Geophysical Research Abstracts, Vol. 7, 09003, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09003

Boundary Layer Processes and Surface Exchange at South Pole: Past Results and New Insights from the ANTCI 2003 Experiment

W. Neff (1), D. Davis (2), D. Helmig (3)

(1) NOAA Environmental Technology Laboratory, Boulder, CO 80305 USA, (2) Georgia Institute of Technology, Earth & Atmospheric Sciences, Atlanta, GA 30332, USA, (3) University of Colorado, Institute for Arctic and Alpine Research, Boulder, CO 80309 USA, (William.neff@noaa.gov / Fax: 303-497-6020 / Phone: 303-497-6265)

Two Investigations of Sulfur Chemistry in the Antarctic Troposphere (ISCAT) field studies were carried out at the South Pole in 1998 and 2000 with the finding that unusually high levels of nitrogen oxide (NO) were present in shallow atmospheric boundary layers as a result of the UV photolysis of nitrate ions in the snow ("South Pole NOx Chemistry: an assessment of factors controlling variability and absolute levels," D. Davis, et al., Atmos. Environ., 38, 5375-5388). Of note were the much higher levels of NO in 1998 and somewhat lesser amounts in 2000. From these first two experiments, a hypothesis was developed whereby nonlinear NOx chemistry depended on the presence of a very thin planetary boundary layer (PBL), on the order of 10 to 30 m in depth. However, no direct measurements of the PBL structure were available in these experiments. To address this limitation in a third field experiment carried out in November-December of 2003 under the Antarctic Tropospheric Chemistry Investigation (ANTCI) program, both high-resolution mini-sodar profiling and tethered balloon sounding (for meteorology, NO, and O3) were carried out. These confirmed the presence of very thin PBLs during high NO periods. In this presentation, we will provide 1) a brief history of the ISCAT/ANTCI field experiment results that stimulated this analysis, 2) the behavior of the PBL as documented by the mini-sodar and balloon profiling and its relationship to synoptic scale forcing and the state of the Antarctic Oscillation (with a high positive index state commensurate with high NO levels), and 3), the behavior of NO levels before and after the breakup of the Antarctic Ozone hole, normalized to the same PBL depth.