

Increases in Stratospheric Aerosols

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Stratospheric aerosols have been measured at Mauna Loa Observatory (MLO) since the 1970's and in Boulder, Colorado since 2000 by the Earth System Research Laboratory. Changes in the stratospheric layer since 1970 have been dominated by two large eruptions, El Chichon in Mexico (1982) and Mount Pinatubo in the Philippines (1991). Eruptions of this scale can increase the mass of stratospheric aerosol by two orders of magnitude. The aerosol then decreases with a characteristic lifetime of about one year so several years are needed to get back to background levels. Influences of small eruptions or injections of forest fire smoke can be seen in the background aerosol, usually near the bottom of the layer, but these only last a few weeks or months. Though both of these have been occurring in the past 12 years there has been an unprecedented well-measured period of no major eruptions since 1996. The MLO lidar shows a significant increase in stratospheric aerosol backscatter between 2000 and 2008 of about 50% or about 8% per year. This amounts to an aerosol optical depth increase from 0.005 to 0.007. The increase is similar at all altitudes in the layer and for all seasons. The layer above Colorado is strongly affected by the changes in the tropopause height but the Boulder lidar shows a similar increase during this time period in the layers well above the tropopause. In the figure below, the annual cycle can be seen in the smoothed curve and in the trend there are three peaks which correlate with the three quasibiennial oscillation cycles that have occurred after 2000, but the overall aerosol backscatter is increasing.

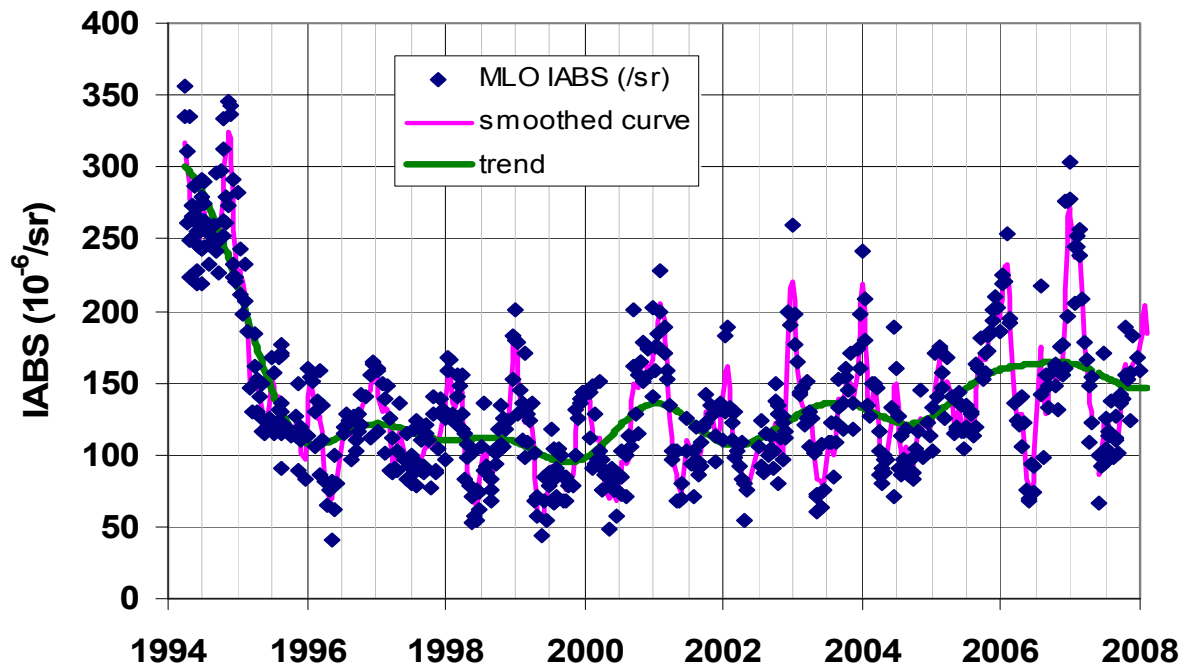


Figure 1. Lidar measurements of Integrated Aerosol Backscatter (IABS) for the stratosphere above Mauna Loa Observatory. The stratospheric layer reached background levels after the eruption of Mount Pinatubo by 1996. Between 2000 and 2008 the backscatter has grown by over 50%.