Dear editor and reviewers,

We thank you for your time and consideration in reviewing our revised manuscript. We have taken the minor revisions suggested by reviewer 2 into full consideration and integrated them into our manuscript. Below we have detailed our point-by-point response to the minor revisions with references to the line number where adjustments have been made in the manuscript.

Thank you for your continued interest and effort in reviewing our manuscript.

Kind regards and best wishes for the new year,

Karen Gabriels, Patrick Willems and Jos Van Orshoven

COMMENT REVIEWER 2

Thank you for your time and consideration in reviewing our revised manuscript. Below we have outlined point-by-point the adjustments we have made according to your suggestions in order to further improve the quality of our manuscript.

As correctly stated somewhere toward the end of the discussion: the numbers are surrounded by large uncertainties. Nevertheless, I find from the abstract until the conclusion EUR values up to the single unit. I suggest replacing them by kEUR to focus more on the order of magnitude of the results instead of the exact values.

The numbers mentioned in the manuscript abstract have been adjusted to represent the values in kEUR (L. 15–16 in the revised manuscript).

Abbreviate corporate author names when used in references. For some of them it is done correctly (e.g. EEA in line 20), other like VMM are sometimes used, sometimes not and for example Agentschap Informatie Vlaanderen, Nationaal Geografisch Instituut, Agentschap Innoveren en Ondernemen are not. The full names, especially when in combinations break the reading flow and therefore the good understanding of these sentences.

Following your suggestion, we abbreviated all corporate author names in our manuscript and in the references.

Cartography can be improved for almost all figures. Select a line to delineate the catchment and then have a white background as a starting point. In addition, select different colours and legend classes to improve the readability and relevance of the maps included (More detailed comments below for individual maps).

The depiction of the figures is based on the catchment delineation of the Maarkebeek. We did not alter the scale of this depiction to a smaller part of the catchment, since the flood events are distributed over the larger part of the Maarkebeek catchment. We have attempted to improve the readability of the figures in our manuscript according to the detailed suggestions provided for each individual map, providing a white background and adjusted scales. These adjustments are described for each figure in the response on the detailed comments.

*Important information is the level of detail of the land use maps: these have pixels of 50*50m² resulting in 100 pixels of the DEM having the same land use class. That's an additional source of uncertainty in the results not mentioned.*

The general land use dataset depicted in Figure 3 has a resolution of 50 m (L. 183–184). This general land use dataset is implemented in the RR-model and thus used in the optimization framework to

assess land use changes. This information is added in L. 186. It is, however, important to note that the maximum damage estimates are based on the land use dataset of 2012 with 5 m resolution (L. 216–217). As such, the DEM and the land use dataset used to derive maximum damage values do have the same resolution of 5 m. This is now clarified in our manuscript in L. 374–376.

The paper referred to (Gabriels et al. 2022) is not yet available to understand some work. However, after enlarging the maps on screen, it looks as the selection of the 750 pixels is based on the RR-model CN parameters only and does not take into account aspects like connectivity to already existing forest plots or to each other. Same for the sealed areas that can occur in the middle of agricultural land and are not necessarily connected to existing urban areas. Is this assumption correct? Although it will probably be expressed in the other paper, some additional details would be welcome to understand what is done here.

The paper of Gabriels et al. (2022) is now available online, the DOI is provided in the references and it can be found on https://www.sciencedirect.com/science/article/abs/pii/S0169204621002255. We agree that some context is lacking to interpret the resulting, selected pixels for afforestation and sealing. The RR-model is implemented in the optimization framework, thus the spatial connectivity between pixels is explicitly taken into account. This is added in L. 125 with regards to the RR-model and repeated in L. 236–237 in the context of the optimization procedure. Further details are also provided in L. 238–245 to provide further context to the spatial distribution of the selected pixels: 'In each of the two flood events in 2002, only one flood extent was observed; the most downstream pixel in this extent, i.e. the outlet, was consequently used as point of interest (POI) in the optimization and pixels were ranked based on the change in runoff volume accumulation at this POI. In the flood events in 2003 and 2010, respectively three and eight flood extents were observed. These extents' outlets were considered the POIs in the optimization and the pixels were ranked based on the combined changes in runoff accumulation at these pixels, weighted according to the observed flood damages in each flood extent. The four optimization results, one for each of the flood events, were summed to obtain one ranking for each land use change, thereby weighting the standardized pixel ranks according to the flood hazard, i.e. as the corresponding flood damages are weighted in Eq. (5).'

Detailed remarks:

- *lines 19-20: There's an indicator for 1980-2019 as well, the EEA reference you give is over a decade old (https://www.eea.europa.eu/ims/economic-losses-from-climate-related). Europe is defined here as EEA member countries or EU-27 (eventually plus UK).*

We opted originally for the older reference, since this relates detailed figures concerning floods, i.e. hydrological events. The more recent indicator relates information regarding all extreme weather events, which also includes economic damages from storms (meteorological events) and droughts (climatological events). The data source of the indicator is not available for further data analysis, however, from the data table we extracted and summed the damages related to hydrological events, resulting in a total of 147 billion EUR. We updated the reference in our manuscript and added the total sum in L. 19-20.

- *lines 55-57: in particular for agricultural damages, the historic damages were compared with LATIS results. A limited comparison with damage records in the (at the time federal) Rampenfonds were done as well in addition to using NL and UK enquiries.*

This information has been added to our manuscript in L. 56–57.

