

## ***Interactive comment on “Quantification of climate change impact on dam failure risk under hydrological scenarios: a case study from a Spanish dam” by Javier Fluixá-Sanmartín et al.***

**Javier Fluixá-Sanmartín et al.**

javier.fluixa@crealp.vs.ch

Received and published: 10 August 2019

These are the Authors' replies to comments from Referee #2, received and published on 5 August 2019. Firstly, we want to sincerely thank Referee #2 for the remarks and recommendations which will undoubtedly improve the quality and scope of the paper.

- The 1970-2005 period has been selected as the Base Case because it was the longest period for which we had both observed and historical data (for the climate projections).
- A risk analysis was already applied to the Santa Teresa dam in a previous study

C1

(Ardiles et al., 2011; Morales-Torres et al., 2016). Results from this study showed that, although the dam didn't required urgent correction measures, its risk was important enough to be carefully monitored. Thus, we considered interesting to evaluate if the risk situation of the dam was expecting to increase and thus immediate actions were necessary, or if its risk was expected to decrease until no urgent actions were necessary.

- In this particular case, different maximum water pool levels are considered for each month because of the expected seasonality of high flows which tend to increase in winter (December to February). In prevision of important water volumes entering the reservoir, the dam exploiters increase the freeboard volume to absorb them. These exploitation rules are contained in the Hydrological Plan of the Duero River Basin (Confederación Hidrográfica del Duero, 2015).

- Please refer to the author's response to Referee #1 concerning this matter. More details about the calibration process will be included in the reviewed version of the paper.

- Event trees help representing all the possible chains of events resulting from an initiating event and are used as a basis for the dam risk model used in the manuscript. A detailed description will be included in the reviewed version of the paper.

- Although population and water demands are supposed variable with time in the paper, for simplicity no new services are considered in the future. This will be included in the reviewed version of the paper.

- Conclusions:

\* The paradigm of low-data study cases has not been considered in this work. Under such circumstances, another approach might be of use. We encourage Referee #2 to consult a previous paper of the authors (Fluixá-Sanmartín et al., 2018) where this situation is tackled.

C2

\* Although this work represents a useful tool for dam safety management, it is clear that further analyses are required before decision can be made. In particular, the uncertainty associated to future risks imposes a deeper evaluation of the recommendations to make. However, this problem as well as some suggestions will be mentioned in the new version of the paper.

\* As suggested by Referee #2, a discussion on uncertainty will be included in the conclusions section.

- The composition of the figures will be re-evaluated to increase their readability.

- List of minor corrections: we will take into account the Referee's remarks and corrections and will include them in the new version of the paper.

## REFERENCES

Ardiles, L., Sanz, D., Moreno, P., Jenaro, E., Fleitz, J. and Escuder-Bueno, I.: Risk Assessment and Management for 26 Dams Operated By the Duero River Authority (Spain), in 6th International Conference on Dam Engineering, C.Pina, E.Portela, J.Gomes, Lisbon, Portugal., 2011.

Confederación Hidrográfica del Duero: Plan Hidrológico de la parte española de la demarcación hidrográfica del Duero. 2015-2021. [online] Available from: [www.chduero.es](http://www.chduero.es), 2015.

Fluixá-Sanmartín, J., Altarejos-García, L., Morales-Torres, A. and Escuder-Bueno, I.: Review article: Climate change impacts on dam safety, *Natural Hazards and Earth System Sciences*, 18(9), 2471–2488, doi:10.5194/nhess-18-2471-2018, 2018.

Morales-Torres, A., Serrano-Lombillo, A., Escuder-Bueno, I. and Altarejos-García, L.: The suitability of risk reduction indicators to inform dam safety management, *Structure and Infrastructure Engineering*, 1–12, doi:10.1080/15732479.2015.1136830, 2016.

Please also note the supplement to this comment:

C3

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-141/nhess-2019-141-AC2-supplement.pdf>

---

Interactive comment on *Nat. Hazards Earth Syst. Sci. Discuss.*, <https://doi.org/10.5194/nhess-2019-141>, 2019.