

Remarks and criticism Reviewer 1

General

Although interesting results are described in section 4, it is not clear to the reader how such results are linked to/supported by the analysis of the five case studies and conducted interviews. I suggest re-drafting the paper in order to make this central point clearer, before its publication.

Major criticisms

- 1 Section 1 is quite interesting but not so relevant for the paper. I suggest to notably reduce sub-sections related to the history of flood defence in Netherlands and give more space to explain robust, multifunctional approaches as this is the focus of the paper (no Dutch readers can be unconfident with them); limiting their explanation to Table 1 is not enough. Specifically, differences between a “delta dike” and a robust, multifunctional flood defense should be explained as the two terms are sometimes used as synonymous and sometimes used to point at different tools.
- 2 Section 3.1.6; this is the most critical part of the paper. A reader would expect that identified solutions are carefully explained, discussing how the latter meet (or not) locations requirements (as this is the objective of the paper, isn't it?).
- 3 Section 3.2; why this section is not included in section 4?
- 4 Section 3.3; If “Stakeholders’ opinions about opportunities, constraints, points of concern, and recommendations for achieving synergy are reported in detail in Van Loon-Steensma (2011)”, what is this paper about? Which are the differences among the following discussion and the quoted paper?
- 5 Section 3.4; why this section is not included in section 4? Where is the result about initiator revealed? Nor tables or the SWOT refer to this point

Our response

Thank you for the valuable comments and suggestions about the linkages between analyses and results. Apparently our attempt to provide a concise overview of the abundant information from the interviews was not completely successful; and perhaps too many interesting details were omitted. In the revised version we will follow the suggestions made by Referee 1 and include more detailed information and explanations in section 3 (see our response to Major criticisms 1 and 2).

We agree with the reviewer that the terminology requires more explanation (as was also suggested by reviewer 2). We will follow-up the suggestion to reduce the sub-sections related to the general history of flood defences in the Netherlands to give more space to explain the robust multifunctional concept and approaches as listed in Table 1.

Apparently, our attempt to present the envisaged functions for the five locations in a concise manner did not leave sufficient detailed information about how the identified solutions meet the requirements of each location. In the revised version we will elaborate a careful explanation and discussion.

We agree that part of section 3.2 better fits in section 4, but think that Table 9 (with its associated explanation) is appropriate in this section.

We refer to the Dutch report 'Robuuste Multifunctionele Rivierdijken; Welke kansen en knelpunten zien stakeholders voor robuuste multifunctionele dijken langs de rivieren in het landelijk gebied' as a background document that provides comprehensive and detailed information based on the interviews (in Dutch). It is this NHESS paper that makes a (selection) of the main findings from the Dutch report accessible for an international readership. So there are essentially no differences between the quoted report and this section (albeit the report contains tables that occupy 3 pages each). This relation between the current paper and the Dutch report will be stated clearer in the revised manuscript.

This section was meant as a written summary (instead of a table) of the remarks made on this subject. As mentioned in section 2.3, we employed an open, semi-structured interview method, which favors a more descriptive way of presenting the results. However, we will report our findings on this subject in the revised paper in a more quantitative way.

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| 6 | Section 4; this section is somehow confused; in detail it should be better linked with the SWOT and be more clearer about what can be inferred from there and which is the current literature/state of art on the topic. Moreover, it is not clear why some results are discussed within section 3 and others in section 4. | We think it is a good suggestion to link the Discussion section (4) better with the SWOT, however we prefer to restrict it to some major topics (instead of discussing all pros and cons in the SWOT). We will more clearly distinguish the findings based on our research from those found in the literature. |
| 7 | Conclusions; it is not clear how recommendations are linked to results in section 3 and 4. How three pilot locations have been identified and why? | We agree that the link of the recommendations and the results in section 3 and 4 can be made more clear. As also explained in response to a comment of Referee 2, our recommendation concerning the pilot locations, are meant as a plea for an in-depth scientific exploration (by monitoring of the process and learn from the experiences) of all aspects of robust multifunctional flood defences at appropriate locations (which are not identified yet). |
| 8 | Multi-functional use of defences should be better discussed in the paper, specifically on what concerns non-structural measures of dealing with flood risk (e.g. emergency route or refugee during emergency, implementation of activities which are not prone to flood risk, etc.). This would also increase the the value of the paper in the context of the special issue on integrated flood risk management. | In general, to enable multi-functional use of the flood defence, over-dimensioning is required (as illustrated in Figure 2). In our paper we try to underpin that functions in addition to flood protection also can help in creating a robust, even unbreachable, dike. Although a robust flood defence fits in a strategy of non-structural measures (as we mention in section 1.4), it is primarily meant as a structural measure to protect the hinterland. On the other hand, the robust flood defences in Munnikeland forms a refugee area for animals grazing in the floodplains. And in the Wadden region the potential of the concept is explored for an industrial area that is currently situated outside the dike ring. Furthermore, when only some sections in the diking are adapted, and reinforcement of other sections is still pending, these robust sections can temporarily function as refugee or emergency route. |

