Recent Research in the CMDL Ozone and Water Vapor Group

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The distribution of tropospheric ozone over the North Pacific during spring is strongly influenced by intrusions of stratospheric air into the troposphere. During April-May 2002, daily ozonesonde measurements at Trinidad Head, California, showed numerous high-ozone events that often penetrated to within 2-3 km of the surface (Figure 1). Such events appear to play a significant role in establishing the spring maximum in tropospheric ozone at higher latitude sites in the North Pacific. Trajectories from a newly developed 3-D model using the National Centers for Environmental Prediction (NCEP)/National Center for Atmospheric Research (NCAR) reanalysis data set were used to establish the origin of layers of strong tropospheric ozone enhancement.

Total column ozone measurements from long-term Dobson and satellite data sets show that within the overall decline of stratospheric ozone there have been significant year-to-year variations in the growth rate. Some of these variations can be linked to particular events such as volcanic eruptions. Ozone declines in the southern hemisphere are closely linked to ozone loss over Antarctica while the maximum declines in the northern hemisphere are at high midlatitudes.

In Antarctica, the 2002 spring stratospheric ozone depletion was interrupted by a strong warming event in late September that divided the polar vortex and left South Pole outside of the vortex. Though the vortex moved back over South Pole, ozone loss ceased and minimum values of column ozone seen in 2002 were well above those seen in all recent years since 1992.

There has been a significant increase in stratospheric water vapor over Boulder, Colorado, during the past 20 years with an average growth rate throughout the stratosphere of about 1% per decade. In 2001-2002 growth rates declined, which may be a consequence of lower tropical tropopause temperatures. Several campaigns were carried out to validate water vapor sensors on satellite platforms.

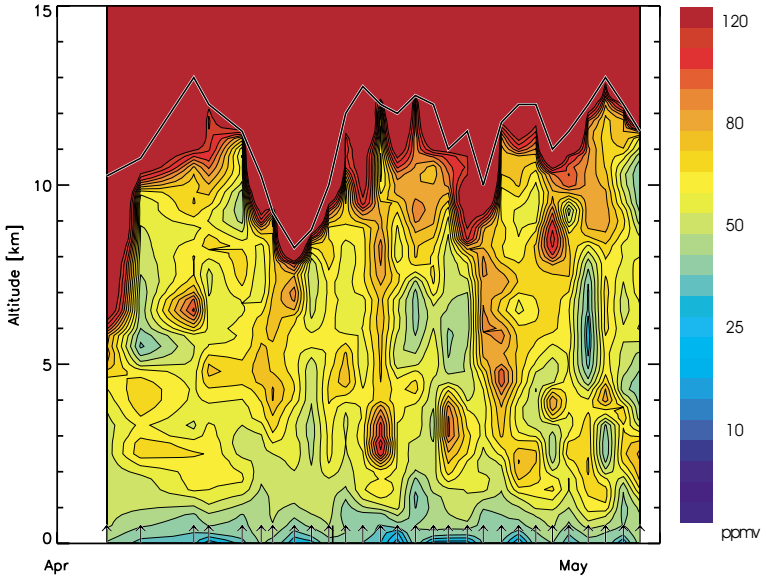

Figure 1. Time-height cross section of ozone mixing ratio at Trinidad, California, in April and May 2002 during the Intercontinental Transport and Chemical Transformation 2002 (ITCT 2K2) field campaign. The times of the ozonesonde balloon launches are noted by the arrows at the bottom of the plot.