Use of Toms Aerosol Data for Ace-2 Mission Data Analysis

Dr. J.R. Herman[1], Dr. C. Hsu[2], Dr. J. Prospero[3], Dr. O. Torres[2], Dr. A. Thompson[1], and Dr. C. Seftor[2]

The focus of ACE-2 is stated as, "anthropogenic aerosols from the European continent and desert dust from the African continent as they move out over the North Atlantic Ocean". Data from the TOMS instrument have been shown to provide a unique view of the UV-absorbing aerosol plumes over both land and water in terms of an aerosol index formed from measured backscattered UV at 340 nm, 360 nm, and 380 nm. The aerosol index has been shown to be particularly sensitive to the presence of Saharan desert dust as well as smoke from biomass burning. In this regard, we have both historical and current data showing the dust plumes originating on the African continent and advecting across the Atlantic to the east coast of North America (see Herman et al., accepted for J. Geophys. Res. 1997, "**Global Distribution of UV-Absorbing Aerosols From Nimbus-7/TOMS Data**" and Hsu et al., "**Detection of biomass burning smoke from TOMS measurements**", *Geophys. Res. Lett*, **23**, 745-748, 1996).

Current TOMS data from Earth-Probe/TOMS and ADEOS/TOMS are received and processed daily to form global maps of aerosol distribution in terms of the aerosol index. This index gives the geographical distribution and relative amount of aerosol present in the atmosphere each day (see Figure 1). The Saharan dust outbreak can be tracked by TOMS as soon as dust particles are lofted above the source regions. The index data can be made available to the ACE-2 mission within 24 hours or less from the time it is received from the TOMS instruments to help in mission planning and data analysis. Figure 1 shows a sample data set obtained from Nimbus-7/TOMS containing a wide variety of absorbing aerosol sources (desert dust and biomass burning). Figure 2 is a time series showing the annual variation of dust in a 10^ox10^o box extending west and south of Spain. Figure 3 is a similar time series centered over the Canary Islands. Figures 4 and 5 are the time series in the same boxes for non-absorbing sulfate aerosols.

On a longer term basis, the aerosol index can be converted to optical depth and single scattering albedo in conjunction with independently gathered data from the ACE-2 mission. We propose to participate with ACE-2 investigators to analyze ACE-2 data and to help validate and further understand the TOMS data.

In addition, there is a new TOMS product that represents sulfate aerosols. This product has not been validated to the extent of the mineral dust observations. We feel that the ACE-2 observations of sulfate aerosol properties simultaneously with TOMS observations will help both projects. In this regard, TOMS can provide daily maps of sulfate aerosol distributions that are

---

[1] Goddard Space Flight Center, Greenbelt, MD 20771, 301-286-7821
herman@tparty.gsfc.nasa.gov

[2] Hughes STX Corporation, Greenbelt, MD

[3] University of Miami RSMAS, Miami FL 33149

distinct from the mineral dust distributions. At the present time, these would be useful for joint analysis with ACE-2 investigators as well as useful for comparison with other data sources such as AVHRR.

We are presently engaged in a program of studies of marine and atmospheric processes using a combination of trajectory and photochemical models applied to a variety of satellite data. These studies have been very useful when applied to other projects similar to ACE-2 (eg in SAGA-3, Thompson et al., J. Geophys. Res., 98, 16955ff, 1993; for TRACE-A, ibid, 101, 24251ff, 1996). We expect that we can contribute similar analysis for the studies of ACE-2 data and its interpretation. We have on-going studies of tropospheric ozone, aerosols and transport, and can bring the GSFC isentropic model [Schoeberl et al, J. Geophys. Res., 97, 7859ff, 1992] to use for ACE-2 analysis. One of the strengths of trajectory analysis and the TOMS aerosol data is that we have been able to follow different aerosol plumes and determine that altitudes of the plumes based on the daily observed motions. The results validate the trajectory models for both dust transport and for photochemical conditions within the parcels.

