NORTH ATLANTIC AEROSOL RADIATIVE EFFECTS BASED ON SATELLITE MEASUREMENTS AND AEROSOL INTENSIVE PROPERTIES FROM TARFOX AND ACE 2

Robert A. BERGSTROM (Bay Area Environmental Research Institute, San Francisco, CA 94122 USA, email bergstro@sky.arc.nasa.gov,)
Philip B. Russell (NASA Ames Research Center, Moffett Field, CA 94035-1000 USA, email prussell@mail.arc.nasa.gov)

We estimate the impact of North Atlantic aerosols on the net shortwave flux at the tropopause by combining maps of satellite-derived aerosol optical depth (AOD) with model aerosol properties. We exclude African dust, primarily by restricting latitudes to 25-60 N. Aerosol properties were determined via column closure analyses in two recent experiments, TARFOX and ACE 2. The analyses use in situ measurements of aerosol composition and air- and ship-borne sunphotometer measurements of AOD spectra. The resulting aerosol model yields computed flux sensitivities (dFlux/dAOD) that agree with measurements by airborne flux radiometers in TARFOX. It has a midvisible single-scattering albedo of 0.9, which is in the range obtained from in situ measurements of aerosol scattering and absorption in both TARFOX and ACE 2. Combining seasonal maps of AVHRR-derived midvisible AOD with the aerosol model yields maps of 24-hour average net radiative flux changes at the tropopause. For cloud-free conditions, results range from –9 W/m^2 near the eastern US coastline in the summer to –1 W/m^2 in the mid-Atlantic during winter; the regional annual average is –3.5 W/m^2. Using a non-absorbing aerosol model increases these values by about 30%. We estimate the effect of clouds using ISCCP cloud-fraction maps. Because ISCCP midlatitude North Atlantic cloud fractions are relatively large, they greatly reduce the computed aerosol-induced flux changes. For example, the regional annual average decreases from –3.5 W/m^2 to –0.8 W/m^2. We compare results to previous model calculations for a variety of aerosol types.