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NORTH ATLANTIC AEROSOL RADIATIVE IMPACTS 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, as described by Russell et al. (this conference). 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.