

Interactive comment on “Using graphs to find economically optimal safety targets for multiple lines of flood defences” by Egidijs Johanna Cassianus Dupuits et al.

Anonymous Referee #1

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The paper provides a coherent narrative and is clearly within the scope of NHESS. It also provides a scientific background to how engineers can systematically explore a multi-dimensional space for optimal solutions using a method unknown to many. As such it is publishable.

My review is based on my background knowledge which is more related to the traditional cost-benefit analyses in relation to risk-based design. So please bear with me if there are things I have misunderstood. On the other hand I have done exactly the same as the authors using traditional economic tools in relation to risk-based design.

I think the paper should be rewritten to improve clarity. Therefore I only have overall comments.

C1

The paper, and in particular the Introduction section, is not very well written for the reader not already familiar with the thinking of the authors. Assumptions about prior knowledge on Dutch design criteria are very high, previous work is not introduced as more than a reference (sometimes even to studies in Dutch).

The authors seem to use the term risk to characterize probabilities and economic loss interchangeably. Please define and use a clear notation. This could be done in relation to Equation 1 which is poorly defined. The problem is encapsulated in the sentence on page 2, line 17.

The authors rightly state (e.g. page 3 line 5) that the major work in relation to risk-based design is calculation of the residual risk (in monetary terms) by a complex procedure involving complex hydrological and hydraulic calculations and subsequent calculation of loss of vulnerable assets. However, I cannot see how calculation of the edges as outlined on e.g. page 4 line 5 can be done without such calculations. Indeed this is also stated on page 7, line 5. So I see a reduction in the required number of calculations in comparison to LP, but at least as computationally demanding than traditional Cost-Benefit Analyses. It is not difficult to set up the mathematical framework for optimization within economics that can identify economically optimal solutions if the risk can be formulated in a simple equation such as the authors do in their examples (e.g. Eq 3).

I would prefer if the extension involving several dikes heights to be optimized simultaneously were introduced using multiple dimensions. Since the paper only discusses two dimensions it should be straight forward also to show graphically. It will make comparison to marginal economic studies on efficiency of alternative measures quite apparent. Still, the visualization and structured approach to identify optimal trajectories makes the approach valuable.