

U.S. Trends in Aerosol Optical Depth and Solar Radiation over the Past 10 Years

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Time series of network-wide annual averages were used to assess the 500 nm Aerosol Optical Depth (AOD) and solar radiation tendencies over the U.S. from 1997 through 2006. Station solar data were normalized as percent deviations from the station means before national annual averages were computed. Results show a solar "brightening" over the U.S. over the decade, which is consistent with brightening noted by others worldwide over the same period. Nationally, 500 nm AOD decreased through that period by about 0.02, which is comparable to decreases reported for the oceans and Europe. However, not all Surface Radiation (SURFRAD) stations exhibit AOD decreases over the decade. Eastern U.S. SURFRAD stations at Goodwin Creek, Mississippi and Penn State do show decreasing AOD, but the tendency at Bondville, Illinois was virtually stable, although its summertime AOD maxima did decrease over the last half of the decade. In the western U.S., where AOD levels are comparatively low, only Desert Rock, Nevada showed a decrease. Fort Peck, Montana and Table Mountain (near Boulder, Colorado) actually show slight increases that were highly influenced by wildfires from 2000 through 2006. When the years with the most abundant wildfires were removed from their AOD time series, decadal AOD tendencies for both stations went flat. If the decreasing AOD tendency in the eastern U.S. continues, both the direct and indirect effects of aerosols on incoming solar irradiance would diminish and contribute to the current solar brightening at the surface. Analogously, the cooling effect of the aerosols would also diminish. If climate change is causing drier conditions in the western U.S., then higher than normal numbers of wildfires are likely in the future and the resulting AOD increase in western U.S. AOD should continue.

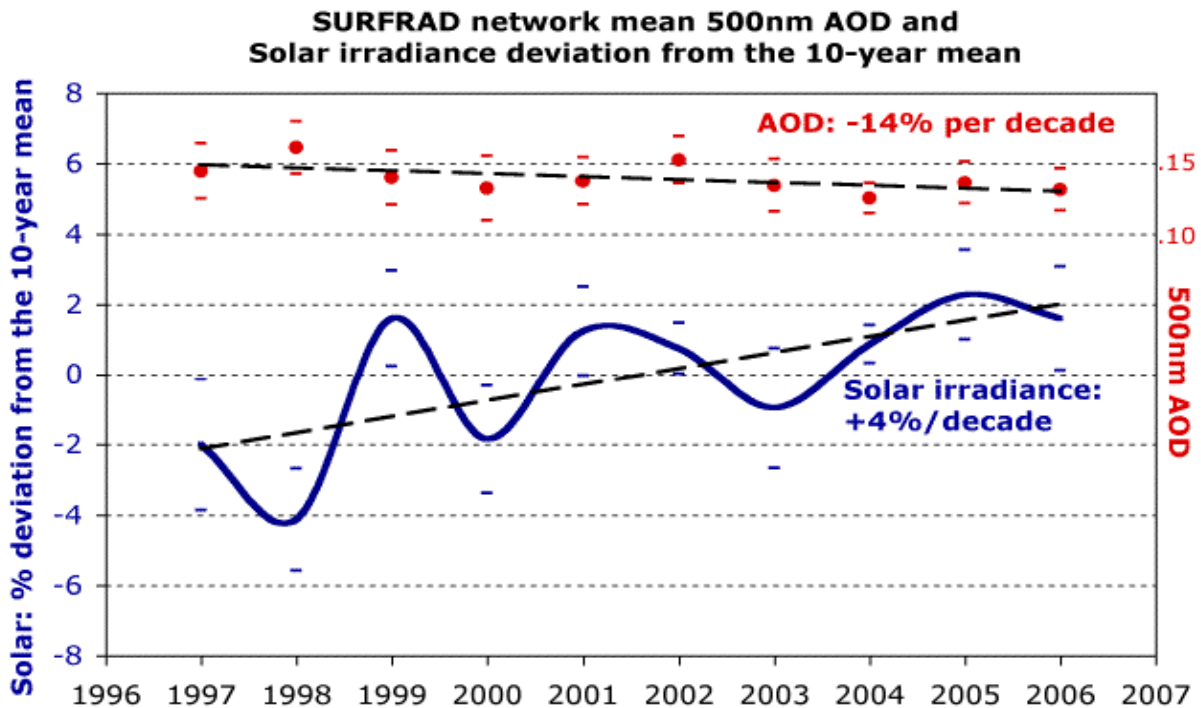


Figure 1. Decadal time series of 500-nm aerosol optical depth for all SURFRAD stations (red), and the trend in solar radiation, expressed as a deviation from the 10-year mean (blue) for the same stations. Dashes represent standard error of the annual means.