

Daily Image of Absorbing Aerosols over Land from TOMS Data

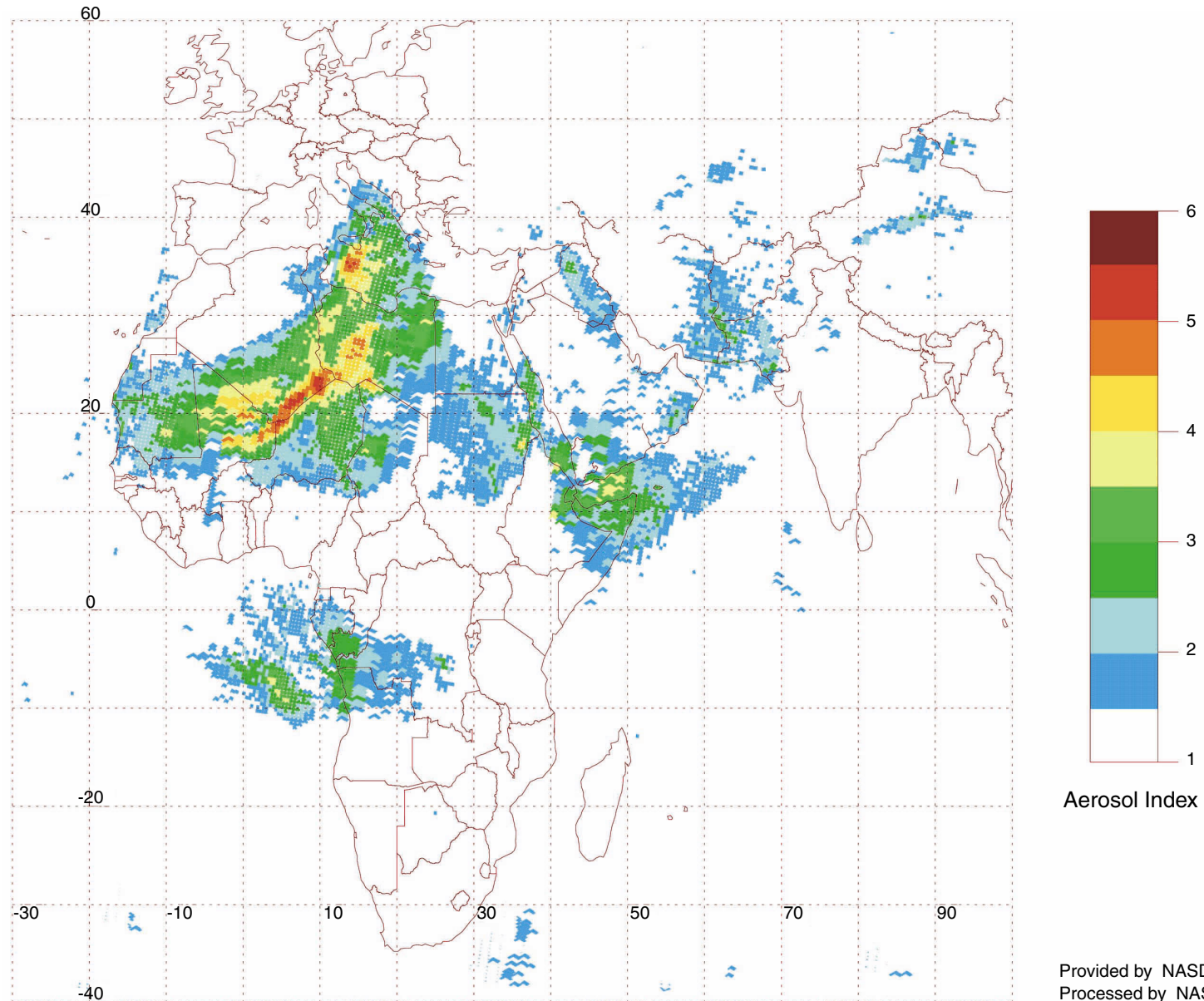


Fig.1 Aerosol Index
ADEOS TOMS
[JUN 28, 1997 Orbit 4494]

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Desert dust and smoke from fires absorb at the UV wavelengths used by TOMS. These wavelengths are strongly affected by Rayleigh scattering (*1) from air molecules and Mie scattering (*2) from aerosols. An Aerosol Index (AI) is defined as the difference between the observations and model calculations from a pure molecular atmosphere with the same surface reflectivity and measurement conditions (Hsu et al., 1996, Herman, et al., 1997). Both the radiance and the spectral dependence of the radiance are affected if aerosols are present. The Index can be interpreted in terms of optical depth if the index of refraction, particle size distribution, and the height of the aerosol layer are known from other measurements (Torres, et al., 1998). The UV aerosol detection method is fundamentally different from aerosol measurements at visible and near IR wavelengths due to the existence of a strong Rayleigh scattering signature at the shorter wavelengths. In addition, the ground reflectivity is much lower and less variable in the UV compared with that at the longer wavelengths. As a result it is possible to image the aerosol clouds over land with TOMS, while the OCTS and POLDER aerosol retrievals are limited to the oceans where the surface reflectivity is more predictable.

This ability to map aerosols over land with TOMS is illustrated in the Fig. 1. Thick clouds of Saharan dust are formed over western and northern Africa on this day (June 28, 1997) and carried by westerly winds to southern Italy and the Indian Ocean. More typically, the Saharan dust clouds are frequently carried in subtropical easterly winds over the Atlantic Ocean to the Caribbean Sea and South America. In addition to the dust clouds in the northern hemisphere of the image, other absorbing clouds are observed to originate in the south of the equator in central Africa. These are known to be clouds of smoke from agricultural burning that are carried out over the Atlantic Ocean by the equatorial easterly winds.

Satellite data on the horizontal distribution of aerosols are important to an assessment of climate change. Aerosols impact the energy budget of the Earth and moderate the extent of warming due to the carbon dioxide greenhouse effect.

*1 Rayleigh scattering: Light scattering by molecules or particles of much smaller size than the wavelength of the incident light. The scattered intensity is inversely proportional to the fourth power of the wavelength.

*2 Mie scattering: Light scattering by spherical particles of any size relative to the wavelength of the incident light.

Literature:

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