Dear Anonymous Referee #2,

We would like to start by thanking you for your positive and constructive comments. Please find below a documented list of changes we have made to the manuscript (marked R: in blue font). We have added a flowchart describing the GCM and synthetic hurricane rainfall event production and how this is translated into flood hazard as well as providing additional explanation in the manuscript. We hope that these clarifications will improve the reader's understanding of our work.

Kind Regards,

Leanne Archer

Anonymous Referee #2 Comments

The authors used forcings of a synthetic hurricane rainfall simulator as inputs to LISFLOOD-FP hydrodynamic model to estimate flood inundation maps in Puerto Rico. Magnitude in precipitation simulations are adjusted to expected changes due to warming under future 1.5C and 2C scenarios. Model results allow to estimate the increase in population that is exposed to flooding.
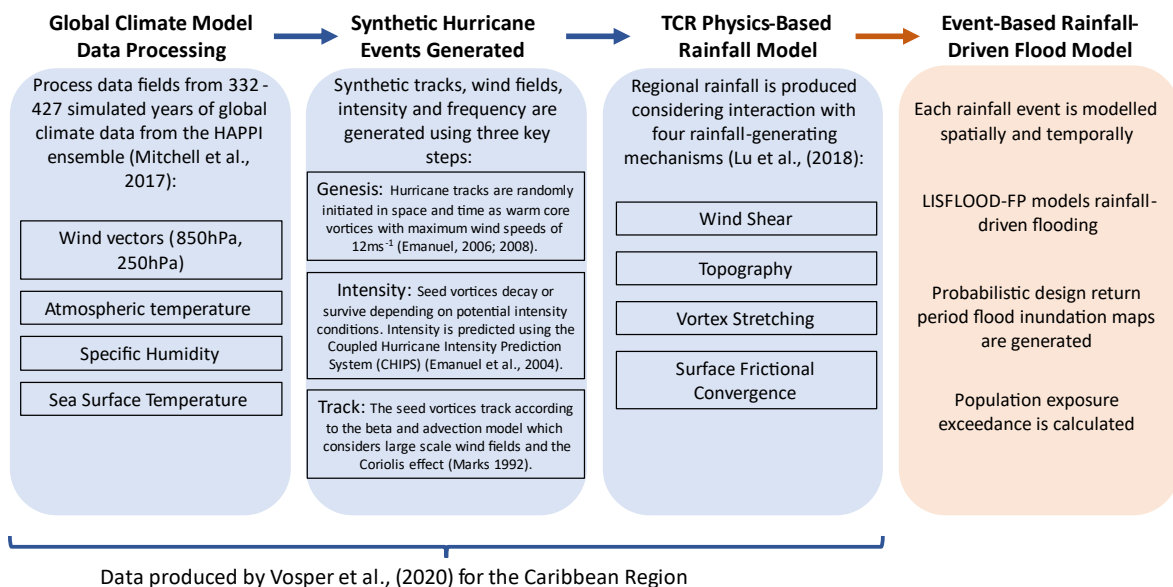
I enjoyed a lot reading and reviewing this manuscript. It is very well written, the methodology is sound, and addresses the problem of changes in flooding in small islands, where more scientific literature is very needed.

I think the manuscript is ready for publication in its current state. I only have minor questions that might be clarified in the manuscript.

R: Many thanks for these comments!

The manuscript could benefit from including a chart describing the methodology, the path from climate forcing to flood inundation maps.

R: We have now included a flowchart in Section 2.1 as Figure 2 starting on Line 160, Page 6 which demonstrates how the synthetic hurricane rainfall events are generated from the climate forcing data, as well as how these are used as input to the event-based hydrodynamic model:

Global Climate Model Data Processing	Synthetic Hurricane Events Generated	TCR Physics-Based Rainfall Model	Event-Based Rainfall-Driven Flood Model
Process data fields from 332 - 427 simulated years of global climate data from the HAPPI ensemble (Mitchell et al., 2017):	Synthetic tracks, wind fields, intensity and frequency are generated using three key steps:	Regional rainfall is produced considering interaction with four rainfall-generating mechanisms (Lu et al., (2018):	Each rainfall event is modelled spatially and temporally
Wind vectors (850hPa, 250hPa)	**Genesis:** Hurricane tracks are randomly initiated in space and time as warm core vortices with maximum wind speeds of 12ms^{-1} (Emanuel, 2006; 2008).	Wind Shear	LISFLOOD-FP models rainfall-driven flooding
Atmospheric temperature	**Intensity:** Seed vortices decay or survive depending on potential intensity conditions. Intensity is predicted using the Coupled Hurricane Intensity Prediction System (CHIPS) (Emanuel et al., 2004).	Topography	Probabilistic design return period flood inundation maps are generated
Specific Humidity		Vortex Stretching	
Sea Surface Temperature	**Track:** The seed vortices track according to the beta and advection model which considers large scale wind fields and the Coriolis effect (Marks 1992).	Surface Frictional Convergence	Population exposure exceedance is calculated

Data produced by Vosper et al., (2020) for the Caribbean Region

Are MRMS precipitation estimates available for Puerto Rico. If so, could those be used as a substitute for Stage IV which has coarser resolution ? MRMS have shorter availability than Stage IV, but includes a better QPE algorithm and finer spatial resolution (1km).

R: MRMS precipitation estimates are only archived from 2020 onwards on the MRMS Operational Product Viewer (https://mrms.nssl.noaa.gov/qvs/product_viewer/), which means we are not able to access and utilise MRMS precipitation estimates from Hurricane Maria (2017). As a result, NCEP Stage IV was the next best available alternative. Nonetheless, MRMS data does have coverage over Puerto Rico, so we do agree with you that this dataset could be used to model hurricane rainfall in our hydrodynamic model for future events instead of NCEP Stage IV where the data are available. To clarify this in the manuscript, we have added a sentence on Line 320, Page 10 summarising this:

"NCEP Stage IV was used instead of the higher resolution Multi-Radar Multi-Sensor (MRMS) rainfall product as the landfall year of Hurricane Maria (2017) falls outside of the MRMS archive period (2020-onwards) (MRMS Operational Product Viewer, 2023).*"*

References

MRMS Operational Product Viewer: https://mrms.nssl.noaa.gov/qvs/product_viewer/, last access: 22 November 2023.