Popular Summary:

Global estimates of average ground-level fine particulate matter concentrations from satellite-based aerosol optical depth

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Exposure to airborne particles can cause acute or chronic respiratory disease and can exacerbate heart disease, some cancers, and other conditions in susceptible populations. Ground stations that monitor fine particulate matter in the air (smaller than 2.5 microns, called PM2.5) are positioned primarily to observe severe pollution events in areas of high population density; coverage is very limited, even in developed countries, and is not well designed to capture long-term, lower-level exposure that is increasingly linked to chronic health effects. In many parts of the developing world, air quality observation is absent entirely.

Instruments aboard NASA Earth Observing System satellites, such as the MODerate resolution Imaging Spectroradiometer (MODIS) and the Multi-angle Imaging SpectroRadiometer (MISR), monitor aerosols from space, providing once daily and about once-weekly coverage, respectively. However, these data are only rarely used for health applications, in part because the can retrieve the amount of aerosols only summed over the entire atmospheric column, rather than focusing just on the near-surface component, in the airspace humans actually breathe. In addition, air quality monitoring often includes detailed analysis of particle chemical composition, impossible from space. In this paper, near-surface aerosol concentrations are derived globally from the total-column aerosol amounts retrieved by MODIS and MISR. Here a computer aerosol simulation is used to determine how much of the satellite-retrieved total column aerosol amount is near the surface.

The five-year average (2001-2006) global near-surface aerosol concentration shows that World Health Organization Air Quality standards are exceeded over parts of central and eastern Asia for nearly half the year.

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Figure Caption. Global, satellite-derived, near-surface aerosol concentration (PM2.5) averaged over 2001-2006, assessed at 10 x 10 km resolution.