Summary of changes and comments regarding observations and recommendations from referee #2

We thank the referee #2 for his new feedback and insights to improve the quality of our manuscript. Below we provide our replies to both the general comments and to the specific points made by the referee, using the following structure: the referee's comment is highlighted in bold font, whereas the answer of the authors is included in normal font.

Referee's general comments

- **Title: suggest adding ':the case of winemaking in France'**

  Answer of the authors:

  - The recommendation has been taken into account and the title modified.

- **Costs definitions and classifications:I go back to my original point that in my view should be addressed in the manuscript. As the commentary in the introduction implies, there is often lack of clarity in the definition, classification and treatment of costs, and this can lead to a combination of confusion, uncertainty and misinterpretation, The topic of the paper is central to this, dealing as it does with 'indirect flood costs'. Definitions of flood costs and treatment of indirect costs have varied. In this context, the authors need to clarify and explain the typology/classification they are using, and how the classification and estimates of costs fit (or does not) with the conventions used by others. There is an important methodological link here. Furthermore, and important in my view, the authors should return to this point in the discussion showing how their approach and estimates relate to the review of the literature on this topic at the beginning of the paper. A critical point also is whether taking the definition of indirect costs as they do makes a 'significant' difference to the estimate of flood damage costs, and in what circumstances. The authors refer to this later, but again this could be framed in terms of this opening commentary.**

  Detail of cost definitions and classifications, including make up of costs. Detail is now provided in a long appendix, to which limited reference is actually made. There needs to be more explanation in the manuscript itself, with more information summarised in the table on 'indicators', please see comments. Is the appendix really supplementary information.

  Answer of the authors:

  - The authors have made different modifications in the manuscript to accomodate the referee #2's requirements.
  - Section 3.1 now informs the reader of a classification adopted to present a decomposition of the baseline results into direct and indirect impacts.
  - In section 4.1, the baseline results are analyzed according to this new classification. We use the resulting decomposition to show the reader the gap between direct and total damages.
  - In sections 4.2.2 and 4.3.2 the quantitative analyses now include absolute values, that, according to our classification, represent variations in the estimation of the indirect damages.
  - More references are made to the appendix throughout the text.

- **The point should be made, in the manuscript and in the abstract, that the modelling and the results are synthetic and not based on actual recorded or observed costs. (it would be nice to anchor them to observations on actual costs, from other work).**

  Answer of the authors:

  - A new statement disclosing that flood impacts are not based in real cases (namely we are not modeling a specific event) has also been included in section 3.2.1 (*Flood process: intensity and impacts of floods*)
  - The authors have not modified the abstract. They consider that to refer to their method as a *virtual laboratory for the ex ante estimation of impacts* already indicates readers that results are based on simulations.

- **Presentation of results. I remain of the view that estimates of absolute costs for the scenarios, summarised in a table, would be helpful, together with a profile that shows the distribution of (synthetically generated) costs by type. %s have obvious limits. A table of results would better support the points made in the discussion. The key question: whether this type of assessment makes a difference and under what circumstances could then be more clearly answered.**

  Answer of the authors:

– A new table with total and direct impacts has been included in section 4.1. This table includes the detail of damages by season in absolute and relative terms, as well as a classification depending on whether the winery is flooded or not.

Referee's specific points on the text

- **Lines 27-41: I go back to my original point, that in my view should be addressed in the manuscript : as the commentary here implies there is often lack of clarity in the definition, classification and treatment of costs, and this can lead to a combination of confusion, uncertainty and misinterpretation, The topic of the paper is central to this, dealing as it does with 'indirect flood costs', but definitions of this and treatment of these has varied. In this context, the authors need to clarify and rationalise the typology/classification they are using, and how the classification and estimates of costs fits (or does not) with the conventions used by others. There is an important methodological link here. Furthermore, and important in my view, the authors should return to this point in the discussion showing how their approach and estimates relate to the review of the literature on this topic at the beginning of the paper. A critical point also is whether taking the definition of indirect costs as they do makes a 'significant' difference to the estimate of flood damage costs, and in what circumstances. The authors refer to this later, but again this could be framed in terms of this opening commentary.**

  Answer of the authors:

  – See answer of the authors to referee #2's second general comment.

