JOURNAL OF COASTAL AND HYDRAULIC STRUCTURES

Review and rebuttal of the paper

A simple design method for concrete fuse blocks at small dam spillways

Achary et al.

Editor handling the paper: Daniel Valero

The reviewers remain anonymous.

We would like to thank the Associate Editor and the two Reviewers for their valuable and insightful comments. All comments have been taken into consideration when preparing our revised manuscript.

Below, we provide a point-by-point response to each comment of the Associate Editor and Reviewers. Changes made in the manuscript are highlighted in a different colour for each Reviewer.

Note that all line numbers mentioned in our responses refer to the revised manuscript.

Associate Editor

Corresponding revisions in the manuscript are highlighted in green.

> Two expert reviewers (dam engineering, dam hydraulics, dam breaks) have provided feedback about this manuscript. Both reviewers are supportive of the study yet offer some comments that should be considered, or at least their points be discussed. I find the article interesting, methodologically robust and experiments very carefully designed and conducted. I think most of the text is readable (very well written) but needs still a bit of polishing to streamline the message (i.e., highlight clearly the takeaway message and the way forward, how should the reader use this information?).

Thank you for this constructive and encouraging feedback. We have carefully addressed all comments and have made the necessary revisions.

We have considered the editor's suggestion to better highlight the takeaway message and practical implications of the study. As a result, we have refined the conclusion and the abstract to clearly present the practical applications of the study and propose directions for future research.

We hope these revisions clarify the scope and added value of the study.

Comment Number: 1

> The abstract is substantially short and could benefit from further extension: And what is the full context (do fuse blocks apply to every spillway, for instance)? what exactly and how exactly has been done? What are the benefits?
>
> The following sentence in the abstract is not clear: "this technology addresses critical needs in regions where small dams face significant challenges".
>
> Correct in the abstract: "experimental tests at laboratory scale".
>
> Correct in the abstract: for every dam height? Or for every head over spillway crest?

Thank you for your valuable feedback regarding the abstract. The revised version now includes:

- A clearer explanation of the context and motivation: it emphasizes the relevance of fuse blocks in regions where small dams are common and design standards are less rigorous.
- A precise description of what was done: the abstract now highlights the development and validation of an analytical model, the experimental tests conducted at laboratory scale (1/10), the configurations tested, and the definition of a standard block geometry.

- Clarification of the practical outcome: a design table based on a standard block geometry considering as parameters the block density and the head over the spillway crest is explicitly mentioned.
- A dedicated mention of practical implications and limitations: the abstract lists examples such as the intensity of discharges, risk of premature tipping, and usable storage range.
- Future research perspectives: the need for further experimental validation and the investigation of potential structural consequences of block tipping are now included.

We also replaced the ambiguous sentence "this technology addresses critical needs…" with a more precise formulation to reflect the specific challenges of small dams. The phrase "experimental tests at laboratory scale" has been corrected as suggested, and "head over the spillway crest" is now clearly used instead of "dam height".

We hope this extended version provides a clearer and more complete overview of the study's objectives, methods, and contributions.

Comment Number: 2

Domestic chores = (human) water supply.

Line 9: "Domestic chores" has been replaced by "human water supply" to improve clarity.

Comment Number: 3

In the beginning of the introduction, statistics on dam failures are referred to. The authors may want to check US statistics of dam failures, which include small dams as well (as opposed as the more general ICOLD statistics, mainly focusing on dams over 15 m height and alike).

We thank the reviewer for this relevant suggestion. We have revised the paragraph accordingly and now include U.S. dam failure statistics from the National Performance of Dams Program (NPDP), which explicitly account for small dams (i.e., under 15 meters in height). The revised text clarifies that while small dam failures are more frequently reported in absolute numbers, their relative failure rate is roughly proportional to their large majority among all dams. The revised paragraph can be found on lines 24–32.

