

The role of African easterly wave on dust transport and the interaction between Saharan dust layer and Atlantic ITCZ during boreal summer

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Saharan dust outbreaks not only transport large amount of dust to the northern Atlantic Ocean, but also alter African easterly jet and wave activities along the jet by changing north-south temperature gradient. Recent modeling and observational studies show that during periods of enhance outbreaks, rainfall on the northern part of ITCZ increases in conjunction with a northward shift of ITCZ toward the dust layer.

In this paper, we study the radiative forcing of Saharan dust and its interactions with the Atlantic Inter-tropical Convergence Zone (ITCZ), through African easterly waves (AEW), African easterly jet (AEJ), using the Terra/Aqua observations as well as MERRA data. Using band pass filtered EOF analysis, we find that African easterly waves propagating westward along two principal tracks, centered at 15-25N and 5-10N respectively. The easterly waves in the northern track are slower, with propagation speed of 9 ms⁻¹, and highly correlated with major dust outbreak over North Africa. On the other hand, easterly waves along the southern track are faster with propagating speed of 10 ms⁻¹, and are closely tied to rainfall/cloud variations along the Atlantic ITCZ. Dust transport along the southern track leads rainfall/cloud anomalies in the same region by one or two days, suggesting the southern tracks of dust outbreak are regions of strong interaction between Saharan dust layer and Atlantic ITCZ. Possible linkage between two tracks of easterly waves, as well as the long-term change of easterly wave activities and dust outbreaks, are also discussed.