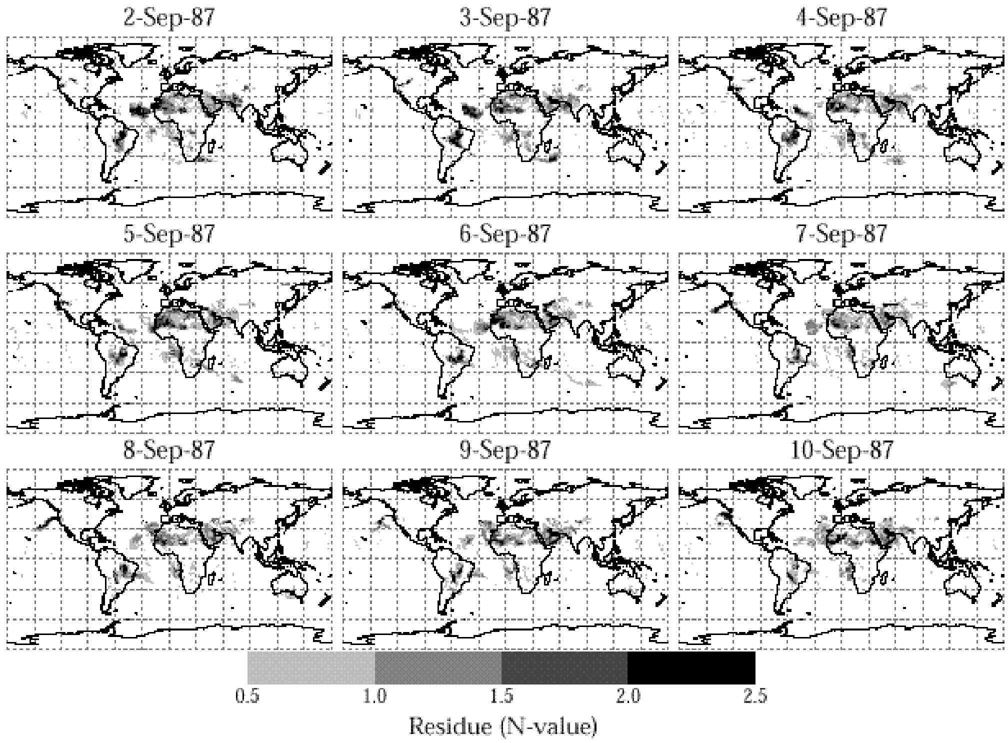

Figure 1 Distribution of absorbing aerosols from desert dust and biomass burning for 9 days during September 1987 from Nimbus-7/TOMS data. Clearly visible are large plumes of desert dust coming from Africa, the Arabian peninsula, China. Also visible is smoke from biomass burning in Oregon and Washington as well as south America and southern Africa.

