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Tropical storm activity enhanced by Sahara greening and reduced dust emissions during the African Humid Period

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Tropical cyclones (TCs) have devastating socioeconomic impacts and understanding the nature and causes of their natural variability is of paramount importance for society. However, historical records of TCs are too short to fully characterize such changes and paleo-sediment archives of Holocene TC activity are still very few both temporally and geographically. Here we investigate global TC activity during a warm climate state (mid-Holocene, 6,000 yr BP) characterized by increased boreal summer insolation, vegetated Sahara, and reduced dust emissions. We analyze a set of sensitivity experiments in which not only solar insolation changes are varied but also prescribed vegetation and dust concentrations. Our results show that the greening of the Sahara and reduced dust lead to more favorable conditions for tropical storm development compared to the orbital forcing alone. In particular, the strengthening of the West African Monsoon induced by the greening of the Sahara triggers a change in atmospheric circulation that embraces the entire tropics. Furthermore, while stronger boreal summer insolation and hence warmer sea surface temperature may actually lower TC activity in the Northern Hemisphere as shown in previous studies, accounting for the Sahara greening and its associated reduction in dust emissions leads instead to an increase of TC activity in both hemispheres, particularly over the Caribbean basin and east coast of North America. Our study highlights the importance of regional changes in land cover and dust concentrations in affecting the potential intensity and genesis of TCs, and suggests the roles they might play in a future warmer climate.