Tropical Cyclone Damage Assessment for Predicting Effects of Climate Change on Caribbean Storms

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Caribbean island nations are particularly susceptible to tropical cyclone (TC) impacts due to their tropical location and proximity to favorable cyclone-forming conditions. Accurate TC models are essential to promoting resilience in vulnerable island nations and informing policy decisions for emergency procedures, allocation of aid, and economic relief such as insurance and reinsurance. The aim of this project is to construct a TC model that will accurately predict the effect of climate change on asset losses caused by Caribbean storm impacts. This project focuses on wind speed as the main variable used in hazard and vulnerability calculations. The hazard component of the model was quantified using IBTrACS data on TC tracks and applying an empirically-derived formula to calculate wind swaths. For the exposure values, LitPop data that includes the World Bank's produced capital stock were utilized to determine the value of manufactured or built assets in each country. Next, the vulnerability was calculated using the formula for wind-related vulnerability. Computed wind swath data were interpolated with LitPop exposure data so that damages from storms that made landfall in the Caribbean were able to be visualized. Asset loss calculations for all storms that made landfall in the Caribbean were completed using the wind-dependent vulnerability function. The findings indicate that although there are limitations in damage assessment since other variables such as rainfall, storm surge, and flooding are not explicitly included in the study, a risk model based on wind speed was accurately constructed based on TC track and exposure data.