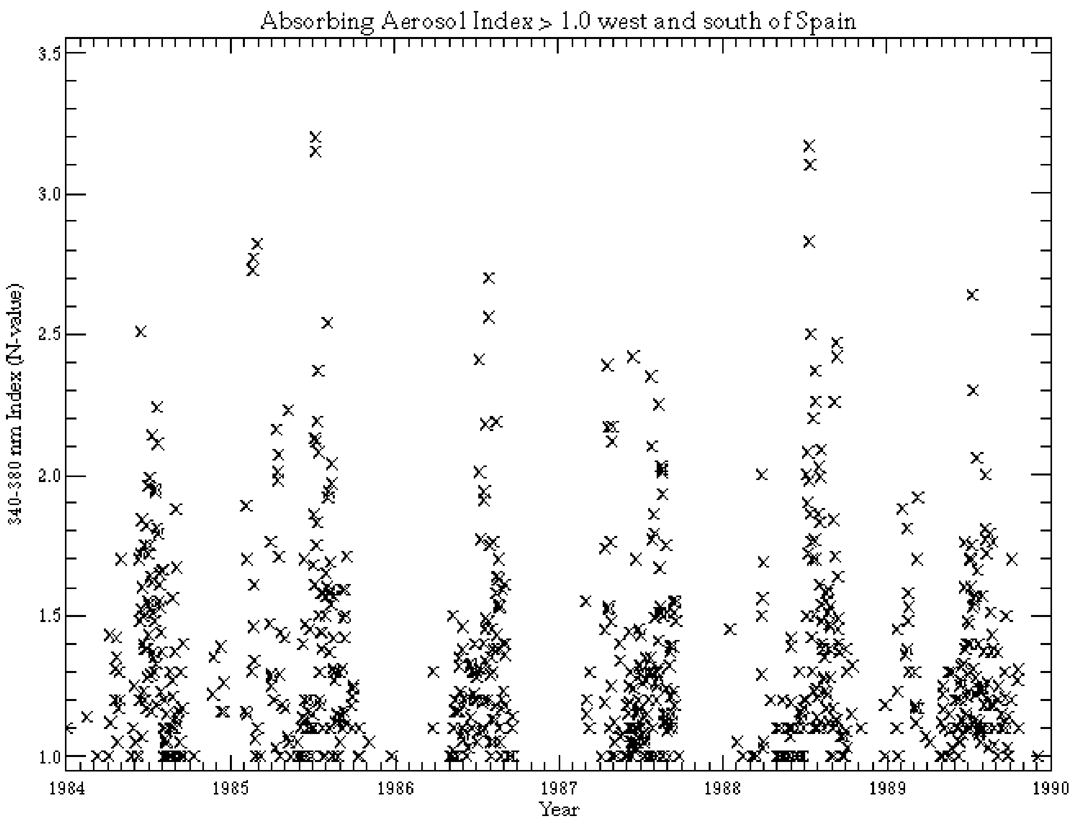

Figure 2 Time series of absorbing aerosols in a 10°x10° box west of the coast of Spain for the years 1984 to 1989. The aerosols are mainly desert dust blowing northward from the main dust plume.

