

Lidar Observations of Aerosols Above American Samoa

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An aerosol lidar was installed as part of the ESRL Global Monitoring Division (GMD) American Samoa baseline observatory (14.232 deg S, 170.563 deg W) in April, 2005. There are very few lidar records of stratospheric aerosol in tropical regions and this instrument complements the records at Mauna Loa Observatory (19.539 deg N) and Boulder (40.0 deg N). The instrument measures backscattered light at 532 nm with high and low altitude channels, and is very much like the GMD lidar in Boulder. Over one hundred nighttime observations have been analyzed to date. There is substantially more scatter in the boundary layer than observed at Mauna Loa Observatory (MLO) and Boulder. The sensitivity of the detectors to the high scatter has required a lower laser power which has decreased the accuracy. In addition, frequent clouds over the site has necessitated shorter integration times (one minute) so the cloud-free data can be selected. The aerosol scatter in the boundary layer reaches the free tropospheric level at about 2.5 km. The instrument is located near the living quarters of the staff and is operated when there is at least some clear sky. So there is a bias toward clearer weather, but typically there are a few measurements for every month. Cirrus clouds can easily be seen in the data and the backscattered light is usually much stronger than the stratospheric layer. Cirrus clouds are seen in 70%+/-9% of the Samoa observations, compared with MLO, 34%+/-11%, but again there may be a bias to clearer weather. The stratospheric backscatter at Samoa is 24% higher than MLO in the 20-25 km altitude range, but this difference is affected by the absolute accuracy of both lidars which has not been well quantified. An increase in the stratospheric aerosol, possibly due to increased coal-burning in Asia, has been seen at MLO and Boulder, and is also seen in Samoa. At MLO a 4.8% per year increase was seen for 20-25 km altitude range and in Samoa it is higher, 11%. The higher rate of increase at Samoa may be due to its proximity to the western pacific upwelling region. An eruption or smoke layer was detected on 2009/03/19 and was seen until 2009/06/15. At the peak (2009/04/06) the backscattered light doubled the stratospheric layer.

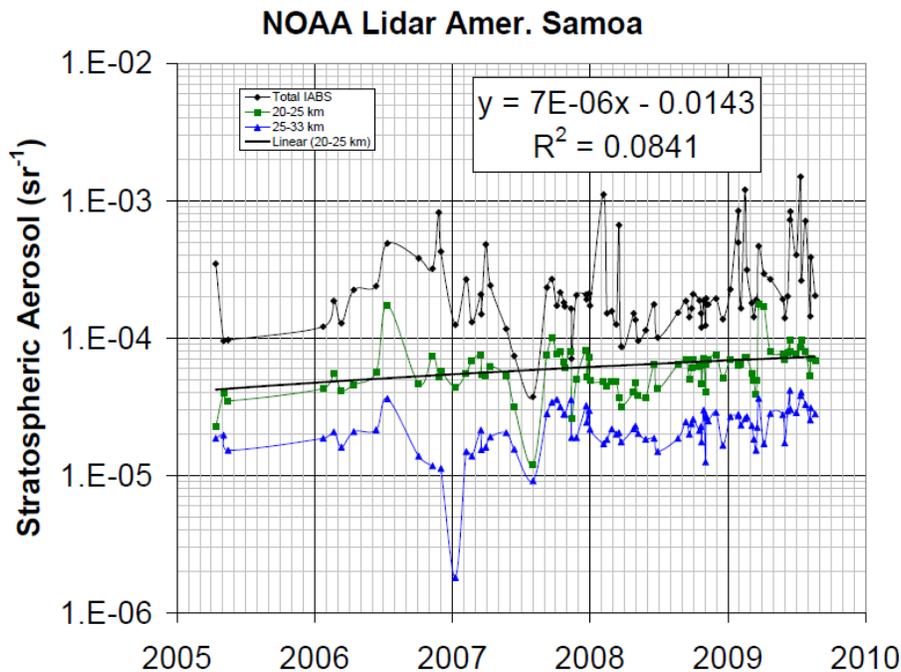


Figure 1. Integrated stratospheric aerosol backscatter (IABS) for different altitude intervals. A linear curve fit is shown for the 20-25 km interval showing the increasing trend.