- **Line 39: This sentence should begin with 'However'.**

  Answer of the authors:

  – The sentence has been modified

- **Line 167: I missed this at first because when I searched there is no annex B : it is an Appendix. I think the links to this appendix can be strengthened throughout this, including in the section on the costs function and the table of indicators.**

  Answer of the authors:

  – The sentence has been corrected.

- **Line 171 (in reference to figure 2): This is not the workflow of the paper, as such, but of the modelling approach.**

  Figure 2's caption: A more detailed title is required

  Answer of the authors:

  – Phrase restated: "The approach we follow in this paper is outlined in figure. . . "
  – The figure 2's caption has been modified

- **Line 175: Now we have a more detailed description, which is good, it would be good to briefly say how this model compares with similar models of its type in feature or application, and importantly why it was considered to be appropriate for the purpose, and the limitations of the model (linked to the limits of the study dealt with later)**

  Answer of the authors:

  – An Overview of agent-based models applied to the study of floods has been included in the introduction.
  – The section '*overview*' now includes a highlight of the reasons to choose ABMs as simulation method.
  – We agree that a comparison of models would be interesting. However as it has now been highlighted in the introduction, at the time this work was done, there were no similar models to the COOPER model. That was one of the reasons to build the COOPER model from scracht
  – As for the limits, we consider that they have already been disclosed in the discussion section, constituing new research lines.

- **Figure 3's caption: A more detailed title is required**

  Answer of the authors:

- The figure 3's title has been modified

- **Line 224: you mean 'Output' not yield, which is a ratio I now see at the end of the paper, the appendix uses the term yield, where yield presumably is taken to mean Output/Farm, a ratio, perhaps make it clear we are talkng about yield at the farm scale.**

  Line 225: Ditto and below.

  Line 271: output or production loss.

  Answer of the authors:

  - We agree with the referee #2 that it is far more common to use the term 'output' rather than the term 'yield' in an economic paper. However we made the deliberate choice of keeping the term 'yield' to easily differentiate between the output from the plot/s from the output of the winery.
  - The 'yield' of a given farm in the context of the COOPER model is not a ratio but the sum of the "yield or output" harvested in each plot owned by said farm. In other words, as it happens in real life, in the COOPER model each plot "grows" grapes during spring and summer that are harvested in autumn. The sum of the amount harvested from each plot owned by a given farm is our fam's yield (qi). Then all fams give their yield to the winery, that produces the wine (which is the system's production -Q) and sells it. Finally the revenue from the wine selling is distributed among farms according to the ratio qi/Q.

- **Line 274: this takes us back to the definition and classification of costs, asset damage, revenue losses, extra operating costs l the term damage implies 'asset/capital' loss, whereas many many of these costs are 'revenue' items.**

  Answer of the authors:

  - Section 3.1 now informs the reader of a classification of damages adopted for the paper. In section 3.2.2 we use table 1 to explicitly state which impacts are considered direct and which impacts are indirect according to the classification of section 3.1. As well, section 4.1 offers a table with absolute and relative values of total and direct damages for the baseline scenario.

- **Line 359 (referred to section 3.2.10): is this really flood cost estimation?. How does the classification of costs align with the discussion at the beginning, how and why are costs identified and grouped in this way? what are the main constituents of these cost element that make up the function, and are they independent? There is no reference to the Appendix here that contains the details. The appendix seems to be more supplementary data than an appendix as such. There could be a succinct summary of the cost components and their constituents. The editor may have a view, but I think there should be more detail in the main manuscript on the costs, asset damage, changes in annual revenues and expenses and so on, and some comment on what are regarded as direct and what are indirect in the classification commonly used. This could be done by strengthening the indicator table with more detail on the cost element, see below.**

  Answer of the authors:

  - The authors use a simulation model that allow them to simulate productive processes with and without presence of floods. By comparing the simulations done without floods with the simulations done with floods, the authors consider that the model captures the whole cost of a given flood within the boundaries of the system.
  - The main constituents of these impacts are detailed in Table 1. so, for instance, impacts on investments are constitued by the reposition cost of damages in buildings, cost of soil reconditioning and the difference between the planned replanting investment in the scenarios without flood and the replanting investment forced by the flood.
  - The ten indicators have been choosen prior to the construction of the COOPER model as relevant indicators regarding impacts of floods in agricultural supply chains and, more concretely, in a french cooperative winemaking system. They are all considered independent in the sense that they are not calculated from one another. Notwithstanding, insofar as we are in production chain losses of yield are going to provoke variations in production costs and so on. Thus there exist some sort of domino effect linking them.
  - Table 1 now includes information on the metric for each indicator as well as the classification in direct or indirect impact.

