SO_2 Measurements at MLO: 1989-2001

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Results are presented for the combined sulfur dioxide record at Mauna Loa Observatory from four separate programs: NOAA Air Resources Laboratory (1989), National Center for Atmospheric Research (1991-1992), and CMDL (1994-1996, 1998-2001). All used a TECO Model 43-S pulsed-fluorescence analyzer with a detection limit of 50 ppt for a 1-hour measurement. Air has been sequentially sampled from 4, 10, 23, and 40 meters on the tower to provide hourly SO_2 profiles since 1998.

The baseline frequency distribution peak is at about 15 ppt. Asian transport events can produce increases of tens of ppt. Pollution from Kilauea volcano (in continuous eruption since 1983) is often present in the afternoon upslope winds, with SO_2 mixing ratios of up to 150 ppb. Between midnight and 7 AM, volcanic pollution episodes of >100 ppt occur 10% of the time and episodes of >1 ppb occur 1.5% of the time. Kilauea pollution can reach MLO at night when the marine boundary layer temperature inversion is either weak or lies above the observatory elevation of 3400 m (10% probability) and also during periods of light southerly winds. Volcanic emissions from the Mauna Loa summit cause CO_2 increases of up to several ppm and SO_2 increases of up to a few hundred ppt. Mauna Loa emissions produce a SO_2 profile that decreases with height at night (the source is inside the inversion). Kilauea emissions produce a SO_2 profile that increases with height at night (the source is outside the inversion) and is flat during the day (air is well-mixed in the turbulent upslope wind).