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SESSION 9

AEROSOLS, RADIATION AND SPECTRAL UV

Oral Session

9-4 35 Years of Stratospheric Aerosol Measurements at Garmisch-Partenkirchen (1976-2011)

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The powerful backscatter lidar at Garmisch-Partenkirchen (Germany) has almost continually delivered backscatter coefficients of the stratospheric aerosol since 1976. The time series is dominated by signals from the particles injected into the stratosphere by major volcanic eruptions, in particular those of El Chichon (Mexico, 1982) and Mt. Pinatubo (Philippines, 1991). The volcanic aerosol disappears within about five years, the removal from the stratosphere being modulated by the phase of the quasi-biennial oscillation [1]. During the long-lasting background period since the late 1990s the stratospheric backscatter coefficients have reached a level even below that observed in the late 1970s. This suggests that the predicted potential influence of the strongly growing air traffic on the stratospheric aerosol loading is very low. Some correlation of the background aerosol with strong forest fires is found. Detailed case studies have been carried out for two pyro-cumulonimbus events [2,3]. From 2003 to 2006 there was some indication of a growing aerosol. This increase is much less obvious than that registered at Boulder (U.S.A.) and Mauna Loa (Hawaii) even many years earlier, both stations being located at lower latitudes. There, it was ascribed to the influence of the growing East Asian air pollution [4]. The pronounced latitudinal difference of the stratospheric aerosol background is difficult to understand since, for comparison, volcanic aerosol is redistributed in the northern hemisphere within less than one year. A more thorough analysis, also clarifying the differences in seasonal cycle and involving the results from other NDACC stations, is needed for a full interpretation. Unfortunately, in recent years, reviving volcanic activity has ended the long background period making a clear trend analysis for the growing background very difficult. During this volcanic period, a special event for Central Europe was the Eyjafjallajökull eruption on April 14, 2010. The plume reached the Dutch and German coast on April 16 and then proceeded to the Alps on the following day where it was blocked by a low-pressure system. The Icelandic plume was observed over Garmisch-Partenkirchen up to the lower stratosphere between April 17 and 20, with both the aerosol lidar and the 817-nm Zugspitze water-vapour lidar. The maximum altitude, almost 15 km a.s.l., was reached as late as on April 20, long after the initial strong blast up to 11 km a.s.l. above Iceland. However, the main portion of the plume stayed below 5 km, with a horizontal visual range of the order of 20 km. The ash was observed by a large number of EARLINET (European Aerosol

Research Lidar Network) stations in a major co-ordinated effort emphasizing the important role of ground-based lidar networks. [1] H. Jäger, Long-term record of lidar observations of the stratospheric aerosol layer at Garmisch-Partenkirchen, J. Geophys. Res. 110 (2005), D08106, doi: 10.1029/ 2004JD005506, 9 pp. [2] M. Fromm et al., The stratospheric impact of the Chisholm PyroCumulonimbus eruption: 2. Vertical profile perspective, J. Geophys. Res. 113 (2008), D08203, doi: 10.1029/2007JD009147, 19 pp. [3] M. Fromm, D. T. Lindsey, R. Servranckx, G. Yue, T. Trickl, R. Sica, P. Doucet, S. Godin-Beekmann, The Untold Story of Pyrocumulonimbus, Bull. Am. Met. Soc. 91 (2010), 1193-1209 [4] D. Hofmann, J. Barnes, M. O'Neill, M. Trudeau, R. Neely, Increase in background stratospheric aerosol observed with lidar at Mauna Loa Observatory and Boulder, Colorado, Geophys. Res. Lett. 36 (2009), L15808, doi: 10.1029/2009GL039008, 5 pp.