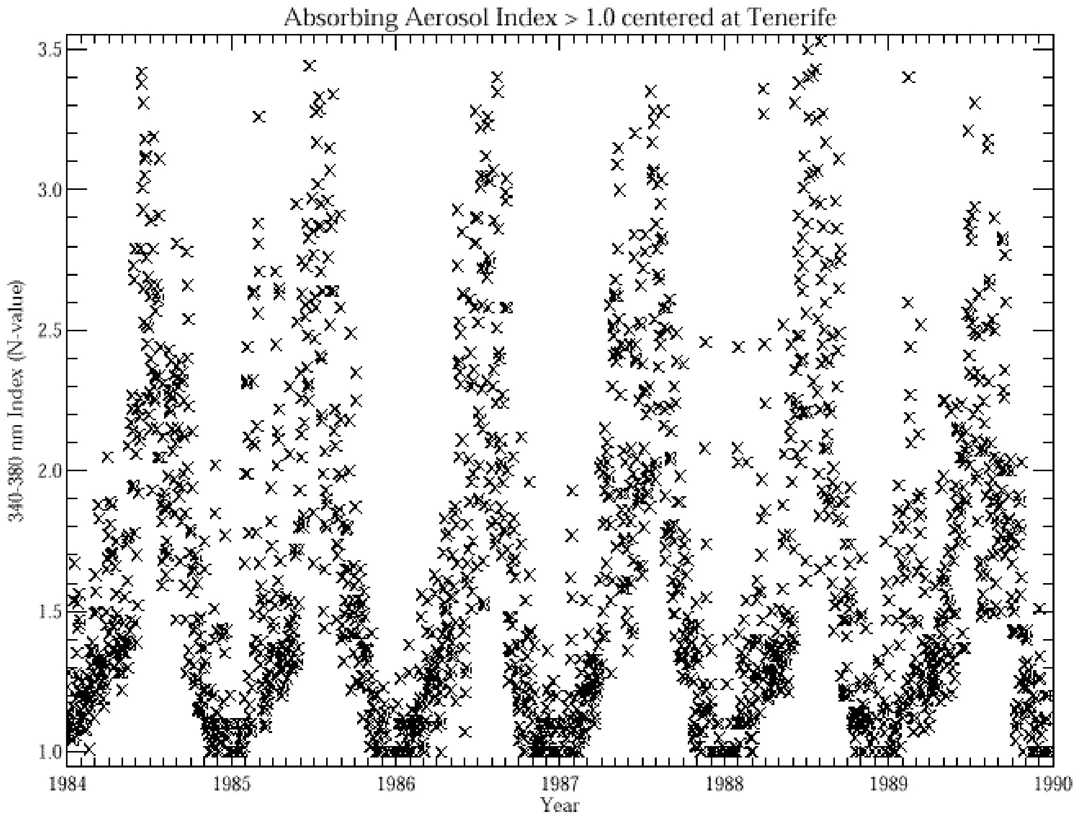

Figure 3 Time series of absorbing aerosols in a 10°x10° box centered on Tenerife for the years 1984 to 1989. The aerosols are mainly desert dust advecting westward as part of the main dust plume.

