

## Review EGUSPHERE-2025-6530

**Note:** I have contacted the editor and NHSS twice because I feel unable to review a large part of this manuscript. However, I have received no reply. The hydrodynamic concepts and the stochastic tools that the authors refer to, are out of my domain. **I am not able to judge the scientific correctness of their approach and would therefore advise to find another reviewer.**

In lack of any response, I will now submit a partial review and will point out for which points an additional reviewer should be consulted. I regret the delay that this situation has caused the authors and apologize for any inconvenience my lack of knowledge in the field is causing the authors.

The authors present a framework for the investigation of scour dynamics. The data basis is increased by creating a large set of synthetic stream flow time series which are used to force a scour and fill model.

The manuscript has a good structure and is well written. However, the manuscript is highly technical. Advanced statistical methods and hydrodynamic scour modelling are constantly referred to and fill many consecutive pages in the methods section. Any reader who is just slightly in a different research field, will have a very hard time to understand the methods or find the manuscript simply unreadable. This aspect also reflects in the fact that the authors, apart from the introduction, mainly cite their previous work, which complicates the independent validation of the underlying methods, as any unnoticed flaws in earlier work may be amplified through continued reliance on the same line of research.

The study is very specialized. This should be in itself no problem but it is unfortunate for the authors. It would help the manuscript, if the authors were able to add short explanations why certain methods are used. E.g. climacographs, climacospectrums, generalised Cauchy-Dagum-type climacogram, Hurst and Mandelbrot parameters, FHK-CD model should be explained, as I doubt that every reader is aware of these concepts and is willing to dig in the references. I am certainly not. To this end, I wonder if this manuscript fits into the rather broad scope of NHSS.

### Major comments

- Section 2.1: Please add some information on the annual rainfall.
- l.69: What do you mean with “near-natural” flow conditions?
- Stationarity: river flow from 2001-2024, can you assume stationarity here? Did you test it?
- Can you elaborate to which extent your method of synthetically creating stream flow time series is able to generate previously unseen extreme events? How many extreme cases beyond the real observations were generated with your method?
- l. 346: “Scour–streamflow synchronisation is weak” This seems a bit strange. Can you elaborate on this?

- **The Methods and Result section should be reviewed by another reviewer. I am not able to review these sections.**

### **Technical comments**

- Fig 1: a) Shape outlines make the bottom part of Chile appear black. b) There are some weird stream segments which are unconnected or even seem to cross the catchment border. Legend missing.
- Table 1: Here you give streamflow in mm/d. Change to m<sup>3</sup>/s so it is comparable to Fig. 1.
- You are using a different color theme for almost every plot. I suggest that you stick to a more homogenous set of colors in your plots.