Dominant Role of Tropical Atlantic Warming on the Active 2017 Major Hurricanes over the North Atlantic

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The 2017 hurricane season in the North Atlantic (NAT) was active in terms of 6 major hurricanes (MHs) –including 3 MH landfalling events (Hurricanes Harvey, Irma, and Maria) causing widespread damage over the Gulf Coast and the Caribbean. A number of factors might have been linked to enhancements of 2017 MH activity, such as marked sea surface warming over the tropical Atlantic and off coast of North America as well as teleconnection modulated by the moderate La Niña condition in the Pacific. Here we show, through a suite of idealized seasonal predictions with a high-resolution global coupled model, that the active 2017 MHs was *not* induced by the 2017 La Niña condition, but by pronounced sea surface warming in the tropical Atlantic. This warming is associated with a positive phase of the Atlantic Multidecadal Mode (AMO) or Atlantic Meridional Mode (AMM), indicating major contribution of natural variability to the active 2017 MH season. It is further shown that increase in green house gasses and decrease in aerosol loading will further increase in MH frequency in the future even given the same spatial pattern of sea surface temperature anomaly like the 2017 summer. Thus, continued anthropogenic forcing will further amplify the risk of MHs in the NAT, with corresponding socio-economic implications. The key factor controlling MH activity in the future appears how much the tropical Atlantic gets warmer than the other open oceans rather than absolute warming in the tropical Atlantic alone, as is also reported for weaker storms in the previous studies.

Keywords: Major Hurricanes, Atlantic Multidecadal Oscillation (AMO) and Atlantic Meridional Mode (AMM), Relative SST Anomaly, Seasonal Prediction