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Open Access Earth System Science Data Discussions



# *Interactive comment on* "A global historical data set of tropical cyclone exposure (TCE-DAT)" *by* Tobias Geiger et al.

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General Comments:

This study describes a dataset of global population and GDP impacted by tropical cyclone winds. The novel approach to assess the exposure impacted by historical global tropical cyclones starts with historical tropical cyclone tracks and applies a parametric wind model to fill out the spatial wind field. These wind footprints are then overlaid with county level measures of exposure (population and GDP) to quantify tropical cyclone exposure that is located above a set of wind speed thresholds. The addition of a second version of the dataset that assumes time-independent exposure will be used widely to explore change variability and change questions.



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Discussion paper

The resulting unique and complete dataset has clear and wide-ranging application to hurricane risk assessments and informing societal planning and responses. A key advantage of the dataset is its global consistency that allows for spatial and temporal data analyses. The dataset is clear, complete, easy to use, and well documented, and the methods are explained in sufficient detail as to be reproducible (albeit with significant effort). Limitations are well articulated.

The subject matter is appropriate for Earth Sys. Sci. Data Discuss.. Given the high interest in tropical cyclone impacts and drivers of longer-term variability and change, this paper and dataset make a valuable contribution. I have a few concerns regarding limitations of the approach, and possible solutions, described below.

Specific Comments

1. The choice to use maximum wind speed to define the impacted area is not well explained. Other choices could be the duration of strong winds or the annual frequency of strong winds. Beyond winds, rainfall or surge could also have been chosen. I realize adding other dimensions are beyond the scope of this study but I think it's important to state that this dataset emphasizes wind speed effects over other aspects of the tropical cyclone hazard.

2. Significant effort went towards creating the population and exposure data on a 0.1 degree grid, but then the resulting data are aggregated to the country level. It seems a missed opportunity not to retain the spatial TCE data on the 0.1 degree grid.

3. The impacted exposure will be sensitive to the defined spatial extent of the cyclone's strong winds. The section describing sensitivity of the TCE-DAT to accounting for storm size is therefore very important. I agree that accounting for size does not affect the impacted exposure over many storms, but clearly differences will be significant for some individual storms. Your note of caution against using the data for individual storm analysis could easily be missed. Why not include a third version of the dataset that includes size information where available? The Holland model includes an option to include an

outer wind value to tie down the wind decay function with distance. Using this would retain consistency across the different dataset versions. It would also be interesting to show the impact of accounting for observed size on the timeseries of exposure by adding this third dataset to figure 3. Maybe on global scales the impact would be small but for single basins the timeseries, and even the long-term trend could differ.

4. Brooke Anderson and colleagues at Colorado State University conducted a closely related, but regionally limited, study to assess historical tropical cyclone wind, rain, flood and tornado, and related impacts. This was published on github, for application to epidemiology research. Please reference this work. https://github.com/geanders/hurricaneexposure. https://github.com/zailchen/noaastormevents.

Minor Comments

1) The first paragraph of the introduction lists the harmful impacts of tropical cyclones. But it's important to note that tropical cyclones can bring benefits such as alleviating drought.

2) Introduction, lines 9 and 10. In addition to facilitating reproducibility, standardized datasets also accelerate science discovery.

3) Page 4, line 20: Can you explain how you filtered landfalling storms? What resolution landmask did you use and did you only consider Islands above a minimum size? Did you also include land-grazing storms, i.e., storms whose center did not make landfall but still brought strong winds onshore?

4) Page 5, line 10: The vector addition of the translation speed to the vortex wind is fairly simple. Others have shown that surface frictional effects reduce magnitude and rotate the direction of the translation speed seen in the surface winds (e.g., Lin and Chavas 2012).

Lin, N., and D. Chavas (2012), On hurricane parametric wind and applications in storm

surge modeling, J. Geophys. Res., 117, D09120, doi:10.1029/2011JD017126.

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