Natural Hazards
and Earth System
Sciences

Discussions

Interactive comment on "AGRIDE-c, a conceptual model for the estimation of flood damage to crops: development and implementation" *by* Daniela Molinari et al.

F. GRELOT (Referee)

frederic.grelot@irstea.fr

In its first part, this paper presents a "conceptual model" for estimating damage induced by flooding of cultivated agricultural plots. This "conceptual model" shall be seen as what should be considered for someone that wish to implement a model that assess "damage to crops" in some given context. This first part is mainly based on a litterature review of past studies. In its second part, the paper presents an implementation of this "conceptual model" on a specific context (in the Po plain, in Province of Lodi). This implementation relies partly on the expertise of some experts, and on the reuse of some models coming from the litterature. This implementation has been made through the

development of a "spreadsheet" that can be find on internet, and has been developped for 4 types of crops (maize grain, wheat, barley and grassland), a special focus being done on maize grain within the article.

General comments

My main concern is on the innovation provided by the article compared to precedent studies. From precedent studies, referred in the state of art section, it can be seen that many bricks presented in the article were already existing. For instance, a "conceptual model" has yet been formalized since the 80's in the USA, combining in a certain way "physical damage" and their "economic implications" in terms of loss of added value. Even if all detail are not given, many specifications are provided (see the user's manual of AGDAM, link provided below). Part of those details may be available from other studies. For instance in our works (Agenais et al., 2013), we explicit completely how we link "physical damages" with "economic implications". Thus, I recommend that the article should be more specific on what it gets from previous studies, and what it added.

This is not specific to the "conceptual model". For instance, in their conclusion (page 20), the authors state that "According to authors' knowledge, AGRIDE-c represents the first attempt to organize all the available knowledge on flood damage to crops in a usable and consistent tool (i.e. the model integrates physical and economic approaches) that can be implemented to guide the flood damage assessment process, in different geographical and economic contexts." I do not master totally the American approach, but it has been developed to be used in different context (USA is a large country...) and has been developed as a tool used by USACE (ADGDAM). Another example is coming from Hess and Morris (1988), that also organized their work on grasslands in a framework comparable to that of AGRIDE-c and included it in a tool (SCADE). Last example, concerning our work, I can specify that in chapter 3, the presentation of the methodological framework gives a clear explanation that damage are considered as loss of added value and how to link them to physical effects of flood. In chapter 4,

we give some precision on modelling of damage to sub-component of farms (which include crops, vegetal material, soil, equipment). For crops, we explain how to take into account farmers' strategies (continuation, abandoning, reseeding for instance), depending on when the flood occurs compared to the crop calendar. In chapter 5 we explain that all this has been implemented in a tool called floodam (now floodam-agri), which aim is to help to adapt damage modelling to different context, including prices, crops calendars, and even also the question of the typology of culture to best fit with typology of GIS. I want also to point that the authors present results for 4 types of crops, whereas both the American and the French approaches deal with many more types (including permanent crops).

Secondly, I feel uncomfortable with the articulation of the two parts of the article, "conceptual model" and "implementation". From figure 2, it is expected that implementation of AGRIDE-c shall take into account all the phenomea described. But when coming to the implementation, it appears that many of those phenomena are not taken into account (loss of fertility due to sedimentation or loss of quality for instance). This shall be exposed in a clearer way not to induce false expectations on the scope of the study.

Third, I think that the conceptual model is incomplete, at least for perennial crops (such as vineyard, but also grassland). First, it does not seem clear that the authors get that for some culture it may be useful to separate crops (fruits) and vegetal material (trees). This is not restricted to vineyard and orchards, but may also be important for asparagus, and even certain type of grasslands. If vegetal material is affected by flood, there may be at least two types of effect that last more than one year. For a given plot, if some plants are to be "destroyed" by a flood, it is expected that yield reduction and thus of products, but also variations of charges occur during the following years. This type of effects are for instance implicitly taken into account in Agenais et al. Secondly

Forth, I think there are not sufficient description of the role of the direct consultation of experts for the current work. It is only said (page 7) that some experts were consulted (agronomists and representatives of the authorities responsible for agricultural damage

C3

management and compensation), that this expertise were used to produce the production costs for normal activity (page 11, figure 3), the 3 possible strategies after a flood occur (pages 12-13) and an opinion on the suitability of yield reduction model coming from our works for maize grain (page 12). As many of the implementation seem to rely on the consultation of experts, I think a much more detailed description of this consultation shall be provided: how many experts has been consulted? What were their precise expertise, especially concerning flood impacts? What were their opinions on the data they provided? Have they been consulted on the results? What were their opinion on those results? What were their opinion on the transferability of those results on other context? This would strengthen this part of the work, that is almost invisible at the moment.

I would therefore recommend to be less ambitious in terms of interest of the article and to reorient it on the question of what has been necessary to adapt from previous works to a specific context. I invite the authors to be more precise on what they really include in their model, not on what they would have liked to include, because this makes things unclear for the reader. Another perspective would be to make a clear list of what that have not included. I also invite the authors to be more specific on how they have really implement their "local" model, by precising all the steps about consultations of experts. This seems important, especially for a expert-based approach. For those reasons I recommend a major revision.