- *lines 83-84: in a newly added sentence you describe the work as similar to LATIS, while in the discussion a lot of differences are mentioned. I suggest to remove the newly added sentence.*

Following your suggestion, we have removed this sentence from our manuscript.

- *line 87: the four events are nowhere defined above and only become clear when looking at Figure 4 several pages later.*

We provided this information in the introduction to describe the general outline of the manuscript. We acknowledge that this information is provided too soon in the manuscript, thus we removed the reference to four specific flood events from the introduction and describe the methodology in a more general way (L. 83–85).

- *lines 156-157: while not applied in the study for VMM in 2006, LATIS can also distinguish maximum damage estimates for Flemish 'landbouwstreken'. Especially in areas with a lot of vegetables, maximum prices differ significantly from maize or wheat.*

We added this information to our manuscript in L. 162–164.

- *Figure 3: somewhere in the text above Figure 3, describe the pixel size of the land use map (see general remark).*

The pixel size of Figure 3 is detailed in L. 183-184.

- *Figure 4b: Select different colours for the flooded areas or consider reversing the colour scale for the DEM. For the 2002 maps: what about overlapping areas flooded in both events? Which of the 2 events is mapped on top of the other? Why is this not a fourth individual map? What do the results show in the next maps: the sum of both, the average, one overlaying the other event?*

A different colour was selected to depict the flooded areas in order to provide a larger contrast with the underlying DEM. The flood events in February and August 2002 each consist of one recorded flood extent. These extents do not overlap, thus, these extents are depicted in the same figure, with different colours to distinguish the extent belonging resp. to the event in February and August. This has been clarified in the text (L. 198–200) and in the caption of Figure 4.

- *Figure 5: delineate the area with a line and leave the background (not selected) white to increase readability. Sealing can get a different colour, for example red to increase readability.*

The background of Figure 5 is changed to white and sealing is depicted in a red colour. Though no areas were delineated with line features, we feel these adjustments do increase the readability of the figure.

- *Figure 7a: I only see green. As pixels with high(er) water depth are probably located close to the rivers, the information is invisible. A continuous linear scale is maybe not the best choice.*

The pixels with high water depths are indeed localized close to the rivers. A linear scale indeed does not well display the distribution of water depths. Water depths are now classified in four relevant classes, leading to more colour variation in the figures.

- *Figure 7b: there's a yellow legend class and a yellow background. Background can be removed. The legend classes result in only green colours being visible. Consider a different scale and add the maximum value to the highest legend class to indicate the range instead.*

The background of Figure 7b is changed to white. The class boundaries have been changed and more classes are added to allow for a better differentiation in the figures.

- *Figure 8: 0 is not bigger than 1265 and should be placed at the other end of the legend (or removed). I see some dashes of red and yellow, but a different legend choice (class boundaries, eventually adding 1 class) would indicate much better areas of attention (and in later figures where the biggest benefits are).*

The legend has been ordered in ascending order and class boundaries have been adjusted, adding an additional class, in order to allow more differentiation between areas with different risk values.

- *Figure 9 a and b: a yellow background with a yellow legend class do not match. Background can be white. In 9b, 0 should be placed at the other end of the legend.*

The background has been changed to white and the legend has been reordered in ascending order.

- *Figure 11: 0 at the wrong end of the legend.*

The background has been changed to white and the legend has been reordered in ascending order.

- *Lines 371-375: it is important to mention the price of land, as this is often forgotten in nature-based solutions. The same for labour forces. Both of them can be partially mitigated (volunteers, volunteering schemes). For the subsidies: these have a cost as well, so they don't replace the cost of land acquisition. And in addition, how likely is it that the 750 pixels selected will be the ones where the afforestation measures are applied? Planting trees is a good idea, but maybe flood reduction is not the primary benefit. I miss topics like ancillary effects (co-benefits) in a discussion that is lengthy and to the point.*

The high costs associated with afforestation are related in L. 353-358, mentioning the labour costs as well as the cost of the land acquisition. In L. 390–392 the impact of small-scale landscape elements is mentioned, which are associated with lower implementation costs.
The presented comparative flood risk assessment framework was illustrated using the land use change scenario aimed at reducing flood risk hazard in the catchment. However, it can be applied on any land use change scenario (L. 396–397). The framework is aimed at quantifying the flood risk mitigation or increment associated with land use changes. Other co-benefits associated with these land use changes are not taken into consideration. However, the results of this framework can be part of a larger assessment of the impact of land use changes in spatial planning. This has been added to the discussion in L 388–389.

- *Figure 12: 0 at wrong end of the legend. Can there in addition to map 12 (which will become 12a) a map 12b presenting the differences in between the 2 results visually?*

The legend classes have been reordered in ascending order and additional classes were defined. A difference map between LATIS and the risk estimated by the flood risk assessment framework was also added. This figure is also described in L399–401 and the caption of the figure was adjusted.

- *Lines 442 and following: Suddenly, a new element is introduced being the flood insurance value. In my opinion it does not contribute much to the overall paper as it neglects many aspects on how insurance mechanisms work, insurance premiums, compensation values. The discussion has enough substance without this aspect.*

Indeed, this new element would require more elaboration on the mechanism of insurances. Following your suggestion, the references to the flood insurance value have been removed from our manuscript.