Recent Research Developments in the Ozone and Water Vapor Group

S. Oltmans

NOAA Climate Monitoring and Diagnostics Laboratory, 325 Broadway, Boulder, CO 80305;
303-497-6676; Fax: 303-497-5590, E-mail: soltmans@cmdl.noaa.gov

Several important results from research carried out by the Ozone and Water Vapor Group over the past year are highlighted. Detailed research results from some of these will be provided in other presentations.

- There are now two operational LIDAR systems in CMDL making regular observations. Aerosol backscatter is measured routinely at Mauna Loa and Boulder. The Boulder system has been operating for a year and a half and is providing a picture of the background stratospheric aerosol conditions over this midlatitude, continental site. At Mauna Loa the volcanically quiescent stratosphere reveals a significant aerosol annual and QBO cycle that was not apparent in the earlier volcanically perturbed aerosol that has prevailed since the beginning of the measurements in the 1970s (Barnes and Hofmann, 2001). Improvements in the LIDAR detector at Mauna Loa for use with e Raman channels allow the measurement of water vapor profiles into the upper troposphere.
- A new method for describing changes in total ozone was developed so that ozone recovery can be detected, followed, and quantified. The method uses autoregressive modeling to account for "explained" variations in the Dobson total ozone records from a number of stations. Tendency curves are derived from the residuals by using the fitting and filtering methods developed in the CCGG Group and growth rate curves are found from these. The analysis confirms the declines in midlatitude total ozone since the 1970s with no indication of recovery through 2000. (Harris et al., 2001).
- The process of dehydration of air passing from the tropical troposphere into the stratosphere is still a poorly understood process even though it has been studied since the 1940s. Analysis of measurements made using the CMDL chilled-mirror hygrometer has documented the existence of three different mechanisms that could be effective in drying air as it enters the stratosphere from the tropical troposphere (Vömel et al., 2001).
- Recently completed laboratory tests and simulation chamber studies of the ECC ozonesonde have clarified the impact of various operating procedures on the performance of the ozonesonde. In particular, the role of the buffer that is used to maintain a neutral pH in the potassium iodide sensing solution has been clarified and the effects quantified (Johnson et al., 2001).
- Analysis of longer-term stratospheric water vapor measurements made over the past four decades reveals a large increase of 30-40% in stratospheric water vapor mixing ratios over this period (Rosenlof et al., 2001). The longest of these records covering the last 20 years shows an increase of about 1% yr^{-1} (Oltmans et al., 2000).
- South Pole stratospheric ozone in austral Spring 2000 began to decline about 1 week earlier than in recent past years. However, the seasonal recovery began by the end of October, which is more than a month sooner than has been seen in recent past years and the earliest since 1988.
- Ozonesonde measurements as part of several campaigns were carried out during the past year. These included SOWER, TEXAQS 2000, TRACE-P, and TOMS3F. Ozone profile measurements at Trinidad Head, California; Boulder, Colorado; Huntsville, Alabama; and Wallops Island, Virginia, show the west-to-east gradient in lower tropospheric ozone across the U.S. (Ayoub et al., 2001).