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Global Synthetic Tropical Cyclone Generation under Present and Future Climate Conditions

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Over the past few decades, the world has seen a drastic increase in tropical cyclone (TC) damages, with for instance the 2017 Hurricanes Harvey, Irma and Maria entering the top-5 costliest hurricanes ever. Calculating TC risk at a global scale, however, has proven to be difficult, given the limited temporal and spatial information on landfalling TCs around much of the global coastline.

In this research, we present a novel approach to calculate TC risk under present and future climate conditions on a global scale, using a newly developed synthetic tracking algorithm STORM (Synthetic Tropical cyclone tracking Model). For this, we extract 30 years of TC activity from the European Centre for Medium-Range Weather Forecasting (ECMWF)'s high-resolution ($\pm$0.225°x0.225°, 3-hourly) model EC-Earth, under both present and future climate conditions (Hazeleger et al 2012). This dataset is used as input for the STORM algorithm to statistically extend this dataset from 30 years to 10,000 years of present and future TC activity. Validation shows that the STORM dataset preserves the TC statistics as found in the original EC-Earth dataset. Furthermore, the STORM dataset highlights some profound changes in TC activity under future climate conditions, such as an intensification of TCs and a poleward shift of the TC tracks. The complete STORM dataset will include wind, precipitation and storm surge heights, and can be applied for global TC hazard modeling and coastal flood risk assessments.