Additionally, to ensure clarity, a definition of small dams is provided in lines 14-18, distinguishing them from larger dams as defined by ICOLD.

Comment Number: 4

This sentence is not completely clear: "This is useful for restoring lost storage capacity due to sedimentation and increasing the water volume, which prevents drying out due to evaporation" Is preventing evaporation really the main target of these fuse blocks?

Thank you for the relevant comment. We agree that preventing evaporation is not the main purpose of fuse blocks. The sentence has been clarified to better reflect the actual objective, which is to increase storage capacity while maintaining dam safety. We removed the mention of evaporation to avoid confusion (see lines 46-47).

Comment Number: 5

A question that arises when reading about these fuse blocks is what level of damage is done to the spillway when the blocks fall from the crest? I assume it only tips, but it is not washed off, maybe not fully clear in the text.

We thank the reviewer for this valuable comment, which helped broaden the discussion and identify important directions for future research. In response, we have added a paragraph in the new subsection "Practical implications and limitations of fuse blocks" (lines 443-453) addressing the potential structural consequences of block tipping, both on the spillway and downstream. As noted, the block is not washed away but may be slightly displaced after tipping, depending on flow conditions. Since this aspect was not investigated experimentally, further studies are needed to assess possible impacts on the structure.

Comment Number: 6

Please, also make sure that it is clear that the crest refers to the spillway crest, not the dam crest (coronation).

We have reviewed the manuscript to ensure that all references to the "crest" are explicitly identified as the *spillway crest* where relevant. This clarification has been integrated into the text to avoid any ambiguity with the dam crest.

Comment Number: 7

This sentence seems a bit far fetched: "For new dams, fuse blocks can double the extreme flood discharge rate with similar concrete usage and costs" Please, expand more convincingly or avoid.

We agree with the reviewer that the original sentence in the introduction lacked clarity and sufficient support. As such, we have removed it from the introduction and expanded on the idea in the Discussion section (lines 433-435), under the newly added subsection titled "Practical implications and limitations of fuse blocks".

According to the new model (Eq. (6)), the predicted tipping head is approximately equal to the block height, P. Therefore, once the blocks tip, the water head acting on the spillway nearly doubles ($\approx 2P$), which explains the substantial increase in discharge capacity. This observation supports the conclusion by ICOLD (2010) that concrete fuse blocks can double the extreme flood discharge using roughly the same amount of concrete as a fixed raised crest.

Comment Number: 8

In Figure 2 it appears as if the block is widening in the streamflow direction (B à b), maybe worth a short clarification of why.

The block is indeed intentionally widened in the streamflow direction (from B to b), as illustrated in Figure 2. This design feature was already explained in lines 70–71 of the original manuscript (lines 71-72 in the revised version): the upstream width b is deliberately reduced to create a trapezoidal shape, in order to minimise friction resulting from manufacturing imperfections (Lempérière and Vigny, 2013).

To further improve clarity, we have also reorganized the manuscript so that the paragraph describing the block geometry (originally in lines 53–74) now immediately follows the description of the tipping mechanism and the presentation of Figure 2. This change ensures that the reader encounters the geometric explanation directly after the figure and before the discussion of global fuse block applications (formerly in lines 38–52). We trust these modifications address your observation.

Comment Number: 9

Line 75: “To design those blocks, two equations can be found in the literature.” That literature should be cited here, even if later expanded, just for clarity.

The appropriate literature has been cited in line 93 to support the sentence.

Comment Number: 10

Line 78: “Hien et al. (Hien and Ho Ta Khanh, 2007)” should simply be: Hien e al. (2007). See same formatting rule at other points of the text.

We have updated all instances of "Hien et al. (Hien and Ho Ta Khanh, 2007)" to "Hien et al. (2007)" throughout the text, as per your suggestion. Other citations have been revised accordingly to ensure consistency.

Comment Number: 11

Figure 3 does not show up in my PDF.

