UNIVERSIDAD DEL BÍO-BÍO

Interactive Discussion: Author Response to Editor

Persistence of scour at bridges using stochastic simulations

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EC: ***Editor Comment***, AR: Author Response, □ Manuscript text

Dear Editor (David J. Peres),

Thank you for taking the time and effort to deal with this manuscript. Surely, incorporating all suggestions is improving the manuscript's readability and overall quality. Please find our responses to your comments below. Below, we list editor's comments verbatim in bold, followed by responses to these comments in blue.

Thank you again for your helpful feedback!

Kind regards,

Alonso Pizarro (on behalf of all co-authors)

EC 1: ***Dear authors,***

thank you for the revised version of your manuscript.

I went through the manuscript and decided that your manuscript should undergo minor revisions. In particular, I think that the motivation for analysing the correspondence between streamflow and scour extreme events should be more explicitly stated (Section 2.4 and then results). Presumably, the underlying question is whether a flood event associated with a given return period can be assumed to produce a scour depth characterised by the same return period. If this is the intended rationale, it should be stated explicitly and demonstrated quantitatively, or at least discussed with some more detail. A low CSI indicates poor temporal correspondence between detected streamflow and scour events, but it could not by itself demonstrate that conventional streamflow-based design produces biased scour return levels.

I am looking forward to receiving your revised manuscript.
Best regards,
David J. Peres

AR 1: Thank you for your comments and feedback on our MS. We fully agree that the underlying question is whether a flood event associated with a given return period can be assumed to produce a scour depth characterised by the same return period. As indeed, this is the intended rationale, we stated it explicitly in the text. In particular, we changed the following parts:

Introduction, L62:

> … A flood event associated with a given return period can be assumed to produce a scour depth characterised by the same return period? …

Section 2.4 Extreme events detection and return periods (after L200):

> … A low CSI indicates poor temporal correspondence between detected streamflow and scour events, but it could not by itself demonstrate that conventional streamflow-based design produces biased scour return levels…

Section 3.2 Deterministic properties of the scouring process (L285-288):

> … A trend from symmetric to positively asymmetric distribution of CSI's values for ξ equal 1.0 to 2.0 (CSI median values are 0.33, 0.32, and 0.30 for ξ equal 1.0, 1.5, and 2.0, respectively) is observed. The resulting low CSI values indicates poor temporal correspondence between detected streamflow and scour events. However, this does not necessarily imply that streamflow-based design produces biased scour return levels…

Section 3.2 Deterministic properties of the scouring process (L295-313):

> … Notice that z_{eq} was computed with the equilibrium scour equation by Sheppard et al. (2014) (i.e., from Eq. 21 to Eq. 29) and assuming hydraulic variables associated with a 100-year flood event. Therefore, if $z_{T=100} = z_{eq}$ (i.e., the median of scour depths with T = 100 years computed from scour time series is equal to the equilibrium scour depth), the same return period will be related to both processes. In all cases, the scour depth to equilibrium scour depth ratio (z/z_{eq}) increased with ξ. In most analysed cases, scour depths computed with scour time series were different and higher than the equilibrium scour depth (especially for T = 200 and T = 300 years). As a consequence, and considering that the median for $z_{T=100}/z_{eq}$ is between 0.93 and 0.95 (for all analysed ξ), a given return period of streamflow does not necessarily translate into the same return period of scour. Exceedance probabilities for $z_{T=100}/z_{eq}$ were lower than 0.0076 for all analysed cases. Table 4 shows the exceedance probability for $z/z_{eq} > 1.0$….

Conclusion:

> … Scour–streamflow synchronisation is weak: The Critical Success Index (CSI) values between streamflow and scour extreme events ranged between 0.15 and 0.60, with mean values around 0.30 to 0.35, showing that not all hydrological extremes translate directly into scour extremes, and thus the time-dependent scour computation caused by long hydrographs is important in scour analysis.…