Stratospheric Quasi Biennial Oscillations and its Modulations on Spectral AODs over Tropical Stations in Asia and Africa

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Quasi Biennial Oscillations (QBO) are downward propagating easterlies or westerlies in the wind field over the equatorial stratosphere (~ 16-50 km) having a variable period in the range 21-32 months had reported that the amplitude of the QBO is approximately Gaussian around the equator with a half width of ~ 12° latitude. Analysis of long-term time series of monthly mean columnar Spectral Aerosol Optical Depths (AOD) at four tropical stations over Asia and Africa revealed the presence of significant annual oscillations (AO, with periodicities of 1 year) and Quasi Biennial Oscillations (QBO, period of 2-3 years). Phase relations revealed that the QBO_{AOD} were out-of-phase with QBO_U at the equatorial stations, whereas an in-phase relationship was noticed at the off-equatorial and extra tropical stations. As the QBO_U induces a meridional circulation with equatorial convection (subsidence) and off equatorial subsidence (convection), during its easterly (westerly) phase, with a cooler (warmer) and higher (lower) tropopause at the equatorial (off-equatorial) regions, the associated vertical as well as horizontal mixing of mass flux would modulate the aerosol properties with an increase (decrease) in AOD at the equatorial (off-equatorial) regions. The wavelet spectra of Outgoing Longwave Radiation (OLR) and monthly mean rainfall over Asia revealed an in-phase relationship with QBO_U at the equatorial and out-of-phase relationship at the off-equatorial stations similar to the AOD.