

Interactive comment on “CLIMADA v1.4.1: Towards a globally consistent adaptation options appraisal tool” by David N. Bresch and Gabriela Aznar-Siguan

Anonymous Referee #1

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The authors present an amendment and application of their open-source python tool CLIMADA to study the benefit of various adaptation options to climate extremes. Their current application deals with a very specific case of tropical cyclone impacts to small islands in the Caribbean. The amendment of the CLIMADA tool seems very useful and timely as it allows to address the full modeling chain from climate impacts to adaptation within a single tool. The code availability and reproducibility on github is best practice. The paper is well motivated and well written despite several very long and complex sentences. Please see my further comments below:

Major points:

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1. As mentioned above, the manuscript contains very long and complex sentences that make it difficult for the reader to follow (just to name a few: page 1, line 19; page 14, line 22-28; page 15, line 10). Throughout the text you find many parentheses providing additional information that disturb the flow of reading. Consider to split these long sentences and to provide extra information in additional sentences.

2. Section 2.2.1: This section is very technical and hard to grasp for the non-expert. While I appreciate the discussion along the lines of the actual methods provided in CLIMADA, the reader might get lost easily. It would be helpful to produce a visualization similar to Fig 1 but less technical that summarizes and describes the different methods and their interrelationship. Maybe even a table might be sufficient.

3. Section 3.1.1: It is understood that this section can only provide a rough introduction to the different adaptation measures. However, I think that one needs to be more rigorous and/or comprehensive in order to highlight that CLIMADA is not just a toy model. My comment about uncertainty assessment below points into the same direction. Here are some points one should elaborate on: 1) the impact intensity reduction by mangroves is considered to be 0.74%. This number is given without reference and should be explained. It appears later in Table 1 and seems to be related to the Turks and Caicos Islands, but this remains very opaque. 2) preparedness is set to avoid damages for events with return periods of up to 7 years. Is there some deeper reasoning behind that? Can the authors provide a reference? 3) the paragraph about risk transfer throws around many numbers which are not very well motivated. For instance, it remains unclear to me whether the cost of insurance refers to annual costs or the costs over the whole period.

4. Figure 3 and Figure 4: The reader expects to read off the averted damage (black arrow in Fig. 3) from Fig. 4b. But instead the gap of roughly 300m USD in Fig. 3 corresponds to less than 100m USD in Fig. 4b. Somewhere towards the end of the manuscript it becomes clearer what might have happened: retrofit was neglected. This is rather unsatisfactory, in particular, because the authors claim that combined mea-

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asures behave differently than single measures. Thus, the reader is unable to reproduce the numbers from the information provided.

5. Section 3.1.3: CLIMADA's ability to combine measures is highlighted in the beginning. When reaching Section 3.1.3 the reader is slightly disappointed as no information about the methods behind the combination is provided (e.g., how is double-counting avoided?). Instead, the reader is confronted with many numbers that require further explanation. In order to better understand how the different measures interact and the numbers come about, I would like to see additional supporting figures in the supplement. Those figures should reproduce the combination effect for the various combinations covered in Section 3.1.3. The figures produced in the jupyter notebook (https://github.com/CLIMADA-project/climada_papers/blob/master/202008_climada_adaptation/reproduce_results.ipynb) should suffice.

6. Section 3.2: What is the reasoning behind choosing the three most cost-effective measures plus risk_transfer? In terms of benefit-cost, this seems not to be the optimal choice based on Fig 4b. Similar to major comment 5, I would also like to see additional supporting figures for all the island groups considered in Figure 6 as a supplement. As above, the figures produced in the jupyter notebook should suffice.

7. Uncertainty assessment: While I understand that uncertainty assessments in this context are very demanding, I still think that the authors need to comment on uncertainties nonetheless. First, in order to strengthen the real-life applicability of CLIMADA, and second, to put the presented numbers into context. The authors cannot extensively discuss benefit-cost ratios with two decimal digits and rate them by effectiveness (fig 6), while claiming in the same instance that uncertainty assessments would overload this paper. I do not want to see an in-depth assessment (knowing the difficulties) but I expect a discussion of the potential sources and ranges of uncertainties for the different measures and how these could affect the presented benefit-cost ratios. This would tremendously help the reader and user to judge on the findings presented in this

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manuscript and the possibilities to account for uncertainties using CLIMADA.

Minor points:

1. Abstract: I would find it very useful to mention tropical cyclones as the object of study in the abstract. It remains unclear otherwise against what the discussed adaptation measures for the Caribbean are guarding.

2. Page 1, line 14: basked -> basket

3. Page 3, line 4: the reference "Aznar-Siguan and Bresch 2019" does not appear in the list of references. Please also correct the multiple occurrences of this reference.

4. Page 3, line 10: The (net present value of) the difference ... -> The (net present value of the) difference

5. Page 5, line 6: the concept of mean damage degree (MDD) is mentioned here and throughout the following pages without being defined properly. As MDD is a central concept of this manuscript, I would strongly suggest to explain it on first use. In addition: What is the difference between MDD and mean damage ratio (see Fig. 2)?

6. Page 5, line 28: on -> one

7. Page 5, line 29 (end of line): as well as -> as

8. Page 7, line 6: 2.2.10 -> 2.2.1 ?

9. Page 9, line 20: the reference to Fig 1 seems not correct.

10. Page 9, line 25: the sentence starting with "building code" sounds strange. Are you sure that the 1 m USD mentioned here is correct?

11. Page 10, line 9: Preparedness ... -> By construction, preparedness... I would add this in order to re-iterate that this threshold was chosen at will earlier.

12. Figure 5: The figure is difficult to understand in its current state. 1) I would likely replace the black bars by thicker/colored bars and refer to them as boxes instead of

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bars, 2) Reducing alpha for the 40y return period in order to highlight different y scales makes blue the predominant color and confuses the reader. Why don't the authors simply use a vertical line between the 10y and 40y case to highlight the difference between the two bars?

13. Page 11, line 18/19: The mangrove protection discussion is too succinct. Where do the 1.5% and 3% values come from? Why do the Turks and Caicos Islands define the reference? How is this related to what the reader already knows from section 3.1.1? See also major comment 3.

14. Page 11, line 20: I would transfer the last sentence before the table to the table caption.

15. Cost-benefit vs benefit-cost: Both terms are used interchangeably throughout the manuscript. Please stick to one wording and adjust also Fig 6 accordingly.

16. Figure 6: Which scenario is displayed here? Current or moderate future?

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-151>, 2020.