

Interactive comment on “The European flood risk directive: challenges for research” by E. Mostert and S. J. Junier

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Received and published: 13 October 2009

First of all, we would like to thank all reviewers for their reviews, which have helped us to improve our paper. In this reaction, we first discuss issues that came back in several reviews and indicate the major changes that we made in the paper. Next, we summarize the main comments of the individual reviewers and indicate how we took these comments into account.

General

The most important point that came back in several reviews concerned the scope of the paper. The paper presently has a dual purpose: to introduce the FRD and to discuss

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the challenges that it poses to research. For most reviewers the structure of section 3, which discusses the challenges and the link between the challenges and the FRD, was not very clear. Most reviewers suggested to focus more on the FRD, but one reviewer suggested to skip the discussion of the FRD. We have opted for a third solution: to clarify the scope of the paper, improve the structure of section 3 and link more explicitly to the FRD.

To clarify the scope, the introduction now states the following: “The paper focuses on the research challenges that are specific for flood risk management. As we intend to show, what is specific for flood risk management is, first, the attention for the consequences of the flooding, second, the inextricable link between “hard” natural science factors and “soft” social and institutional factors, and third, the combination of assessment and management, or, in other words, of research and practice.”

The paper does not discuss specific tools or models. The FRD changes first and foremost what should be studied, for and with whom and why. According to Colin Green’s rule of thumb, “engineers are precise to the nearest millimetre but wrong to the nearest metre” (see below, comment nr. 7). This may be a bit of an overstatement, but the point to make here is that our paper deals with the nearest meter and not with the nearest millimetre.

Section 3, “Research challenges” has been reorganized and now contains five subsections. The first three discuss the research challenges that are directly related to the three main products under the FRD: the preliminary flood risk assessment, the flood hazard and flood risk maps, and the plans. The last two subsections discuss challenges related to uncertainty and risk communication. These are more general but highly relevant for implementing the FRD.

The discussion of interdisciplinary and participatory research has been moved to a new section 4, titled “research approach”. This section contains the main message of the paper: to meet the research challenges outlined in section 3, interdisciplinary

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and participatory research is needed. We feel that this is a very relevant message for the readership of HESS. The discussion on interdisciplinary and participatory research has been expanded considerably. The terms are now defined better, the need for interdisciplinary and participatory research are presented more clearly, and the problems and possibilities are now discussed explicitly.

Section 2 has not been changed, except for the addition of a short paragraph on climate change and the FRD (section 2.4). Most reviewers found it clear as it was. One reviewer suggested to skip the discussion of the FRD because it is a single function directive based on a lowest common denominator model and would be unlikely to advance flood risk management in Europe. We agree that the FRD is a single-function directive, but the implementation needs to be coordinated with the implementation of the Water Framework Directive. Moreover, it contains many elements that are new to some or to many countries: the requirement to consider all types of floods and a broad range of consequences, the obligation to set "appropriate objectives", the requirement to organize "active participation" and to coordinate at the river basin level, etc. Many of the research challenges are also relevant for flood risk management outside of the EU, but within the EU the FRD puts flood risk management firmly on the agenda.

Finally, we have skipped the Annex "scanning the literature...". We feel that the conclusions are correct, at least in as far as academic research is concerned, but we did not have time to analyze all the grey literature, which is not so easily accessible. More importantly, the Annex is not essential for the paper: readers who do not know that there was an Annex before, probably will not miss it.

Anonymous reviewer 1

1. Section 3 consists of summary reviews of a list of concepts to do with flood risk that are not linked to the discussion of the FRD in section 2. They are not really 'research challenges' either. R: We have tried to make the link with the FRD more explicit: see above under "general". We call the challenges "research challenges" because they are

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difficult issues that researchers have to face.

2. It is not useful to separate out research science and practice as the two are inextricably linked. R: We distinguish between research and practice but we do not separate them. The introduction now mentions the combination of science and practice as a key characteristic of flood risk management and in many sections we show that research involves many policy choices. Our starting point is research and researchers because researchers constitute the readership of HESS, but we continuously link research with practice.

3. Suggestion for section 3: "Summarize demands from the FRD/ identification of key research areas coming out of the FRD" "Review of current research in each area" "Research needed for implementing the FRD" "Remaining challenges" "Recommendations for research practice" R: We have decided to improve section 3 in a somewhat different way: see above under "general".

4. Too little attention is paid to current flood risk management practice R: The paper does not intend to offer a review of the flood risk management practice. As discussed, its starting point is research. Nonetheless, we refer explicitly to the flood risk management practice in for instance section 3.1 (measure of risk most commonly used) and 3.2 (English flood maps and Dutch risk maps). Throughout the paper we refer in general to practical issues, such as trust in flood warnings (section 3.5). The references used give many more examples.

