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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Review article: climate change impacts on dam safety" *by* Javier Fluixá-Sanmartín et al.

Anonymous Referee #2

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The review is clearly structured and easy to read. I also think that most of the text is substantiated with good references and makes sense. Novelty cannot be demanded from a review, but I still miss some recommendations coming out of the review: What is the main findings of collecting this information, either for practice to be used for design or operation or for the research community to explore further because of lack of information on specific or cross-cutting topics. As it is I am in doubt what the purpose of the paper is.

Throughout the paper I am in doubt whether the safety assessment is related to upstream or downstream of the dam itself or both. The discussion on the hydrological performance seems to focus on upstream loading, but typically dam safety is also concerned with downstream consequences of failures. Please clarify the scope of the

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Discussion paper

paper, also in terms of physical boundaries. When considering T=100000 downstream consequences can be catastrophic and often much higher than upstream.

The risk definition in Eq 1 [P3L3] is unusual and not very accurate. 'Events under study' imply a finite number of events and hence summation rather than integration. The cited ref does not give an explation and I cannot identify the ICOLD (2003) reference, which seems to be the original reference. If you wish to use that definition I suggest you start with a standard formulation as in e.g. Merz et al (2010) and then extend to the definition you wish to apply, including a discussion of Figure 1. Together they can form a precise definition. It would be nice to end the review with how this figure (that only considers stationary input) by means of this review can be converted into a diagram, that considers nonstationarity. As a community we miss a figure that combines the detailed analysis schemes corresponding to Fig01 with the soft figures from IPCC (e.g. http://www.ipcc.ch/report/graphics/images/Special%20Reports/SREX/Chapter%2001/Fig1-1.jpg from IPCC (2012)).

I am somewhat surprised that the review does not specifically cover the impacts in relation to the frequency domain. Climate change (and other drivers) impact both average and extreme values. Intuitively the first will impact operation, including the value of having a dam, while the second must be most important for safety. I sometimes see the paper only focussing on extremes (e.g. in the hydrology section) but other times also average impacts (e.g. socio-economic section).

There is an interesting mentioning on other key drivers of change such as population increase, economic development etc [P4L10] but the paper does not come back to discussing this except for a very broad discussion on socio-economic consequences. During this discussion I cannot see if it is the presence of the dam that drives changes in the socio-economic conditions or vice versa. Is there a difference between deciding on building of a dam and considering safety in relation to an existing dam?

More detailed comments: [Fig01] Diagram starts with a loading of Flood. Is that up-

stream or downstream of the dam? A Consequence (Hydrograph (no failure)) leads to Failure modes, which seems counterintuitive. Figure needs more explanation.

[4L15] You use the term flooding both for a high loading of the dam and for the consequences downstream. The illustrations in Fig02 seems to be unaffected by dam management, but is discussed as if it is downstream?

[P6L15] There is quite abundant literature on extracting correct projections of extremes. For single sites methods developed by e.g. Kilsby and Willems are predominant (each has many refs), while for larger regions spatially distributed methods are employed (e.g. Pereira-Cardenal et al 2014 incl. supplementary information).

[Fig04] This forward-propagation modelling chain deserves a reference.

[Fig05] Subfigure a and b are identical. Suggest to replace legend on yaxis on subfigure a.

References: IPCC (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). Downloaded from http://www.ipcc.ch/report/srex/

Merz B, Hall J, Disse M, and Schumann A (2010). Fluvial flood risk management in a changing world. NHESS, https://www.nat-hazards-earth-syst-sci.net/10/509/2010/nhess-10-509-2010.pdf

Pereira-Cardenal SJ, Madsen H, Arnbjerg-Nielsen K, Riegels N, Jensen R, Mo B, Wangensteen I, and Bauer-Gottwein P. 2014. Assessing climate change impacts on the Iberian power system using a coupled waterpower model. Climatic Change, 126, 3-4, 351-364. DOI 10.1007/s10584-014-1221-1.

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