We have reviewed the PDF, and the figure appears correctly on our end. Additionally, one of the reviewers provided feedback on this figure, and we have addressed it accordingly. Please let us know if you would like us to provide a new version of the file or if the issue persists.

Comment Number: 12

The introduction, all in all, is a bit lengthy. Two subsections could be use: 1. Background, 2. Existing design methods for fuse blocks. A bit more information of what happens with the fuse blocks once they are "activated" may be useful for the unaware reader.

We have reorganized the introduction into two subsections: 1. Background and 2. Existing design methods for fuse blocks, as recommended. We believe this improves the clarity and structure of the section.

To clarify what happens when the fuse blocks are activated, we have added a detailed description of the tipping mechanism in the revised manuscript (lines 39-45). This includes an explanation of how the blocks rotate passively under hydraulic force and fall downstream without requiring any mechanical system or human intervention. Figure 1b has also been included to help visualize the submerged state of the blocks before tipping.

Additionally, we now specify, in the Discussion section, what occurs after the blocks have toppled, highlighting the potential temporary loss of storage capacity and the proposed solution of using temporary flashboards as suggested by ICOLD (2010) (lines 439-442).

These additions aim to provide a clearer understanding for readers unfamiliar with the system.

Comment Number: 13

In Figure 10, it is not entirely clear to me why the total moment is not taken in the lower-right corner, but offset by "i"?

As mentioned in lines 223–224 of the manuscript (lines 248-249 in the revised version), the block rotates around an axis located at the downstream abutment, at a distance i from its bottom (labelled as point O in Figure 10). The moment is therefore taken about point O, rather than at the lower-right corner, because this point represents the actual physical axis of rotation of the block during tilting. To improve clarity, we have now explicitly indicated the location of the abutment in Figure 10.

Comment Number: 14

When looking at Eq. (6) (Hth,simp or Htipping?), I wonder how the "-1.304" scales to real world? Th H [m] and P [m], but both with a lab-scale (mm to cm) range of application.

To clarify, Equation (6) now appears as $H*_{Tipping}$ to make it explicit that it represents a particular case of the general tipping head model.

This equation was obtained by applying the general expression (Eq. (4)) to a block geometry defined by fixed aspect ratios, consistent with the standard geometry proposed by Lempérière et al. (2013) and the blocks tested experimentally (see revised lines 304-309):

$$e = \frac{12}{10}P \; ; c = \frac{1}{4}P \; ; s = \frac{1}{10}P \; ; i = \frac{1}{20}P$$

Substituting these expressions into Eq. (4) yields the simplified form:

$$H^*_{Tipping} = P \cdot (1.075 \cdot 10^{-3} \cdot \rho_b - 1.304)$$

Note that this is not a simplification by approximation, but a direct application of the general model to a specific block geometry with constant aspect ratios. The numerical coefficient 1.304 is dimensionless, ensuring that the equation remains valid across scales (laboratory or prototype), as long as the geometric proportions are preserved.

Comment Number: 15

I appreciate the analysis presented in Figure 14, which I was assuming could explain great part of the variability in tipping heights. This is addressed in lines 325 – 334, then followed by more discussion… but not a clear conclusion: what do we do with this in design? Do we take Htipping more conservative or less?

We have clarified the conclusion in the revised manuscript. The updated discussion (in response to comments 9 and 10 from Reviewer B, lines 370-379) emphasizes that the new model consistently overestimates the tipping head measured during the experiments, including in cases where the watertight seal was carefully positioned. This confirms the inherently conservative nature of the model. The variability observed between operators (approximately 9%) is comparable to the experimental uncertainty associated with repeated tests performed by the same operator across different configurations. Therefore, it does not increase the overall uncertainty of the results. From a design perspective, this means that small misalignments in the sealing strip do not require the application of additional safety margins, as the model already provides conservative predictions that support dam safety.

