Geophysical Research Abstracts
Vol. 20, EGU2018-3957, 2018
EGU General Assembly 2018

Climatology and Predictability of U.S. Mid-Atlantic Tropical Cyclone Landfalls in High-Atmospheric-Resolution Seasonal Prediction System

Julia Manganello, James Kinter, Benjamin Cash, and Erik Swenson
Center for Ocean-Land-Atmosphere Studies (COLA), George Mason University, Fairfax, USA (jvisneva@gmu.edu)

Tropical cyclone (TC) landfalls over the U.S. Mid-Atlantic region (Virginia, Chesapeake Bay, Delmarva Peninsula and New Jersey coastlines), which include the so-called “Sandy-type”, or westward curving, tracks, are among the most infrequent landfalls along the U.S. East Coast. However, when these events do occur, the resulting economic and societal consequences are devastating. A recent example is Hurricane Sandy in 2012 which is considered the third largest monetary loss due to a hurricane on record (Swiss Re 2014) and the second-costliest cyclone to hit the United States since 1900, with the greatest number of U.S. TC related direct fatalities in the northeast since 1972 (Blake et al. 2013). We have utilized multi-model ensemble seasonal forecasts conducted with a high-atmospheric-resolution coupled prediction system, based on the European Centre for Medium-range Weather Forecasts operational model (Project Minerva), as “extensions” of the observational record to compile the statistics of these rare but potentially highly destructive events. We show that Minerva retrospective forecasts exhibit skill in reproducing climatological characteristics of the Mid-Atlantic TC landfalls particularly at the highest atmospheric horizontal spectral resolution of T1279 (16-km grid spacing).
The forecasts are further used to identify regional and large-scale environmental conditions associated with these anomalous TC tracks to better quantify their predictability and its limits, and their dependence on model resolution. Specifically, the evolution of the large-scale atmospheric flow patterns leading to the mid-Atlantic TC landfalls is analyzed using local finite-amplitude wave activity (LWA), which has been shown to be an effective diagnostic of weather extremes at the regional scales, and capture the local wave amplification associated with the blocking episode during Hurricane Sandy. We have identified large-amplitude quasi-stationary features in the LWA anomaly distribution that persist up to a week leading to these landfalling events. An index is introduced by averaging LWA anomalies over the selected regions and several days prior to landfall. A statistical model utilizing this index as a predictor is developed that exhibits skill in predicting Mid-Atlantic TC landfalls several days in advance. Implications of these results on longer timescale predictions of these events including climate change projections are discussed.