AUTHORS' RESPONSE TO REFEREE #2

Research article:

Bresch, D. N. and Aznar-Siguan, G.: CLIMADA v1.4.1: Towards a globally consistent adaptation options appraisal tool, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-151

Authors:

David N. Bresch (dbresch@ethz.ch), Gabriela Aznar-Siguan (Gabriela.Aznar@meteoswiss.ch)

We thank the anonymous referee for his comments, which have improved the quality of the manuscript.

The original comments from the referee are listed below *directly followed by our responses in blue and italic and changes to the manuscript in blue and **bold** (unless where it gets complicated or tiny, where changes are made in the manuscript only).*

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18 September 2020

The authors intend to introduce a methodology that integrate climate modelled risk, impacts (loss and damage), and adaptation options assessment (cost/benefit analysis). In addition, they provide a case study in Antilles to demonstrate an example to use the tool. The intentions are valuable and the platform seems useful to scientists and decision makers at local levels. However, the authors fail to present their intentions and execution well enough for readers to comprehend the value of this study. Here are my comments to this paper:

1.The paper is difficult to read because of a lot of grammar issues. It is perhaps better to proofread the entire text in the next revision.

We carefully re-checked the paper and adopted a more lisible style throughout – in line also with the other reviewer's remark about occasionally long sentences (sic). With the many changes to the text, we do not list all of them here, but provide both a clean revised version of the paper as well as a version with track changes.

2.Section 1 (Introduction): This section is mixed with problem statement and literature review, which make this section confusing. Unfortunately, both (problem statement and theoretical background) are not presented clearly. What's the problem now? What's the scientific gap now? What does this study aim to achieve? These questions can help readers to get to know the reasons behind this study. In addition, a lot of reviewed literature are citing the authors' previous work and stating the content of the reviewed papers. It lacks of discussion of the problems of current practices from reviewing literature.

The introduction of the paper is structured along the following 'fil rouge': Climate change is a fact, yet greenhouse gas mitigation does not happen at the required scale, hence the need for adaptation and demand for risk assessment and adaptation options appraisal. Adaptation is (utterly) local, but best informed by globally consistent approaches.

In line with point 1, we broke many sentences in two, reformulated as appropriate and better highlighted the 'fil rouge' also by breaking the introduction into sections. Again, as for point 1, given the many changes, we do not list all of them here, but provide both a clean revised version of the paper as well as a version with track changes.

The gap consists in the mere fact that globally consistent approaches to adaptation options appraisal are rare to non-existent – and none are readily available as an open-source and -access software tool.

Hence the need to set globally consistent approaches forth, underpinned by versatile platforms, ready for practical application. In this sense, the introduction states the clear demand and does not focus on an in-depth discussion of current practices, as this is not the aim of the present paper. We deemed it useful to cite key contributions to support our argumentation, but do not aim at a review of the full body of literature, which would warrant a study of its own.

The aim of the paper is to present the open-source and -access CLIMADA platform which implements the Economics of Climate Adaptation (ECA) framework, as described in the last paragraph of the introduction. Hence we deem it useful to provide the basics about ECA, which leads to citing a couple of previous studies.

We carefully reviewed and removed select references as suggested. As we strived to keep the paper to the point, we provide a brief description of ECA in the introduction, too, such that we can focus in CLIMADA in the methods section of the paper.

Having thus laid out the structure of the paper, we deem it useful to end the introduction with a sentence to stress the enabling nature of this work. Again, we set this apart by introducing a break to separate from the signposting in the sentence before. Still, we deem it helpful to stress the enabling function of this work already at the end of the introduction, not only to conclude the paper with, namely:

"This extended version of the CLIMADA platform has been designed to enable risk assessment and options appraisal in a modular form and occasionally bespoke fashion […] yet with high reusability of common functionalities to foster usage in interdisciplinary studies […] and international collaboration."

3.Section 2 (Framework Concept and Design): This section provides a lot of technical details of CLIMADA. It is useful to add some important perspectives. For example, can CLIMADA be used in every climate impacts? The paper uses Hurricane as an example risk, but can other impacts (e.g., agriculture, health, etc.) be used in the platform? Is there a constrain in this tool? Such as data availability? In addition, why a moderate scenario is selected? Since the authors are exploring a hazard/disaster impact, why not use the worst case scenario (RCP 8.5)?

