

File Revision Date:

March 2, 2010

Data Set Description:

PI: John E. Barnes
Associate Investigator: Russell Schnell
Instrument: Lidar
Site(s): Boulder, Colorado
Measurement Quantities: Aerosol Backscatter at 532 nm

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Reference Articles:

Determination of Aerosol Height Distributions by Lidar, F.G. Fernald, B.M. Herman, and J.A. Reagan, Journal of Applied Meteorology, Vol. 11, April, 1972.

Methodology for error analysis and simulation of lidar aerosol measurements, P.B. Russell, T.J. Swissler, and M.P. McCormick, Applied Optics, Vol. 18, No. 22, November, 1979.

Correction for nonlinear photon-counting effects in lidar systems, D.P. Donovan, J.A. Whiteway, and A.I. Carswell, Applied Optics, Vol. 32, No. 33, November, 1993.

Barnes, J. E., and D. J. Hofmann, Lidar measurements of stratospheric aerosol over Mauna Loa Observatory, Geophys. Res. Lett., 24, 1923-1926, 1997.

Barnes, J. E., and D. J. Hofmann, Variability in the stratospheric background aerosol over Mauna Loa Observatory, Geophys. Res. Lett., 28, 2895-2898, 2001.

David Hofmann, John Barnes, Michael O'Neill, Michael Trudeau, and Ryan Neely, Increase in background stratospheric aerosol observed with lidar at Mauna Loa Observatory and Boulder, Colorado, Geophys. Res. Lett., 36, doi:10.1029/2009GL039008, 2009.

Instrument Description:

The lidar is based on a Big Sky Ultra laser (20 Hz, 0.6 Watt). One 61 cm telescope is used with high and low altitude channels. Photomultiplier tubes are used in the photon counting mode for both channels. The system first used a PC 80486 and the data acquisition electronics were MSC II boards made by Tennelec. A new data acquisition board (AMCS) was installed in 2009 and the computer was updated to run Microsoft Windows. Measurements are made during the night, usually once a week.

Algorithm Description:

The calculation is a single pass calculation (Fernald et al, 1972) which uses a reference altitude range (no aerosol) between 35 and 40 km. This entire range is forced to an average aerosol backscatter of zero, with the altitude bins weighted by signal error. The atmospheric density comes from the Denver, Colorado National Weather Service radiosondes and the MAP 85 model interpolated in time from monthly averages above the radiosonde.

Expected Precision/Accuracy of Instrument:

The error in the backscatter ratio is contained in the data file at each altitude. The typical error is about 6% for the integrated aerosol stratospheric backscatter. This error (Russell et al, 1979) accounts for the signal error both at the altitude being calculated and the reference altitude, and the error resulting from the transmission calculation.

Instrument History:

Aerosol backscatter was first measured in August, 1999 and has continued to the present.