Comment Number: 16

I find the variable "Hdam" problematic, since it may suggest the height of the dam, whereas it refers to energy level over broad crested weir (Ht?)

We have replaced the variable H_{dam} with H_{HRWL}, where HRWL stands for Highest Reservoir Water Level, to avoid any confusion with the dam height. This change should clarify that the variable refers to the maximum energy level over the broad crested weir, rather than the height of the dam.

Reviewer A

Corresponding revisions in the manuscript are highlighted in yellow.

The Authors present an experimental study on the tilting behavior of fuse blocks at spillway crests. The purpose of these blocks is to increase the storage capacity of reservoirs while ensuring the dam safety by limiting the maximum water head. The paper is generally well written and the study appears thoroughly conducted. The manuscript fits well into the journal's scope.

We thank the reviewer for their supportive comments.

Comment Number: 1

Fig. 3a: Should it be rho_w? Same in line 226. Please ensure to harmonize variables.

We have updated the notation to ρ_w in Figures 3a, 4a, and 10a, as well as in line 251, to ensure consistency across the manuscript.

Comment Number: 2

Please explain in more detail how the blocks are placed to prevent them from sliding.

In the revised manuscript, we have expanded the description in both the Introduction and the Methodology sections.

In the Introduction, we now specify (lines 73-74):

"Blocks should be positioned upstream of a small abutment to prevent them from sliding. This abutment also serves as a pivot point around which the block rotates when subjected to hydrodynamic forces."

In the Methodology section, we added more technical details (lines 188-191):

"The fuse blocks are placed on a PVC support, which allows for the attachment of abutments and intermediate walls. The abutment is a PVC element, 0.5 cm high and 1.5 cm wide, placed continuously along the weir width and screwed onto the PVC support. It prevents the blocks from sliding by physically blocking their movement in the flow direction. In addition, it defines the pivot point for block rotation under the action of the flow-induced forces."

We hope this addresses your concern.

Comment Number: 3

Line 154: Can the authors provide any references regarding the limitation of scale effects for similar cases?

While we are not aware of published studies addressing scale effects for directly comparable cases, scale effects have been discussed in the literature (Erpicum et al., 2016; Ettema et al., 2000) for flow trajectory over weirs and discharge laws. These studies generally indicate that scale effects become significant when the water head is lower than approximately 3 cm and 7.5 cm, respectively. In our experiments, the measured heads (around 10 cm) are well above these thresholds, which limits the risk of such effects. Moreover, the tests were conducted on a 1:10 scale model, which is relatively large and considered close enough to prototype conditions to ensure realistic hydraulic behaviour. Therefore, scale effects are expected to be limited in our setup (lines 326-328).

Comment Number: 4

Line 203: Why 13 s? The noise seems to have a regular frequency. Could it be an oscillation in the experimental reservoir? If so, velocity head in your data may not be negligible. Please show a close-up of the time series and maybe a FFT to allow checking for frequency contents.

The 13-second window for the moving average was determined through trial and error to best fit the data and reduce noise, rather than being based on physical consideration (added in lines 228-229).

As for the oscillations, we have examined the amplitude of these fluctuations in the close-up of the first 60 seconds of the time series (see below) and found that their amplitude is of the same order of magnitude as the uncertainty in the positioning of the sensors (on the order of millimetres). This is why these oscillations were not considered in the analysis.