While the present application focuses for purely illustrative purposes on hurricane risk in the Caribbean, the CLIMADA platform can *not only, but* is *actually used for most extreme weather events in a globally consistent manner. To clarify this point, we therefore added to the manuscript:* "**Please note that CLIMADA does provide global coverage of major hazards beyond tropical cyclones (TC), yet we focus in TC in the present paper for illustrative purposes.**"

As of today, CLIMADA provides global coverage of all major climate-related extreme-weather hazards at high resolution, namely (i) tropical cyclones and storm surge at 10 and 1km, (ii) river flood at 4km, (iii) drought at 50km, (iv) wildfire at 1km and (v) European winter storms at 4km. Tropical cyclones (Geiger at al., 2019;) are based on IBTrACS (Knapp et al., 2010; updated monthly since)., river flood (Sauer et al., submitted) and drought (Eberenz et al., in preparation) on isimip (isimip.org), European winter storms on Copernicus WISC (Welker et al., submitted)

and wildfires on MODIS (https://modis.gsfc.nasa.gov, implementation experimental still). For all mentioned hazards, a historic, a probabilistic and several future climate (RCP-based) hazard sets exist, enabling assessment of risks today and under diverse climate scenario futures. CLIMADA does also provide a globally consistent exposure dataset at 1km resolution, based on population and satellite-measured night-light intensity (Eberenz et al., 2020a). To implement bespoke vulnerability, impact functions have been calibrated for global regions for tropical cyclones (Eberenz et al., 2020b, in review), flood (Sauer et al., submitted) and European winter storms (Welker et al., submitted). With hazard, exposure and vulnerability datasets being provided, CLIMADA is currently the only ready to use open-source and access (no strings attached, even free for commercial use, GNU GPL license) globally consistent impact modeling platform.

Sure there are constraints, but given the versatility of the general concept as well as the openness of the platform itself, it is merely available extreme weather hazard data that limits its use. While the paper focuses on a regional application, the platform has been used an many scales, from global (e.g. Gettelman et al. 2017) to truly local (c.f. Wieneke and Bresch, 2016).

As for the scenario, again, we chose this for illustrative purposes, any other combination of RCP and year, can, based on Knutson et al. 2015, readily be explored. See also last para of the answer to the next point.

One can play with the RCP selection (and other parameters/settings) in the Jupyter notebook as provided - we will add this as a reference to the paper, instead of a static appendix (https://github.com/CLIMADAproject/climada_papers/blob/master/202008_climada_adaptation/reproduce_results.ipynb).

As we intend to use the case study in many conversations, not all are best initiated with the worst case to start with – hence we would like to trigger questions exactly such as yours (why not RCP8.5) rather than impose this. In this sense, too, your comment is highly appreciated.

4.Section 3 (Case Study): It is perhaps helpful if the authors can provide some background information of current response measures of Antilles in facing Hurricane hazards. In addition, one key challenge of climate modeling in island nation is the resolution and hurricane projection. Did you conduct downscaling? How did you project hurricanes in 2050?

With the case study being illustrative, it was by no means within the scope of the present paper to study the local situation in terms of actually implemented response measures. But we welcome the comment in the spirit of the many Economics of Climate Adaptation (ECA) studies we conducted so far in most world regions, with teams on the ground and deeply rooted in a transdisciplinary approach both in shaping and scoping of the studies. Given limited resources, efforts were directed at contributing facts suitable for local decision making and technical reports, rather than bringing these studies into the peer-reviewed body of literature. This was also due to the fact that at that time, the first author was fully employed in a private sector company with global presence and local attention. Other priorities kept him from publishing in other forms than technical reports (see https://wcr.ethz.ch/research/casestudies.html for a collection) and policy briefs, such as e.g. to the G20 (World Bank Group, 2017).

No downscaling was employed in the study, as the probabilistic tropical cyclone track set was modified according to on Knutson et al. 2015. The wind fields, calculated based on Holland (2008) can be calculated at any spatial resolution, down to 1 km is reasonable. Again, as we present an illustrative case for the full options appraisal methodology, any (sub)model can be further refined, the tropical cyclone wind field e.g. by adding a surface roughness component to it, the exposure layer by specifying sector-specific exposure etc.

For the climate projection 2050, we applied the Atlantic basin factors as published by Knutson et al. 2015 to the probabilistic tropical cyclone track set, i.e. we modified the single event frequency and wind field intensity accordingly. Specifically, we multiplied the wind intensity of storms with category greater than 1 by a factor of 1.045, interpolating these values between the time stamps, and left the event frequency unchanged, all as provided by Knutson et al. 2015 table 3 (we just consider changing frequencies and intensities when the significance level of the hypothesis test is lower than 0.05). Again, we would like tom stress the fact the case study is provided as an illustrative example, by no means pre-empting other methods to generate hazard datasets, such as e.g. obtaining tracks from GCMs (as done in Gettelman et al. 2017) or hybrid methods, such as using synthetic tracks (Geiger et al. 2018), both papers employing CLIMADA for all impact calculations.

References as used in this reply (which are not referenced in the paper itself):

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