5. Scan presented in Annex A is too limited. Why not look more into detail into some of the papers? R: Annex A has been skipped: see above under "general."

Anonymous reviewer 2

6. The paper needs to be focused more. It needs to be much more narrowly addressed to some specific and more clearly defined audience. R: Although parts of the paper may be of interest to a political science audience as well, especially section analyzing

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the FRD, the target audience of the paper is the readership of HESS, hence different species of earth scientists.

7. For a political science audience more should be added the role of the EU, multi-level governance, and other policy issues. It says for instance little about the institutions responsible for flood risk mapping, data access and intellectual property rights obstacles to mapping the spatial extent of exposure. R: see point 6.

8. For the readership of HESS the paper does not say in enough detail what the specific research challenges for hydrologists, ecologists or other species of earth system scientist might be. It says for instance little about the methods of catastrophe modeling. R: See above under "general". We feel that the central message, the challenges and the factual description of the FRD are relevant for hydrologists, ecologists and other earth system scientists. As is now stated explicitly in the introduction, we do not discuss specific tools or methods, for the reasons explained above, under "general".

Reviewer 3, Colin Green

9. The interesting parts concern research and the FRD, so the paper could focus on the former. The FRD is a single function Directive based on a lowest common denominator model and will not help to advance flood risk management. R: See above, under "general".

10. There are wider questions concerning interdisciplinarity. Different disciplines are in fact different cultures with different languages, social norms and views of the world. A major research question is how to conduct effective interdisciplinary research. R: The discussion on interdisciplinarity has been expanded.

11. The broader issue is how to learn effectively and facilitate policy change? R: We agree, but we have decided not to broaden the scope too much and take research as our starting point.

12. A distinction could be made between, on the one hand, doubt concerning which

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action to take, and, on the other, uncertainty about the world. We may also interpret figures between 0 and 1 as indicating the degree of confidence that we have. Uncertainty is not synonymous with probability. Variability is a more useful concept. R: Uncertainty has been defined as uncertainty about the world ("the situation in which there is not a unique and complete understanding of an object or a system"). Variability is mentioned as one cause or aspect of uncertainty.

13. While there is nothing as useful as a good theory, practical applications can help identify gaps and weaknesses in the theory. Hence, there is a virtuous circle between theory and practice. R: We agree. In the conclusion we recommend action research that would link theory and practice.

14. "Technical solutions and governance are the Yin and Yang of flood risk management." The dominant approach is indeed technical, with governance then seen as an add-on extra required to make the chosen technical solutions work. R: We agree.

15. How precise should maps be? As a working rule of thumb, "engineers are precise to the nearest millimetre but wrong to the nearest metre." They should be generally right but may be imprecise in detail (instead of the other way around). R: This question is hard to answer in general. In section 3.2, we state that "depending on the intended functions and target audiences, different information may have to be included and more or less accuracy may be required." We like the working rule of thumb and sometimes use it in presentations - with mention of the source, of course.

16. Whereas old style flood management involved a Platonic Philosopher-King model of experts deciding what the public needed and determining the best means, the emerging model is one of decision making by the stakeholders, enabled to make informed decision by the available expertise. From that perspective, I would criticize the authors for accepting the technical framing of the discourse, notably the use of 'risk communication. "Conversation" may be a better term as it stresses interaction. R: We agree with the description of old-style and new-style experts, but we keep the term

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"risk communication." It is true that "communication" can be one-directional, but it can be interactive as well, and this is how we use the term and how the term is used in most of the references on "risk communication" that we have used. In the section on risk communication, we give a critique of one directional risk communication ("There is, however, no reason why the public should uncritically accept the risk assessments made by the experts", "in a sense, the lay persons approach is more rational than the technical approach"). "Conversation" has some unfortunate connotations: inconclusive, chitchat.

17. The definition of stakeholders would require further development. Governance is about power. This engages difficult issues of legitimacy, accountability, and justice. What weight to give to each interest? Procedural justice may be key. R: The different types of stakeholders are now introduced at the end of section 3.3. The selection of stakeholders to be involved is now mentioned in section 4.2 on participatory research.

18. A key question for flood risk management is how to integrate water and land use planning. R: We agree: already the definition of "flood risk" from the FRD mentions "land", and the consequences of flooding depend on land-use. In section 3.3 we now mention the need for cooperation with land use planning authorities in the implementation of the FRD. The integration of water management and land use planning would deserve a paper on its own.

19. Who is the competent authority for implementing the FRD and what determines "competency"? R: This is a very interesting question, but beyond the scope of this paper (more for a paper with a social science audience).

