

Cause of the Atlantic Multidecadal Oscillation: A Positive Feedback between SST and Dust Aerosol via Sahel Rainfall

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Most studies of African dust and North Atlantic climate have been limited to the short time period since the satellite era (1980 onward), precluding the examination of their relationship on longer timescales. Here we use a new dust data set with the record extending back to the 1950s to show that tropical North Atlantic dust aerosol, Sahel rainfall, and Atlantic hurricanes vary with the Atlantic multidecadal oscillation (AMO). When the AMO was in the cold phase from the late 1960s to the early 1990s, the Sahel received less rainfall and the tropical North Atlantic experienced high concentration of dust. The opposite was true when the AMO was in the warm phases before the late 1960s and after the early 1990s. This suggests a novel mechanism for the AMO – a positive feedback between North Atlantic SST, African dust, and Sahel rainfall on multidecadal timescales. That is, a warm (cold) North Atlantic Ocean produces a wet (dry) condition in the Sahel and thus leads to low (high) concentration of dust in the tropical North Atlantic which in turn warms (cools) the North Atlantic Ocean. An implication of this study is that coupled climate models need to be able to simulate this aerosol-related feedback in order to correctly simulate climate in the North Atlantic. Additionally, it is found that dust in the tropical North Atlantic varies inversely with the number of Atlantic hurricanes on multidecadal timescales due to the multidecadal variability of both direct and indirect influences of dust on vertical wind shear in the hurricane main development region.