

Long-term Trends in African Dust Transport to the Caribbean: African Sources, Changing Climate, and Future Scenarios

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Aerosol studies were begun on Barbados in 1965 and they continue to this day at the University of Miami Atmospheric Chemistry Station [Fig. 1] situated on a promontory on the east coast at Ragged Point (13.165N; 59.432W). The monthly mean dust concentrations (based on daily filter samples) in Barbados trade winds show a strong seasonal cycle with a maximum in summer and a minimum in winter [Fig. 2]. Moreover there are great changes on interannual and decadal time scales. Over much of this record there was a strong negative correlation between dust concentrations in Barbados and rainfall in the Sahel-Soudano (SS) region of North Africa. In retrospect, this correlation was largely driven by three distinct periods in the early record: the period of high rainfall and low dust transport in the mid-to-late 1960s; the first SS drought and increased dust in the early 1970s; and the extremely intense SS drought of the early 1980s which is associated with the highest dust concentrations of the entire record. During this early period, dust transport showed promising relationships to various climate indices: e.g. ENSO, NAO, AMO. However, since the early 1990s the drought has moderated. Although there have been large year-to-year changes in SS rainfall, there is no relationship between dust on Barbados and SS rainfall or between dust and common climate indices. Furthermore, over the entire record there is a strong shift in seasonal dust transport, most notably, a great increase in winter and spring transport compared to the pre-drought and early-drought period. Over various parts of the record there are suggestions of strong relationships to various climate indices but these do not hold over the entire record. These changing relationships suggest that there have been profound long-term changes in dust emissions and transport and the driving mechanisms. A possible contributing factor could be increased population and land use in the SS region. As to the future, the Intergovernmental Panel on Climate Change 2007 multi-model projections of rainfall in Africa show drier conditions in the North but they could not reach a consensus in the SS region. The absence of a clear relationship between dust transport and African-Atlantic climate and the uncertainties in climate projections make it impossible to anticipate how transport to the Caribbean might change in the future.



Figure 1. University of Miami Atmospheric Chemistry Station.

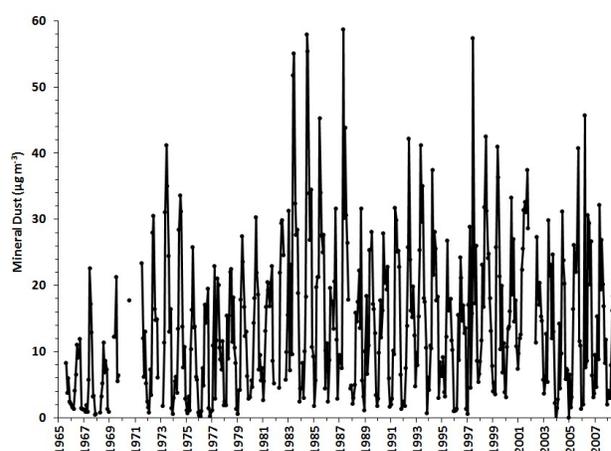


Figure 2. Barbados Monthly Mean Dust Concentration ($\mu\text{g m}^{-3}$).