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Subject: ReSubmission of "Timescales of emergence of chronic flooding in the major economic centre of Guadeloupe."

Dear Editor,

We thank you for considering the publication of our manuscript in Natural Hazards and Earth System Sciences. On behalf of my co-authors, I am pleased to submit a revised manuscript.

We provide below a detailed response to your concerns, which we hope to have addressed satisfactorily.

We hope that this paper will be suitable for publication in Natural Hazards, and stay at your disposal for any further information.

With best regards,

On behalf of the co-authors,

Gonéri Le Cozannet

Editor's comments

Thank you for the revised submission of your very interesting manuscript "Timescales of emergence of chronic nuisance flooding in the major economic centre of Guadeloupe".In the revised version, the manuscript has significantly been improved. Your research on the specific case is excellent.

- *We thank the Editor for his appreciation of our work*

However, before the acceptance of the manuscript, the following issues need to be resolved:

1. It is not explicitly described, 'why should someone outside of your study area be interested in the results'. If you were to explain the results of your case study to someone in another area, what would they gain from your case study? Do they learn from your methodology and what you encountered when applying it? What is novel and what might they learn? This (how the innovative idea of your study can be transferred to others, along with challenges) needs to be explicitly described both at the beginning so we understand, but also in discussion. This is crucial for accepting the manuscript. The existing explanation is not sufficiently satisfactory.

- We understand the comment from the Editor and agree that this was not explicit in the previous version of the manuscript. In response to this comment, we have implemented the following changes:
- At the beginning of the abstract: we have included a sentence to remind the context of sea-level rise and climate change: "Sea-level rise due to anthropogenic climate change is not only projected to exacerbate extreme events such as cyclones and storms, but also to cause more frequent chronic flooding occurring at high tides under calm weather conditions."
- At the end of the abstract, we now write: "Similar [chronic flooding] processes are expected to take place in many low-elevation coastal zones worldwide, including in other tropical islands. The method used in this study can be transported in other locations, provided tide gauge records and local knowledge on vertical ground motions are available. We argue that identifying times of emergence of chronic flooding events is urgently needed in most low-lying coastal areas, because adaptation requires decades to be implemented, whereas chronic flooding hazards can worsen drastically within years after the first event has been observed."

- We have extended a bit the motivation of the study in the introduction; we feel this is necessary to motivate our statement that similar studies should be conducted in other regions. This reads: "Global assessments available today tend to focus on extreme events exacerbated by sea-level rise, without evaluating the significance of chronic flooding (Oppenheimer et al., 2019). Studies raising awareness on chronic flooding are mostly local, and often focus on temperate areas such as the USA and New-Zealand (Sweet and Park, 2014; Moftakhari et al., 2017;Dahl et al., 2017; Stephens et al., 2020). However, chronic flooding is also a significant matter of concern in tropical islands, because their low lying areas are critical for human activities such as trade, transport and housing (Kumar and Taylor, 2015)." We added a reference to Stephens, S. A., R. G. Bell and Lawrence, J.: Developing signals to trigger adaptation to sea-level rise. Environmental Research Letters, 13(10), 104004, doi:10.1088/1748-9326/aadf96, 2018.

- *We have extended the conclusion to provide practical recommendations: this reads:"* We argue that studies assessing future chronic flooding are urgently needed in most low-lying coastal areas across the Globe. In fact, sea-level is projected to rise along most inhabited coastlines, and adaptation takes decades to be implemented (Haasnoot et al.,2020). The case of Guadeloupe shows that adaptation should ideally be planned before the first chronic flooding events are attributed to sea-level rise. Based on our study above, we recommend that the following points are considered when performing future assessments of chronic flooding hazards:
    - Attribution of chronic flooding events is needed to assess the urgency of adaptation. Yet, the simple observation that chronic flooding events are becoming more frequent is not sufficient to formally attribute the observed phenomenon to sea-level rise. In Guadeloupe, we do not attribute formally observed events to sea-level rise due to lack of consistency between the location of hotspots and their altitude. For future study attempting formal attribution of chronic flood events, we recommend collecting and analyzing additional information on rainfall, runoff and groundwater flows.
    - The times of emergence of chronic flooding can be assessed provided tide gauge records and some information on vertical ground motions are available. Our study provides additional data and methods allowing to assess these times of emergence (see data availability statement). Where resources are limited, a simple preliminary assessment can be performed, by superimposing spring tide levels and sea-level projections available below.
    - Sea-level rise due to climate change is a major driver of future chronic flooding risks, but vertical ground motions due to natural processes or anthropogenic activities need to be considered as well for precise local assessments. In Guadeloupe, the tectonics remain a major source of uncertainties. For future study, we recommend assessing their role, using e.g. the geodetic methods used here (GNSS, InSAR), potentially supplemented with knowledge on the geology. Alternatively, in case of deep uncertainties, users may also consider following a scenario approach as presented above.
- Additional reference: Haasnoot, M. et al.: Adaptation to uncertain sea-level rise; how uncertainty in Antarctic mass-loss impacts the coastal adaptation strategy of the Netherlands. *Environmental Research Letters*, **15**(3), 034007, doi:10.1088/1748-9326/ab666c, 2020.

2. In paragraph 420 (Discussion section), you introduced 'it would be interesting to build upon the experience of Mayotte'. ... 'Mayotte could become a natural laboratory'. How Mayotte case became suddenly important, without providing any context.

- We agree that more context is necessary. We have extended this discussion to refer to geophysical and social observations from other case studies in the Pacific (Ballu et al., 2011; Jamero et al., 2017). We have rephrased the paragraph as follows: "To better manage adaptation to such chronic flooding events, we could learn from areas that experienced rapid relative sea-level changes due to vertical ground motions. For example, a village in the Torres Islands (Vanuatus) was relocated in 2002/2004 due to chronic flooding events caused by relative sea-level changes partly attributed to an earthquake (Ballu et al., 2011). Another earthquake that took place in 2013 in the Philippines caused the subsidence of several

islands (e.g., Batasan, Ubay) and chronic flooding events up to 135 days per year. Yet, people from these islands preferred accommodating with chronic flooding in this case (Jamero et al., 2017). Hence, the local adaptation response can be very different depending on the local context. For Guadeloupe, it would be interesting to build upon the experience of Mayotte, another French island with a similar institutional context. In Mayotte, chronic flooding events emerged in 2019 after a subsidence of about 0.2m caused by the eruption of a submarine volcano off the island (Lemoine et al., 2018;Cesca et al., 2020). The rise of sea-levels observed within two years in Mayotte is typically what is projected to take place in almost all tropical islands worldwide over the coming three decades."

- Additional references

Ballu, V., Bouin, M.N., Siméoni, P., Crawford, W.C., Calmant, S., Boré, J.M., Kanas, T. and Pelletier, B.. Comparing the role of absolute sea-level rise and vertical tectonic motions in coastal flooding, Torres Islands (Vanuatu). Proceedings of the National Academy of Sciences, 108(32), 13019-13022, 10.1073/pnas.1102842108, 2011.

Jamero, M.L., Onuki, M., Esteban, M., Billones-Sensano, X.K., Tan, N., Nellas, A., Takagi, H., Thao, N.D. and Valenzuela, V.P.. Small-island communities in the Philippines prefer local measures to relocation in response to sea-level rise. Nature Climate Change, 7(8), 581-586, 10.1038/nclimate3344, 2017.