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Some highlights of current tropospheric ozone research

Hendrik Feldmann,[1] Hans-Eckhart Scheel,[2] Andreas Stohl,[3] and Thomas Trickl[2]

[1]*Rheinisches Institut für Umweltforschung, D-50931 Cologne, Germany*

[2]*Forschungszentrum Karlsruhe, IMK-IFU, D-82467 Garmisch-Partenkirchen, Germany*

[3]*Norsk Institutt for Luftforskning, N-2027 Kjeller, Norway*

Ozone is one of the key constituents in air chemistry determining to a major part the oxidation capacity of the atmosphere. Its concentration is influenced by numerous processes, in particular photchemically induced build-up from precursors, notably hydrocarbons and nitric oxides, and atmospheric transport. In recent decades a pronounced increase of ozone due to the growing air pollution has frequently been emphasized on. In some rapidly developing regions of the earth the air quality is, still, deteriorating at a considerable rate. However, all this must be regarded with great care since this is not the case elsewhere and not much information has been available on the long-term development of the natural sources of ozone.

In major parts of Europe the emissions of pollutants have decreased by as much as 30 % after 1990. This is due to emission control measures, but also due to the political changes. In contrast to this, the ozone measurements at mountain sites show a zero or even positive trend, in particular at the high-altitude monitoring stations, such as Zugpitze (2962 m a.s.l.) operated by IMK-IFU since the 1960s. By a correlative analysis based on the concentrations of O_3, humidity and the stratospheric tracer ^7Be for the time period 1978 to 2004 a pronounced positive ozone trend due to stratospheric air intrusions into the troposphere was found. In recent years at least 40 % of the tropospheric ozone at 3000 m could be attributed to ozone input from the stratosphere, a rather surprising result.

A lot of details on stratospheric air intrusions and long-range atmospheric transport have been analysed by a combination of lidar remote sensing and advanced atmospheric modelling. One particular highlight is the first detection of intercontinental transport of ozone at IMK-IFU in 1996 and 1997 [1,2], which has stimulated a thorough evaluation of the principal source regions, chemical transformation and transport routes. These investigations will be further strengthened by simultaneous measurements with a newly developed water-vapour lidar based on a 0.7-J tunable single-mode laser system.

[1] A. Stohl, T. Trickl, *J. Geophys. Res.* **104**, 30445-30462 (1999).

[2] T. Trickl, et al., J. Geophys. Res. **108**, 8530, doi:10.1029/2002JD002735, STA 15 (2003).