Assessing future hurricane risk in the Caribbean based on large-scale predictor fields

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Hurricanes are the most damaging natural disasters in the Caribbean and global warming is expected to increase their impacts. It is well understood that tropical cyclones (TC) will intensify as sea surface temperatures warm and that the amount of precipitation brought by these TCs is going to increase with the water holding capacity of the atmosphere. However, for an assessment of future hurricane risk in the Caribbean it also important to better understand whether and how the overall frequency of tropical cyclones might change.

Projecting future tropical cyclone activity remains challenging because of the weak representation of tropical cyclones in most global circulation models. Here we want to overcome this shortcoming by estimating hurricane risk indirectly based on favorable climatic conditions in the region. These large-scale predictor fields are easier to model and therefore allow for an improved assessment of future hurricane risk.

We define hurricane risk as the accumulated energy that TCs produce in proximity of Caribbean islands. Using novel statistical methods, we identify regions of sea surface temperature, wind speeds and sea level pressure with predictive power for the next weeks hurricane activity. Based on these predictors we construct a classification model to estimate the probability of having TCs in proximity of islands and their strength for the following week. The expected value of seasonal hurricane risk based on these weekly probabilities shows high skill in reproducing the observational record.

Applying the same hurricane risk model to climate projections from global circulation models allows us to estimate future hurricane risk without relying on the ability of climate models to adequately represent tropical.