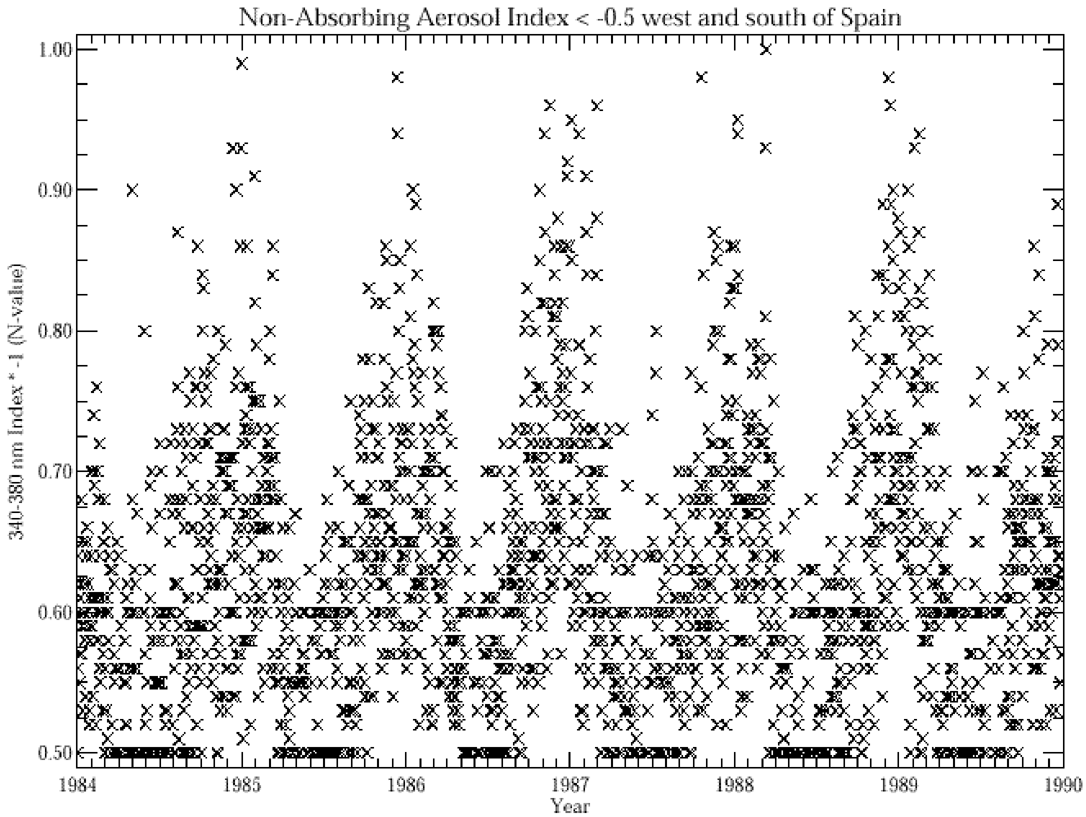

Figure 4 Time series of non-absorbing aerosols in a 10°x10° box west of the coast of Spain for the years 1984 to 1989. The time series most likely represents sulfate aerosols. Part of the seasonal dependence may be masked by the absorbing aerosols.

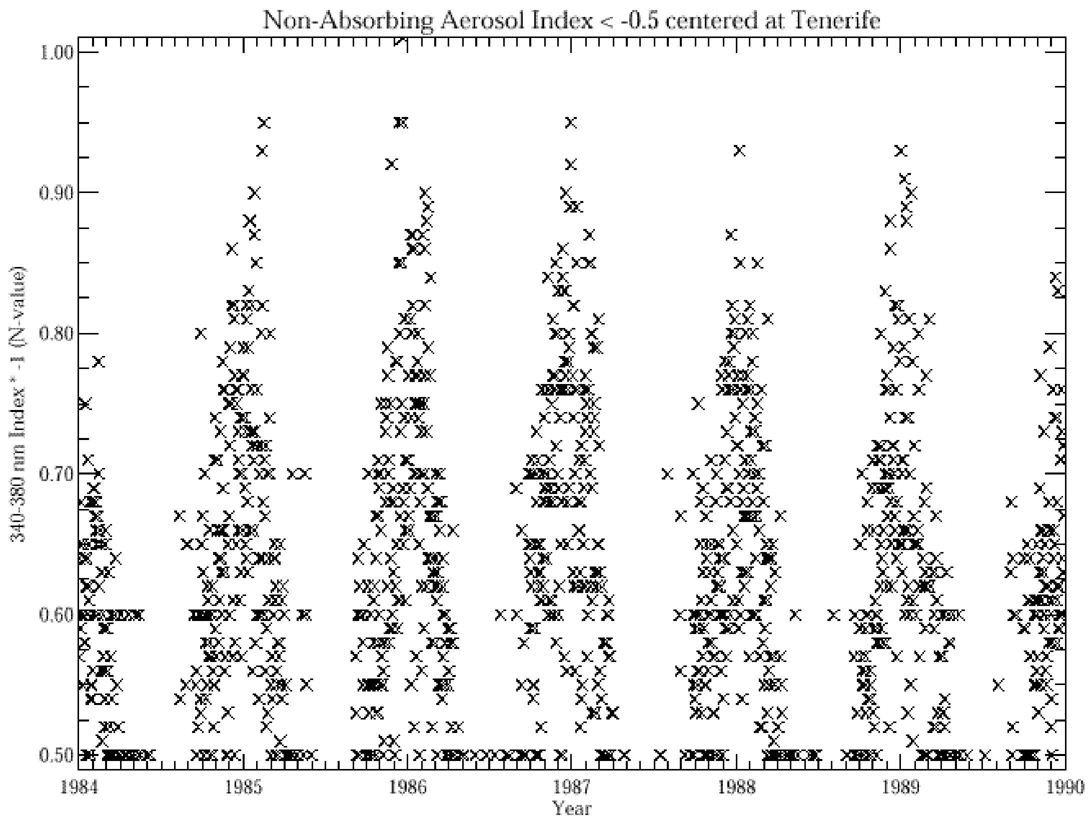

Figure 5 Time series of non-absorbing aerosols in a 10°x10° box centered on Tenerife for the years 1984 to 1989. The time series most likely represents sulfate aerosols. Part of the seasonal dependence may be masked by the absorbing aerosols.