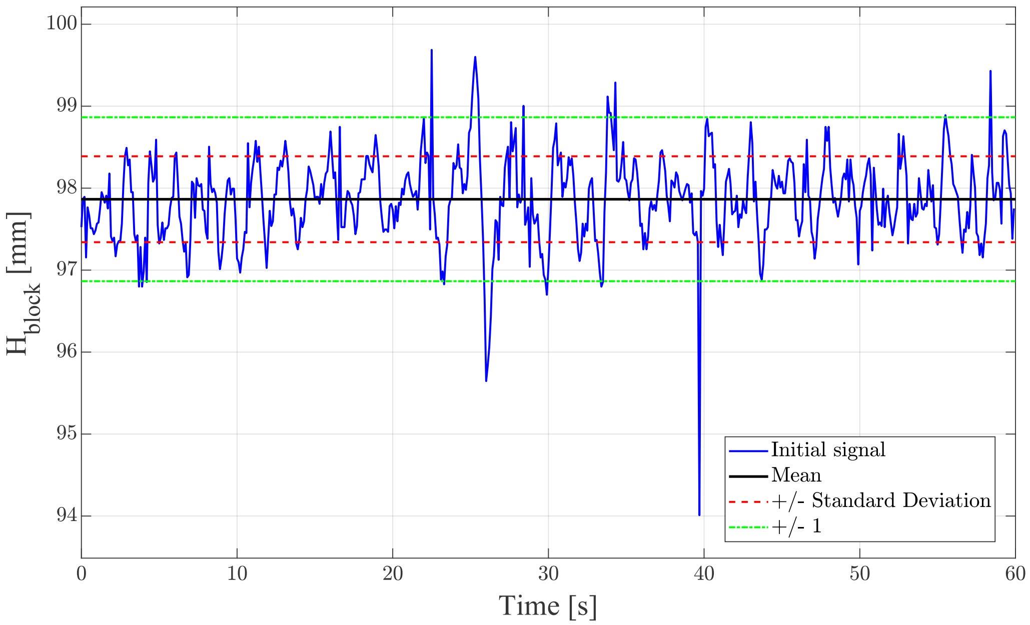

Figure 1- Close-up of the first 60 seconds of the time series

Additionally, we performed a Fast Fourier Transform (FFT) on the first 60 seconds of data, which revealed two peaks between 0.4 and 1 Hz. However, no dominant frequency stands out, suggesting that the oscillations do not significantly affect the data at the frequencies observed.

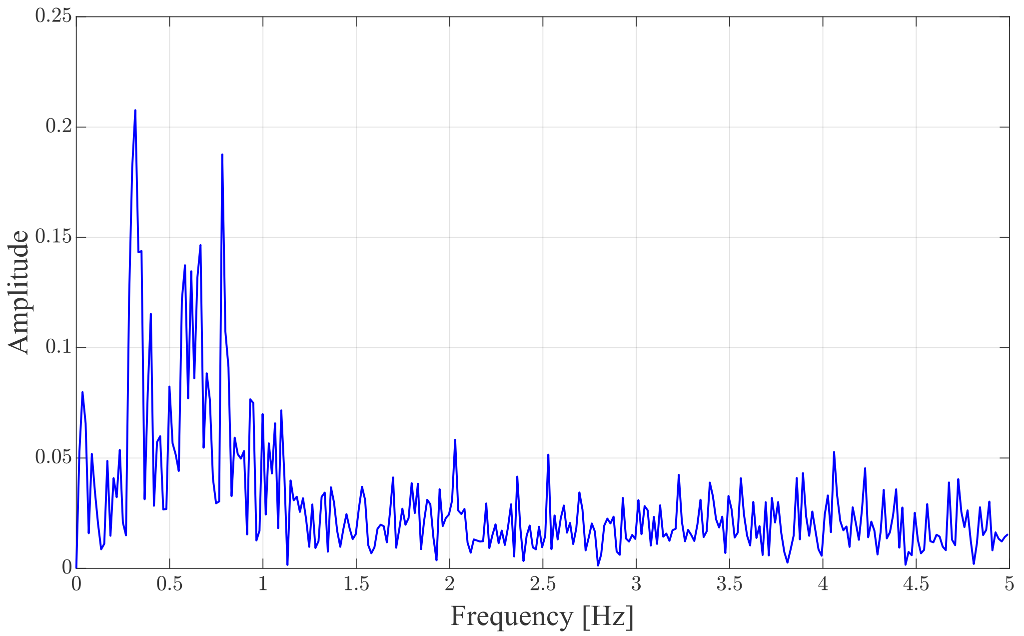

Figure 2- Fast Fourier Transform on the first 60 seconds of the time series

Comment Number: 5

Line 229: I think it should read "compared".

