

Review:

Title: A comparative flood damage and risk impact assessment of land use changes

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MS type: Research article

location	Text	Issue to correct / refine
Abstract	These measures include the establishment of land use types with a high (e.g. forest patches) or low (e.g. sealed surfaces) water retention and infiltration capacity at strategic locations in the catchment.	Use of sealed surfaces is a bit unusual and might imply the 'opposite of a nature-based solution'? It needs more explanation of how this has influenced the hydrology. Are you modelling urbanisation?
Abstract	Rainfall runoff model	Can you name the model here please and describe it in more detail
	Sealing scenario	Needs more explanation – are you suggesting artificial surfaces?
Line 34	<i>Finally, the flood risk is determined by combining the flood damages caused by flood events with different return periods in a weighted summation.</i>	I think this definition should be more scientific, e.g.: Risk can be quantified in terms of an average annual damage, by weighting the computed impacts for design events with their respective annual exceedance probabilities.
Para lines 40-50		Reads well
Line 51	...LATIS....	Would it be better to introduce LATIS alongside your model and state the differences from the outset – especially the differences in assumptions on e.g. indirect damages. LATIS gets used and results presented but we don't really understand the background to it here.
Line 82	<i>Using a flood damage model, flood damages were assessed from four flood events occurring in the Maarkebeek basin between 2000 and 2016</i>	This flood damage model needs to be defined and more details provided. What were the antecedent conditions for each event? Soil moisture will strongly influence the assumptions on runoff generation
Line 83	<i>The overall flood risk was determined by combining the flood damages of the four events with their respective probability of occurrence.</i>	Please specify the assumption made at low return periods for the onset of flooding – do you assume onset at the median flood or somewhere between that and the minimum flood hazard used? What probability events were used? Please specify here.
Line 86	<i>spatially explicit rainfall-runoff (RR) model, calculating the runoff volume accumulated in each pixel after a rainfall event</i>	Please specify the model used!!!
Line 95	Return periods	Define in relation to annual exceedance probability and also specify which ones!
Line 97	<i>Consequently, an empirical relationship between observed flood volumes and modeled runoff volume accumulation is established to</i>	I think I understand this, but perhaps some curves of volume versus runoff should be shown to illustrate? Did you build a look-up table to relate the

	<i>determine the flood volumes after land use changes.</i>	volume on the floodplain to runoff (volume? Peak flow?) for the available flood hazards? You could refer to figure 5 later.
Line 99	<i>Based on these modeled flood volumes, a DEM is progressively filled and corresponding water depths are thus determined.</i>	One issue here is what happens if water in reality not going to reach a certain pixel until depths overcome an embankment? Do all depressions fill up simultaneously? I think this is very approximate
Line 110	Deriving depths and volumes	This technique seems too approximate – some measure of uncertainty in the level might be useful – or a sensitivity analysis
Figure 1	diagram	I think the diagram could be explained better. I guess the delta is the estimated change in impacts. Perhaps an example of the statistical relationship would help such as a curve of depth versus runoff accumulation?
117	CN-based	CN? Needs more explanation please
118	<i>This CN-based RR-model propagates the runoff through the watershed, thereby continuously assessing downstream re-infiltration using the Manning's equation.</i>	The Manning's equation is for open-channel flow – please explain tis better – how does it help assess the re-infiltration are you talking about a difference?
126	equation	Ok I have also used a similar relationship so good to see this here.
140	Figure 2	Interesting that the damage factor is so high for shallow flooding of roads – why is this? Is it relating to disruption losses?
149	Household damages	What was the average max damage per unit area used for residential? Please provide as you provide this for other receptors and later in the paper
164	Weighted summation	Not sure about the 'double counting' here – you are weighting the damages with the return period – or annual exceedance probability – it is not removing double counting?
170	Equation 4	The important factor here is your lowest return period modelled – as it sets the limit of what we know about the onset of flooding. What is your smallest RP modelled hazard? Was it 10 years?
193	Interpolation	This is a better explanation /summary than earlier
199	Residential damages	Worth using earlier to give a feel for the range
219	This procedure ranks pixels based on (i) where in the upstream area of the flooded zones afforestation maximally reduces the runoff accumulation in these zones, and	I do not understand how you have moderated the upstream accumulations in the modelled land use change – how is this represented in the model. This is really important to the credibility. Are you assuming the top 750 pixels don't contribute anymore or is there

		<p>some sort of fractional reduction? On what evidence is it based? The modelled change leads to a BIG reduction in damages, so needs fully explaining.</p> <p>Also the afforestation must surely have a different impact on runoff depending on the soil moisture – which depends on the antecedent rainfall . I think you need to state your assumptions or model more conditions, and also which hydrological processes you are representing.</p>
220	Prioritising pixels	I think the uncertainties will be high in this approach – It would be good to understand the sensitivity of the outcomes: for example - the errors in damages that could be incurred due to +/- 0.1m error in the water surface level
236	determine	Replace use of this word with estimate
243	error	There are 2 formatting errors
255	inflicted	Replace with 'incurred'
Figure 5	discussion	Discuss the impact of the lower return period damages mainly being underestimated by the regression model compared to the data. These will all be weighted more strongly. Perhaps a two stage relationship is needed? Again, sensitivity to this would help understand the decisions that could be made.
Figure 6	5m*5m impact cells	If you are using 5m then may be a flow accumulation grid using 5m DTM would have been more appropriate / compatible (instead of 50m)?
Line 277	Comparative damages	<p>These reductions in damages are very large and of concern – would woodland really have such a big impact?</p> <p>– what antecedent conditions do you assume in the 'model' for different storms?</p>
285	Sealing scenario	The change is not nearly so great
353	comparison	It is good to compare with other estimates
357/8	Comparison with LATIS	if indirect damages are being assessed in one model but not the other then it might be possible to just use a factor to correct and allow a better comparison.
360	uncertainties	...but you could help define the uncertainties better with more sensitivity analysis here
Figure 11	LATIS reporting	I'm not sure why the LATIS reporting and outputs are shown here as it's not

		been used in the main study? Is this just for comparison – in which case a side-by-side plot might be more useful with your method or an overlay.
Line 373 + 382	Use of regression	See comments about two stage or exponential regression, plus this section should include information summarising antecedent soil moisture for the calibration events – are they different? How do they vary seasonally? You finally mention boundary conditions in the last section – I think this is very important and may account for some of the scatter etc.
385/conclusions	First sentence	The framework does allow for this comparison but I think the uncertainties must be very high, and the predicted reductions in flood risk seem very high.
394	57% reduction	<p>I haven't seen values this high – you need explain what mechanisms in hydrology can help with this – are you including:</p> <ul style="list-style-type: none"> • Increased infiltration • Increased soil storage • Increased transmissivity in soil profile • Increased wet-canopy evaporation • Increased friction <p>I think you need to explore how the changes you've imposed in the model are justified in relation to hydrological processes</p>