Specific comments

Abstract

Pg. 3858 line 14: "These provide possibilities for co-financing as well". This aspect is not explicitly handled in the paper.

We agree with this comment, and will take this statement out of the abstract.

Section 1

Pg. 3861 line 6: "As indicated in Fig. 1, the dose-response relationship is far less abrupt for a robust, broad dike compared to narrow dikes". This Figure does not match with the contents of the paragraphs (i.e. resistance of dikes). Moreover I am not sure that it is appropriate to talk about dose-response relationship in this case, maybe "damage function"?

We think Figure 1 illustrates very clear how a robust dike prevents a catastrophic flooding by its erosion resistance that allows overflow (leading to gradually increasing damage) instead of collapse (of a traditional narrow dike as illustrated by the 1953 flooding in the South-western Delta area in the Netherlands). We agree that the term dose-response is probably not the best possible terminology (flood protection works respond cannot actively respond, but merely withstand certain forces or impacts).... not a very familiar term in the engineering disciplines. We will replace it with the suggested term 'damage function'.

Section 2.3

Pg. 3864 line 5: "Stakeholders were asked about their roles, interests, and activities concerning dike reinforcement projects, along with background information". How these variables influence results (i.e. answers) is not discussed in the paper. As this information is also reported in Table 9 (which distinguishes among different stakeholders) I suggest to comment on it or simply remove.

Thank you pointing at this recurrence of information. We will follow the suggestion to remove this sentence and Table 2.

Section 4

Pg. 3870 line 4: "Analysis of the five locations revealed that for each several suitable robust flood defenses could be identified that would contribute to the envisaged functions and ambitions for the area". This point is not discussed, see major criticisms above.

In the revised version we will discuss this more elaborately, and also provide a careful explanation (see our response on Major Criticism 2).

Conclusion

Pg. 3873 line 4: "We analyzed the pros and cons of "unbreachable" or robust, multifunctional flood safety zones in riverine areas of the Netherlands, looking at both technical criteria and opinions expressed by stakeholders". What do you mean with technical criteria? No technical considerations are present in the paper.

The term 'technical criteria' is perhaps not well chosen; we meant it as shorthand for 'physical and spatial constraints' (which can often be resolved by technical means). In the revised manuscript we will use the full description ('physical and spatial constraints') for maximum clarity.

Tables

Table 1 and Table 8 should be better discussed. See previous comments

We agree with that (see our response on previous comments)

Figures

Figure 4 should be better discussed. See previous comments. The quality of the figure must be improved.

We agree with that (see our response on previous comments), and will improve the quality of Figure 4.

Bibliography

Ministerie van Economische Zaken Landbouw & Innovatie: Gebiedendocumenten Natura 2000 Gebieden, available at: <http://www.synbiosys.alterra.nl/natura2000/gebiedendatabase.aspx?subj=n2k> (last access: 27 June 2013), 2013 à 2011 in the paper, please correct

Thank you for spotting this typesetting/conversion error. It will be corrected in the revised version.

Stowa: Deltafact Deltadijk, available at: www.deltaproof.stowa.nl/publicaties/deltafact/Deltadijk (last access: 20 June 2013), 2012 à 2011 in the paper, please correct

Thank you for spotting this typesetting/conversion error. It will be corrected in the revised version.

N.B. Most of references are in Dutch (only 3 of 27 quoted references are in English). This limits the possibility of verify/document the paper.

We agree completely with this observation. We regret that information and research results on such a challenging topic is reported in Dutch 'grey literature', and we hope that our article contributes to the dissemination of findings (and observed research challenges) to a broader and more scientific oriented audience and will result in discussion and additional scientific research (reported in English). At the same time we do like to emphasize that most of these Dutch references are freely available in digital form via open archives and do expect that Dutch scientists will critically verify the paper.