Other comments

Given the scope of the article, I am not totally convinced that the state of the art analysis should be done in such a detailed way. This is more convenient for a kind of review articles. If this section should stay in such a detail version, some imprecision needs to be corrected. For instance: - P3-L16. "No model in Table 2 considers instead the behavior of farmers after the occurrence of the flood (e.g. the decision of abandoning the production or to continue with increasing production costs)..." Agenais et al. does (see chapter 4) - P3-L22. The distinction between "physically based" and "cost based"

C4

is not clear. As formulated "cost based" models appears as simpler models where yield reduction is always total, which is not the case for "physical based" models. But for "physical based" models consequences in terms of production costs are considered. - Table 2. I am not convinced by the way some works are classified. For instance AGDAM cannot be said as "cost based", as it also consider some physical aspects on flood for yield reduction. I have not the time to check for all the works. Thus, I am not confident by what is presented in table 2. - P5-Table2 Agenais et al. present damage functions for 14 crops type, based on a detailed model of 50 crops types.

I haven't seen the demonstration of what is promised in the abstract about "comprehensive cost-benefit analyses of risk mitigation actions". What is said in the discussion (page 17) is just that AGRIDE-c provide a way to estimate direct damage to crops, but in fact, it is only one contributions among others. I also feel that the authors did not get that for CBA purpose, it should be considered a "collective perspective", without considering possible transfers. This is not clear (see remarks on the "spreadsheet" tools). I think that should be reformulated.

I haven't seen neither the demonstration that AGRIDE-c is a "a powerful tool to orient farmers' behavior towards more resilient damage alleviation practices". I do not know in detail what is the context of management of flood and agriculture in Italy. It is not presented in the article. But, this context may have some implications on what strategy would be follow by farmers, independently of what AGRIDE-c shall demonstrate. For instance, in France, if a farmer expect to receive some compensations from "Calamités Agricoles" (a State compensation scheme) or from "Assurances Récoltes" (Private insurance), he shall have to follow some recommendations concerning what he can follow as a strategy. If he does not, he may not receive any compensation. Also, it is not clear that the consequences presented are really those supported by the farmers. If there exists some compensations in Italia, this shall be included to provide a true "financial perspective" (point of view of the farmers).

I am not convinced by the the §starting line 19 on page 19, concerning the necessity of

"sediment and contaminant transport models" as the authors said before that they did not find available models to estimate the effects of sediment and contamination. This appears not coherent.

I think that some of the figures presenting the results shall be changed. In fact, in the title, the authors say that they analyze "damage to crops" but none of the figures clearly present a "net" damage. The reader has to make a mental effort to understand what are the damage from those figures (5 and 7): - make a difference between last point of the curve of scenario 0 and last points of three other curves for the production costs part - make a difference between a value given by a bar for scenario 0 and 3 other values for the "turnover" part - and then make a difference between the difference of turnover and the difference of production costs... Well, this should be done for the reader! This could allow to have a representation of the flood damage depending on the season of occurrence (as a function).

Concerning figure 1, the authors announce that relative damage is supplied by our works (Agenais et al. 2013), but this is not the case. Our results are expressed in absolute damage (see page 51 of our report). Thus, the figure 1 is an interpretation of what we have done, but this interpretation is not explained. Moreover this interpretation is necessary incorrect, as our results are presented on a seasonal time step (3 months) whereas the time scale in the figure 1 is one month. Moreover, as seen in our reports, relative damage are maximum only in summer, for long duration, and height over 130 cm, thus it is impossible to have relative damage of 100 % for any other case. I have not verified what is announced about the presentation of the results of Forster et al., but it shall be verified.

"Spreadsheet" tool

I had a look at the "spreadsheet" tool, and I share some comments on it, as I understood that all the application where made thanks to it: - There is not a manual to help people use the tool, it would be nice (necessary?). - Technically this tool is not designed

to produce damage function but to estimate damage for specific value of hazard. This is not very practical for a user interested in a "damage function". - I have some questions on how the value coming from "Agenais" were filled, as I cannot remember that the authors asked for those values, which are not detailed in our report. - For instance, in some cases (maize, germination) yield reduction may occur for flood with a duration of 0 day, and in other cases (maize, flowering) there is no yield reduction for such flood with duration of 0 day. This may be a misunderstanding of what we developed. This leads to possible damage for a flood of 0 day and 0 cm for maize, which has no sense in our works. Such a flood is typically a flood with no consequences. - Another thing is that it is not specified that all data used from Agenais et al. are only specified for negligible flow velocity. This is particularly important for maize, wheat, and barley, that are very sensitive to this parameter. This may induce a bad use of the tool. - One of the aspects that may change from site to site is the list of actions inside the crop management sequences. There are many reasons for which those actions may differ, not only in value but also in nature. This aspect is not taken into account, and doesn't seem to be easily taken into account with the provided tool. - In the tool, "EU contributions for agriculture" are included. This is more oriented for a financial analysis (point of view of a specific farmer, including transfers) than for a Cost-Benefit Analysis (collective point of view, excluding transfers). I think a clear precision on the usage of damage produced should be added. If a financial perspective is to be promoted, all insurance or compensations mechanisms should be also included to give a better view of net consequences for the farmer.

I think this tool should be added (if possible) as additional data to the final version of the article. In this case, I recommend adding a "manual user" sheet to the tool.

"Technical corrections"

At this stage, I have not focus on those aspects.

Some references (and access):

USACE. (1985). AGDAM, Agricultural Flood Damage Analysis – User's Manual (Provisionnal). CPD-48. Davis, CA, USA: US Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center (HEC). https://www.hec.usace.army.mil/publications/ComputerProgramDocumentation/AGDAM_Use 48).pdf

Agenais, A.-L. et al. (2013). Dommages des inondations au secteur agricole. Guide méthodologique et fonctions nationales. IRSTEA. https://irsteadoc.irstea.fr/cemoa/PUB00041499