Evolution of US Hurricane Risk in a Changing Climate

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Hurricanes pose a significant threat to the nation's population and critical infrastructure in the coastal regions annually, making it important to characterize the risk associated with them and understand how that may evolve in a changing climate. While the reliable observed record is not long enough to robustly quantify storm behavior, direct simulation of hurricanes using high resolution numerical models is computationally expensive. To overcome these challenges, a Risk Analysis Framework for Tropical Cyclones (RAFT) is being developed at PNNL.

RAFT is a hybrid modeling approach that combines physics-based models with machine learning to model not only the physical behavior of hurricanes but also the human-systems impacts associated with them. Here we apply the RAFT framework to climate model output to understand how the US coastal hurricane risk may evolve in a changing climate. To this end, RAFT will be applied to large-scale environmental conditions derived from climate simulations belonging to the Coupled Model Intercomparison Project phase 6 (CMIP6). First, climate model output from the historical period will be applied to RAFT and a comparison of model-simulated storms with observations will be performed to benchmark model skill. Next, model projections of future climate under the 'SSP585' emissions scenario with unchecked anthropogenic greenhouse gas emissions, will be applied to RAFT to quantify the potential future change in hurricanes and the risk associated with them.

In summary, the proposed analysis will allow a robust quantification of the US coastal hurricane risk in a non-stationary climate using the hybrid modeling approach of RAFT.