Reviewer 4, Tim Harries

20. The paper makes good use of the FRD as a vehicle for discussing some key research topics, but it fails to use or define its terms with sufficient rigour or to raise some of the fundamental debates that define the research agenda. It would benefit from taking a more critical look at the Directive itself and from identifying with greater

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precision how social science and natural science research can contribute to its aims. The logical flow of the argument is sometimes less clear. R: We have restructured large parts of the paper, clarified the scope and reformulated several introductory sentences and whole paragraphs in order to improve the logical flow of the argument (see above under "general"). The contributions that social science and natural science research can make should now stand out more (see for instance the last two paragraphs of section 3.3). We have decided not to critique the FRD, but to treat it as a given, which it is for the coming years or even decades. For our use of terms we refer to our reactions to point 14 and 16.

21. Some key issues in some research areas are missing, such as problems related to differences in data availability and quality for flood risk mapping and some institutional issues. R: The issue of data availability and quality is now mentioned in section 3.2 on the flood hazard and flood risk maps. Whether or not to prepare and publish flood maps is in Europe not an issue anymore because it is required by the FRD. The issue what to include exactly is mentioned in section 3.2, as is the problem of suggesting too much certainty.

22. The term "research" seems to cover activities normally attributed to practitioners rather than to researchers (e.g. "assess the economically optimal level of flood protection and propose and assess measures"). R: This remark seems to refer primarily to what is now section 3.3. The introductory sentence of this section has been replaced by "The preparation of flood risk management plans will require a lot of research on possible measures, their effectiveness and their costs." Especially in the engineering sciences it is not uncommon to suggest new measures or develop (and assess) different strategies (e.g. the work of Jonkman and De Bruijn referred to in the paper).

23. Is trust in researchers really an issue? This needs to be addressed in the paper. R: By reformulating one introductory sentence, we have tried to make clear that a) public acceptance of risk assessments is not always low, and b) if it is low, lack of trust in researchers is sometimes, but not always, the reason. That being said, Wynne (1992),

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referred to in the paper, gives a very convincing example of lacking trust in researchers, albeit concerning a different type of risk. Another example is river dyke strengthening projects in The Netherlands, which were based on river discharge and water level predictions that were subsequently contested. Unfortunately, no peer-reviewed articles have been written on this case.

24. More justification is needed for the conclusion that there is a large need for interdisciplinary and participatory research. Participatory research is neither defined nor critiqued, the discussion of interdisciplinary research is scant. R: The discussion has been expanded considerably and the terms "interdisciplinary research" and "participatory research" have been explained better. See above, under "general".

25. Section 2 is mostly descriptive. To understand the role to be played by research, the social/ political context of the creation of the FRD and the motivation for it being written immediately after the 2002 floods should be made clear. R: To understand the implication for research, it is first of all necessary to find out what the FRD exactly requires. For this a legal analysis is necessary. The motivation of the FRD is important because the European Court of Justice, the highest authority in interpreting European directives, interprets provisions in the light of the purpose of the directive. However, to find out what the purpose was, the Court only looks at officially published documents, such as published drafts and especially the recitals of the directive. These are quoted in section 2. The social-political context of its creation would be very important for political science analysis of its development, but this falls outside of the scope of the paper.

26. In English, the directive is generally known as the European Floods Directive (EFD) and not the Flood Risk Directive (FRD R: The reasons for using Flood Risk Directive instead of European Floods Directive are explained in the rewritten introduction of section 2.

27. Several more minor points, line by line: 4972.10-11 The paragraph has been com-

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pletely rewritten. 4962.8: Corrected 4962.7: "Flood hazard and flood risk maps" is the name given to the maps in the FRD. The FRD-terminology is not great: "flood consequences maps" would have been more correct. 4962.9: "Alternatives" is not mentioned anymore. 4975.11 Corrected 4963.17: We mention that "significant" is not defined in the FRD. There is not much more to tell. It is not uncommon for legal documents to contain vague terms requiring interpretation. 4964.15: The best solution was to delete the term "river basins" at this place. 4967.8-9: Given the aim of the FRD as expressed in the preamble, a reasonable interpretation of the requirement to include measures in the plan is that these measures have to be implemented as well. It would not be in keeping with the aim of the FRD just to produce paper. 4970.26: Both references refer to very recent research that has not yet been published in a peer-reviewed journal. They are more to the point than the older references to peer-reviewed articles. In our eyes, the quality is just as good. 4975.19: The sentence has been changed slightly to make clear that a) public acceptance of risk assessments is not always low, and b) if it is low, lack of trust is sometimes, but not always, the reason.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 4961, 2009.

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