The correction has been made.

Comment Number: 6

Falling of the blocks may lead to a 1 m water column in prototypes, suddenly discharging over the crest and leading to higher loads on spillways or exceeded capacity of downstream channels. Please comment on limitations of the applicability of such fuse blocks.

We have addressed this concern in a new subsection of the discussion entitled "Practical implications and limitations of fuse blocks." As mentioned, although tipping results in a discharge increase, a significant flow is already passing over the blocks before they tip. The transition does not correspond to a shift from zero to full discharge, but rather to a quantifiable increment. To mitigate the risk of a sudden large flow due to the simultaneous tipping of all blocks, a staged tipping approach can be adopted by designing blocks with varying tipping thresholds. This is done by varying the cross-sectional geometry of the blocks, so that each block tips at a different water level. This allows for a more gradual increase in discharge capacity and helps reduce the risk of overwhelming downstream structures.

A staged tipping configuration is particularly relevant when downstream channel capacity or spillway structural limits are a concern. We have now included this discussion in the manuscript (lines 414-420).

Comment Number: 7

What is the Authors' experience with debris flow in the reservoir in relation to these fuse blocks?

We do not have direct experience with debris flow in the reservoir in relation to the fuse blocks. However, according to ICOLD (2010), "Model tests have shown that floating debris has no significant effects on the water levels at time of tilting." Therefore, we do not expect debris flow to have a substantial impact on the behaviour of the fuse blocks during operation (added in lines 436-438).

Reviewer B

Corresponding revisions in the manuscript are highlighted in blue.

This paper investigates the tipping of concrete fuse blocks at small dam spillways. A series of laboratory experiments were performed to determine the reservoir head that induced tipping of blocks with 5 different sizes, 2 configurations, and 2 positions. The laboratory setup, measurement techniques, and data processing procedure are described very well. An analytical model for estimating the reservoir level that causes tipping is proposed, based on momentum equilibrium due to hydrostatic pressures and block stability. Application of the model results in a conservative block design, in comparison to the laboratory experiments and other models. A simple methodology for estimating block height is proposed, with a design table based on dam safety requirements and block density. This paper provides high-quality experimental results, and a useful model and methodology for block design.

We thank the reviewer for their positive feedback on our work.

Comment Number: 1

Page Number: 2

Line Number: 30

Content: "…and increasing the water volume, which prevents drying out due to evaporation."

Comment: This sentence isn't clear.

We addressed a similar remark made by the Editor and have revised the sentence accordingly for clarity. Please see our response to the Editor's comment (comment number 4).

Comment Number: 2

Page Number: 3

Line Number: 59

Content: Hydrocop

Comment: Shouldn't it be "Hydrocoop"?

The correction has been made.

Comment Number: 3

Page Number: 10

Line Number: Figure 10

Content: Hydrostatic pressure distribution.

Comment: H_{block} is measured 25 cm upstream and 44 cm to the side of the block. Why was this measurement not made immediately upstream of the upstream edge of the block? Is there a notable difference in head between the H_{block} measurement location and the upstream edge of the block?

The water level (H_{block}) was measured 25 cm upstream and 44 cm to the side of the block to avoid the contraction and acceleration zone near the upstream face of the weir. This location allows the velocity to be neglected (flow velocity is small due to both the measurement location in a reservoir corner and the limited discharge compared to reservoir dimensions) and the measurement to be considered representative of the hydraulic head acting on the block (lines 169-172).

Comment Number: 4

Page Number: 11

Line Number: Figure 11

Content: Pictures of block tipping.

Comment: The block configuration and location is difficult to recognize. Can the side of the block be outlined? And the configuration described in the caption?

