by estimating and preserving vital stochastic properties of scour, such as the long-term persistence and the fractal behaviour, by using high-quality hourly streamflow timeseries with over 20 years of length, and calculating the scour effect through the BRISENT model; please see some (mostly minor) suggestions that I hope they can be helpful to the Authors to further highlight their innovative work.***

AR 1: Thank you for your comments and suggestions.

RC 2: ***In the Title of the manuscript (i.e., ": Variability and persistence of scour at bridges using stochastic simulations"), I would recommend keeping the "persistence" since if a process is considered persistent, then it will also show high variability.***

AR 2: Thank you for raising this issue in the manuscript's title. Indeed, we fully agree with what the reviewer stated. With the intention to avoid rewording, we will update the manuscript

title from *"Variability and persistence of scour at bridges using stochastic simulations"* to *"Stochastic and deterministic properties of scour at bridges using stochastic simulations"*.

RC 3: ***I would recommend replacing the "non-stochastic properties of the scouring process" to "deterministic properties of the scouring process".***

AR 3: We entirely agree. We will replace the section title as suggested in the revised manuscript, i.e. from *"3.2 Non-stochastic properties of the scouring process"* to *"3.2 Deterministic properties of the scouring process"*.

RC 4: **I would recommend that "Observations" shown in Table 3 cannot be "Assumed stationary" and "Nonstationary" but rather the model used to simulate them can be either stationary or non-stationary (see for example, the work by Koutsoyiannis and Montanari, 2015; doi:10.1080/02626667.2014.959959, which describes exactly this issue and its consequences in stochastic simulation).**

AR 4: We apologise for this confusion. In Table 3, *"Observations"* was related to a comment in the table and not to the data analysed. We fully agree with the Reviewer's comment that "stationarity" or "nonstationarity" are characteristics of the model rather than the data. With the intention to avoid confusion and misinterpretation, the revised manuscript will change the wording from *"Observations"* to *"Comments"*.

RC 5: **Please note that the case H=0.0 shown in Table 3, can be very difficult to mathematically simulate it; I would recommend to replace it to the H>0 case.**

AR 5: Thank you for the suggestion. We will replace "=" by ">" (i.e., positive case).

RC 6: **Please consider further explaining in more detail the 3 key parameters in the BRISENT model (i.e., λ, W, and S) since some Readers may not be familiar with these terms.**

AR 6: In Section 2.3 (Computation of time-dependent local scour and fill at a bridge pier), we will add additional information on the BRISENT model parameters.

RC 7: **In the sentence "It is worth mentioning that rough dynamics (i.e., $M < 0.5$) instead of a smooth one (i.e., $M > 0.5$) is usual in many hydrological processes at the analysed hourly scale such as the cases of near-surface temperature, relative humidity, dew point, sea level pressure, wind speed, and precipitation (see, e.g., Dimitriadis et al., 2021b..."), I would recommend replacing the Dimitriadis et al., 2021b (which coincides with Dimitriadis et al., 2021a) to the more relevant study by Pizarro et al. (2022; doi:10.3390/hydrology9070126), where they also estimate important stochastic properties such as the fractal and Hurst parameters.**

AR 7: Thank you for this suggestion. Pizarro et al. (2022) analysed the marginal and dependence structure of streamflow, considering fine-scale records to multi-centennial paleoclimatic reconstructions (i.e., from minutes to centuries). We will add the reference in the main text as suggested.

Reference:
Pizarro, A., Dimitriadis, P., Iliopoulou, T., Manfreda, S., & Koutsoyiannis, D. (2022). Stochastic analysis of the marginal and dependence structure of streamflows: from fine-scale records to multi-centennial paleoclimatic reconstructions. Hydrology, 9(7), 126.

RC8: Please consider discussing the work by Vavoulogiannis et al. (2021; doi:10.3390/hydrology8020063), where the AMA model is applied and the asymmetry of streamflow is estimated as prominent at time scales up to four days.

AR 8: The suggested work by Vavoulogiannis et al. (2021) is indeed very relevant for the presented work. We will mention it in terms of the relevance of considering asymmetry in streamflow at time scales up to four days. We will clarify this by adding the following sentence in line 133 (preprint):

> … Interesting the fact that $\theta(\omega) = 0$ implies time symmetry and AMA converges to the symmetric moving average (SMA) scheme. However, $0 < \theta(\omega) \leq 1/4$ preserves time asymmetry. As a consequence, $\theta(\omega)$ must be chosen to preserve the skewness ratio. It is worth mentioning that time asymmetry is an important feature of streamflow at time scales up to four days (see Vavoulogiannis et al. 2021, and Koutsoyiannis 2019) and consequently, it should be preserved when working at the hourly scale…

References:
Vavoulogiannis, S., Iliopoulou, T., Dimitriadis, P., & Koutsoyiannis, D. (2021). Multiscale temporal irreversibility of streamflow and its stochastic modelling. Hydrology, 8(2), 63.

Koutsoyiannis, D. (2019). Time's arrow in stochastic characterization and simulation of atmospheric and hydrological processes. Hydrological Sciences Journal, 64(9), 1013-1037.