FORM B: GACP SIGNIFICANT HIGHLIGHTS

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Aerosol Direct Radiative Effects over the Mid-Latitude North Atlantic Region Derived from Satellite and In Situ Measurements

In a recently published paper [*Bergstrom and Russell*, 1999] we estimated the net solar radiative flux change caused by atmospheric aerosols over the mid-latitude (25°N to 60°N) North Atlantic Ocean under cloud-free and cloudy conditions. We used aerosol optical depths derived from AVHRR satellite measurements and aerosol radiative properties determined during the recent TARFOX field study. We considered only the direct effect of aerosols on radiation; i.e., we excluded the indirect effects caused by cloud modification. The results, shown in Figure 1, illustrate that over the ocean the aerosol decreases the net (downwelling minus upwelling) radiative flux at the tropopause and therefore has a net cooling effect. Results for the four seasons for cloud-free conditions and the TARFOX derived aerosol properties are in Figure 1a-d. As shown, summer and spring have the largest aerosol effects. The summer plume off the US East Coast (where TARFOX was conducted) is clearly evident. The annual average is shown in Figure 1e, again for the TARFOX derived single scattering albedo of 0.9 (i.e., moderate absorption). Figure 1f shows the annual average calculated as in Figure 1e but for a nonansorbing aerosol (single scattering albedo of 1.0). Assuming no absorption increases the net flux change by roughly 30% while keeping the spatial patterns the same. We calculated the effect of cloudiness using ISCCP cloud fraction data (see http://isccp.giss.nasa.gov). The annual average results for the absorbing and non-absorbing aerosol are shown in Figure 1g-h. As shown, the cloud fraction reduces the radiative flux change considerably.

The cloud-free North Atlantic regional averages ranged from –1.7 W/m^2 in the winter to –5.1 W/m^2 in the summer, with a regional annual average of –3.5 W/m^2. Use of ISCCP cloud data to compute the effect of clouds reduced the regional annual average to –0.8 W/m^2 for the absorbing aerosol and –1.1 W/m^2 for the non-absorbing aerosol. We also compared our calculations with other estimates of the aerosol effects. While we can only make an approximate comparison, our results appear to agree with the recent calculations of *Hansen et al.* [1998] and *Jacobson* [1999] better than with some other calculations.

References

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