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Possible influence of dust on hurricane genesis

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Tropical Cyclones (TCs) belong to the most extreme events in nature. In the past decade, the possible impact of dust on Atlantic hurricanes receives growing interest. As mineral dust is able to absorb incoming solar radiation and therefore warm the surrounding air, the presence of dust can lead to a reduction of sea surface temperature (SST) and an increase in atmospheric stability. Furthermore, resulting baroclinic effects and the dry Saharan easterly jet lead to an enhanced vertical shear of the horizontal winds. SST, stability, moisture and vertical wind shear are known to potentially impact hurricane activity. But how Saharan dust influences these prerequisites for hurricane formation is not yet clear. Some dynamical mechanisms induced by the SAL might even strengthen hurricanes.

An adequate framework for investigating the possible impact of dust on hurricanes is comparing high resolution simulations ($\sim$0.5°x0.5°, 31 vertical levels) with and without radiatively active dust aerosols. To accomplish this task, we are using the general circulation model ECHAM6 coupled to a modified version of the aerosol model HAM, ECHAM6-HAM-Dust. Instead of the five aerosol species HAM normally contains, the modified version takes only insoluble dust into account, but modifies the scavenging parameters in order to have a similar lifetime of dust as in the full ECHAM6-HAM. All remaining aerosols are prescribed. To evaluate the effects of dust on hurricanes, a TC detection and tracking method is applied on the results.

ECHAM6-HAM-Dust was used in two configurations, one with radiatively active dust aerosols and one with dust being not radiatively active. For both set-ups, 10 Monte-Carlo simulations of the year 2005 were performed. A statistical method which identifies controlling parameters of hurricane genesis was applied on North Atlantic developing and non-developing disturbances in all simulations, comparing storms in the two sets of simulations. Hereby, dust can be assigned a more influencing role on TC genesis in the simulations with active dust. Despite dust is seeming to have a negative influence on TC genesis, the relative importance of dust compared to the sea surface temperature (SST) cannot be determined thoroughly. This is largely due to a similar pattern of SST and dust off the west coast of Africa, so that possible effects of dust and SST could hardly be separated.