On the Cause of the Great North Atlantic Hurricane Drought of the Late 20th Century

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Abstract

By all sensible metrics, North Atlantic tropical cyclone activity underwent a pronounced decline from the middle of the 20th Century through the 1980s, and then recovered. A rich literature is devoted to the causes is this hurricane drought, with some arguing that it is part of a natural, multi-decadal oscillation of North Atlantic climate, and others pointing to time-varying radiative forcing as the main cause of the drought. In this work I show that the net variability of Atlantic tropical cyclone activity in the second half of the 20th Century has two spectral peaks: One around a single decade and another at a period close to 70 years. I hypothesize that the longer period variability, of which the drought was a part, was principally owing to time-varying radiative forcing, while the quasi-decadal signal is part of a natural oscillation of North Atlantic climate. To test this hypothesis, I present evidence that the two main contributors to time-varying radiative forcing over the period were CO_2 variations and aerosol forcing brought about by a combination of sulfate originating in European sulfur emissions and natural mineral dust from the Sahara, and then show that most of the longer-period variations can be statistically explained by a combination of these two forcing agents, at the same time demonstrating that the spatial pattern on this variability is consistent with the radiative forcing hypothesis. On the other hand, the spatial pattern of the quasi-decadal variations is closely aligned with that of the EOFs of natural variability in a large suite of unforced, coupled climate models, suggesting that this quasi-decadal signal is part of a natural oscillation of the North Atlantic climate.