North Atlantic Hurricane Potential Intensity in CMIP5 Models: Anthropogenic Forcing versus Atlantic Multidecadal Variability

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In our previous study (Camargo et al., 2012, Climate Dynamics), we examine the role of local and remote sea surface temperature (SST) on the tropical cyclone potential intensity (PI) in the North Atlantic using a suite of model simulations with prescribed observed sea surface temperatures (SSTs), focusing on the relative importance of anthropogenic (external) forcing and the internal influence of Atlantic Multidecadal Variability (AMV) for the period from 1900 to 2005. Consistent with previous results indicating a tampering influence of global tropical warming on the Atlantic hurricane potential intensity, our results show that non-local SST tends to reduce PI associated with locally forced warming through the changing upper level atmospheric temperatures. Our results further indicate that the observed late 20th Century increase in hurricane power dissipation index, while closely related to the tropical Atlantic SST increase, may not have been dominated by anthropogenic influence but rather by internal variability.

In this study, we extend the analysis to the newest generation of coupled ocean-atmosphere model simulations (CMIP5) for both the historical and the future scenario runs, to further determine the role of anthropogenic radiative forcing versus internal multidecadal variability on Atlantic hurricane potential intensity. We use the signal to noise maximizing EOF analysis to separate the radiatively forced SST signal from the internal SST variability on multi-decadal time scales, and then regress each model's potential intensity onto the forced and internal SST variability in North Atlantic. While the role of anthropogenically forced SST on North Atlantic hurricane potential intensity is relatively small compared to that of the internal SST variability at the end of the 20th Century and the beginning of the 21st Century, its effect is expected to increase toward the end of the 21st Century. The results based on the CMIP5 models are compared to that of the previous generation of the IPCC models, i.e., CMIP3, to show the model improvements as well as the role of aerosol indirect effects that have been incorporated into some of the CMIP5 models.