We have added a description of the block configuration in the caption of Figure 11, as suggested. Additionally, we have outlined the side of the block in red for better clarity.

Comment Number: 5

Page Number: 11

Line Number: 261

Content: The presence of other fuse blocks on the sill does not influence the tipping head. This is illustrated by the measurements made on B10 (10 cm wide), B20 (20 cm wide), and B30 (30 cm wide) in configurations 1 and 2.

Comment: In 4 of the 5 comparisons, $H_{tipping}$ for configuration 2 is 2-4 cm greater that for configuration 1. Is that not indicating an effect of other blocks?

Thank you for your comment. We have revised the paragraph to avoid stating that there is no influence, and instead, we now emphasize that any potential effect on $H_{Tipping}$ is likely masked by the experimental uncertainty. As stated in the revised paragraph (lines 286-290), we observe overlapping ranges in the boxplots for different configurations (block alone on the weir vs. presence of adjacent blocks with B10, B20, B30), different positions on the weir (centre vs. side with B10 and B20), and varying block widths (from B10 to B60). Although slight differences in median values exist, the variability in repeated tests prevents any clear trend from emerging. Additionally, we would like to clarify that the differences of 2-4 cm are actually 2-4 millimetres, as $H_{Tipping}$ is given in mm on the graph.

Comment Number: 6

Page Number: 11

Line Number: 262

Content: The differences observed between the two positions of the blocks (B10 and B20) – at the centre and the side of the weir – are not significant.

Comment: Comparing positions, the differences in $H_{tipping}$ for the same configuration (i.e. the first and third result for B10) are up to 11 cm. Is this not indicating an effect of position?

Thank you for your observation. As explained in response to comment 5, we have addressed the potential influence of position on $H_{Tipping}$. Regarding the observed differences between positions for the same configuration (i.e., B10 at the centre and the side of the weir), we would like to clarify that the observed differences are actually on the order of 1-1.1 cm, not 11 cm, as $H_{Tipping}$ is given in mm on the graph. As mentioned earlier, the variability in repeated tests masks any significant trend, making it difficult to attribute this difference to position alone.

Comment Number: 7

Page Number: 12

Line Number: Figure 12

Content: B20 depictions of configurations.

Comment: Are the second set of depictions (centre) for configurations 1 and 2 in B20 switched?

The top diagrams for configurations 1 and 2 of the centred block B20 were switched. We have corrected this issue.

Comment Number: 8

Page Number: 12

Line Number: 285

Content: "In contrast, the new model, while not necessarily offering higher accuracy, ensures that predictions remain consistently on the safe side. This is a significant advantage, as it provides confidence in the reliability of the results."

Comment: The new model overestimates $H_{tipping}$. This means that, for blocks designed based on the new model, the block will tip under lower heads that anticipated. Is this truly always a significant advantage? This would indeed be an advantage from the perspective of safety against dam overtopping during extreme floods, which I expect is the authors' point here. But what if tipping at lower reservoir levels than expected leads to more frequent outflows that are still large enough to be damaging floods? Also, what if the range of reservoir heads between usable storage and extreme floods is small? The purpose of these blocks is to increase usable storage in small dams. If the blocks are tipping while reservoir head is in the usable storage range, then the blocks are not as useful as intended. This could be mentioned in the discussion.

We thank the reviewer for encouraging a more nuanced discussion of this point.

We have revised the sentence in the manuscript to clarify that the "safe side" refers specifically to *dam overtopping* (lines 316-317). As the reviewer rightly pointed out, consistently conservative predictions can have trade-offs in practical applications. We agree that while overestimating the tipping head contributes to dam safety, it may result in earlier-than-expected tipping, potentially causing more frequent outflows.

To address this important point, we have added a new subsection titled "Practical implications and limitations of fuse blocks". In this section, we explicitly discuss the possible consequences of conservative predictions, including the increased frequency of outflows and their impact on the usable storage range in small dams.