- **Line 362: there needs to be a reference here to the Appendix that provides further explanation : I didnt see this until i reached the end.**

  Answer of the authors:

  - The text includes now more references to the appendix

- **Table 1 (page 16, line 393): the title is unhelpful. Need a full title that explains contents.**

  Table 1 (page 16, line 393): More detail would help here, and some further explanation. I now see there are detials in the appendix, which is not signposted here. I think that more information on the metrics of these cost items and sources of data should be summarised here in this table for the main part of the manuscript. Damages implies asset losses and some of these impact are, but some are losses in revenue. it would be useful to inlcude a colums that shows the units of measurement and metrics for each of these high level indicators, eg soil damage assessed in terms of soil restoration costs, and for the other items also, them it becomes clear what is being measured. Also the table could show where the data are derived from

  Answer of the authors:

  - The title of the table has been modified.
  - A new column (named *"Metric"*) has been included in the table. Inasmuch as all indicators eventually provide the information in monetary terms, a mention of the measurement unit has been included in the table's caption.
  - A new column specifying whether the indicator is considered direct or indirect impact has been included.

- **Line 407: advise avoid use of the term 'concrete' in English unless the authors mean a mixture of sand, stone and cement, which they may for buildings perhaps, but not here. Also see below**

  Line 427: as above, implies a strong mix. . . .

  Answer of the authors:

  - The phrases have been restated avoiding the term.

- **Line 544: (referred to section 4.1): the authors are missing a trick here. There is much interest in assessing the profile and make up of costs, and the balance of asset and other costs, and how the estimated costs align with the kind of classifications referred to earlier, by other authors and in this work. A table on the type and distribution of costs would be really useful. This would also show where the big hits are, and from a resilience/response aspect, where the effort should be placed in terms of Flood risk management.**

  Line 544: (referred to section 4.1): which is what, max €8 million in figure 6 ?

  Answer of the authors:

  - The article now includes a fully rewritten section 4.1 where we enter in the detail of the magnitude of total impacts as well as direct ones. A new table with total and direct impacts has been included in section 4.1. This table includes the detail of damages by season in absolute and relative terms, as well as a classification depending on whether the winery is flooded or not.

- **Line 646: is this apparent in the Quant results - if they are presented, perhaps for the extreme cases.**

  Line 653: see my earlier comment, where are the quantitative results that show the breakdown and distribution of costs, and which of these these costs significant in absolute terms. I am still trying to understand whether allowing for the linkages makes a difference and is worth the trouble, when the winery itself is not flooded but farms are, and vice versa. Also, some of the literature alluded to use 'weights' applied to direct costs, to estimate knock on effects in the non flooded areas ; are there implicit weights here? I am trying to see where the comment below is coming from in the results, namely: 'the observation does not allow us to give a general recommendation one way or the other . . . .'

  Answer of the authors:

- The authors have provided orders of magnitude in absolute values for all the section of quantitative analysis. We expect that this new information helps readers to realize the significativity of the differences especially when compared to the annual potential added value of the system.

- **Line 779: this begs the question what decisions might be made if these assessment/information gaps were filled ; are these estimation errors 'significant' in the scheme of things, relatively or absolutely This would help decide whether further assessment effort is justified would changes in future risks, possibly associated Climate Change, make the extra effort more or less valid.**

  Answer of the authors:

  - The authors consider that the new elements added (explicit impact classification, table with absolute total and direct values of damages for the baseline and explicit numerical values in both quantitaive analyses) reinforce the opening argument of the conclusion: *"[. . .] the introduction of explicit interactions in productive systems has a non-negligible impact on the amount of damage estimated at a microeconomic scale"*. Indeed, the inclusion of absolute and relative values for both total and direct damages now gives a clearer idea of the magnitude of the damages that might be incorrectly estimated. Furthermore, according to the classification established in our work, those incorrectly estimated damages are going to be indirect damages and their magnitude is going to depend on different factors such as, e.g., season, flood extent, material entities flooded, links among material entities, etc.

- **Line 800: or other responses such as relocation.**

  Answer of the authors:

  - Indeed. Different responses to cope or to adapt in order to avoid bankrruptcies are to be expected.