Volcanic Eruption Clouds in the Stratosphere Observed by Lidar at the NDSC Station Garmisch

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Lidar remote sensing has proven to be invaluable in detecting and monitoring the occurrence, magnitude, spread and decay of volcanic eruption clouds perturbing the stratospheric sulfate aerosol layer. Lidar measurements at the northern midlatitude station Garmisch (47.5°N, 11.1°E) have contributed to the understanding of the stratosphere since 1976 and are part of the Network for the Detection of Stratospheric Change (NDSC) since 1991. Major global perturbations observed were caused by the equatorial eruptions of El Chichon (Mexico) in 1982 and Pinatubo (Philippines) in 1991. Besides these events additional eleven eruption clouds could be detected since 1979, their atmospheric effects ranging from global to hemispheric and regional. The time series at Garmisch also includes observations during three stratospheric background periods, 1976/79, 1988/90 and the present. Lidar backscatter profiles are converted to parameters important in understanding the impact of stratospheric aerosols on the atmospheric radiation budget and heterogeneous chemical processes: particle optical depth, mass and surface area concentration. The method utilizes particle size distributions derived from measurements by balloonborne optical particle counters at Laramie, Wyoming. Recent observations indicate that the decay of the Pinatubo perturbation terminated in 1997. The presently very low aerosol level in the stratosphere is suitable to study processes which sustain a minimum stratospheric aerosol content. These may include both natural and anthropogenic sources.