Regarding the concern about more frequent outflows that may still be large enough to cause damaging floods, we now mention (lines 421-426):

"The model is conservatively designed to overestimate the tipping head, thereby ensuring dam safety with respect to overtopping. However, if blocks tip earlier than predicted, this may lead to more

frequent overflows, which represents a limitation of the system. Still, dam safety remains the priority, as the flows generated by tipping blocks are less hazardous than those resulting from dam failure. To further reduce flood risks, designing blocks to tip at different water levels can help mitigate the impacts by spreading the release over time and reducing the intensity of the resulting flow."

Concerning the usefulness of the blocks when tipping occurs earlier than expected, we now clarify (lines 427-432):

"Even if blocks tip earlier than predicted, they remain useful. Tipping only occurs after submersion, so the usable storage—equivalent to the block height—is always preserved provided that only limited floods occur. According to the new model (Eq. (6)), the predicted tipping head is approximately equal to the block height, P. Experimental tests showed an overestimation of tipping head ranging from 0.63% to 18.20%. Therefore, even if tipping occurs slightly earlier than predicted, i.e. for floods smaller than the design flood but still important in terms of overflow depth and discharge, the blocks still provide a reliable increase in storage capacity."

Comment Number: 9

Page Number: 14

Line Number: 335

Content: "From these tests, it is evident that the placement of the watertight seal influences the tipping of the block."

Comment: Does the new model still overestimate $H_{tipping}$ when the watertight seal is place correctly? Does the model function best with a correctly placed seal?

To address it, we included in Figure 14 the tipping head predicted by the new model. As shown, the model consistently overestimates the results obtained by all three operators. The prediction is closest to the results of Operator 3, who ensured that the watertight seal was aligned with the downstream face of the block. This confirms that the model performs best when the seal is correctly placed. However, the prediction remains conservative in all cases, even when the seal placement varies slightly (discussed in lines 374-379).

Comment Number: 10

Page Number: 14

Line Number: 337

Content: "Despite this observed difference, the variation in results between operators is about 9%, indicating no significant difference."

Comment: How do you determine what is a significant difference? Significance typically implies some sort of statistical interpretation of results.

To clarify, we have rephrased the sentence in the manuscript to avoid any ambiguity. The revised version reads (lines 370-373):

"Despite this, the variability between operators remains within approximately 9%. This level of variability is comparable to the experimental uncertainty observed when repeating tests with the same operator in different block configurations, and therefore does not increase the overall uncertainty of the results."

Rather than implying statistical significance, our intention was to highlight that the observed variation between operators does not exceed the typical variability already seen across repeated experiments. This suggests that operator-related variability is within the expected experimental uncertainty range.

Comment Number: 11

Page Number: 15

Line Number: 369

Content: "This suggests that the formula developed in this work consistently ensures a safe design."

Comment: Is it truly always a safer design? Considering the potential for early block tipping leading to more frequent small floods? Perhaps "more conservative design" is more accurate?

We have clarified in the manuscript that "safe design" refers specifically to dam overtopping (line 410).

The trade-offs of early tipping are discussed in the new subsection "Practical implications and limitations of fuse blocks" (lines 421-432).

Comment Number: 12

Page Number: 17

Line Number: 405

Content: "A simple and effective system 405 for waterproofing the vertical gap between the fuse block and separating walls is the placement of a thick plastic or rubber sealing strip, along with providing adequate clearance."

Comment: It is not clear what is meant by "along with providing adequate clearance."

We understand that the phrase "along with providing adequate clearance" may have caused some confusion since it does not refer to water proofing but to the clearance required between block and side wall to prevent friction effects. To clarify, as specified in the manuscript (lines 490-492), we found that a specific clearance between 2 to 4 mm is necessary to ensure proper operation of the fuse blocks, without causing premature tipping.