Geophysical Research Abstracts, Vol. 9, 09238, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09238

An overview of the effect of boundary layer processes on surface NO concentrations during ANTCI 2003

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An acoustic sounder, or sodar, was used during the 2003 Antarctic Tropospheric Chemistry Investigation (ANTCI), to document the behavior of very shallow ($<$ 50m) boundary layers thought to be one of the critical factors for explaining the very high levels of nitric oxide (NO) found in past field experiments at the South Pole under light wind and statically stable conditions. With an extended sampling period, two sub-seasonal regimes were examined: 1) a late-December period, with the full suite of supporting measurements, where the earlier results that shallow mixing layers associated with light winds and strong surface stability can be among the dominant factors leading to high NO levels was repeated and 2) a late November period that revealed additional complexities with very high NO concentrations appearing at times in concert with higher winds, weaker surface stability, and deeper mixing layers. The latter results are only consistent with a more complicated picture of how NO can build to very high levels that involves invoking both the previously expressed dependence of elevated NO levels on non-linear NOx (NOx = NO +NO2) chemistry, greater fluxes of NOX from the snowpack than previously observed at the South Pole, and the potential for enhanced NOx accumulation effects involving air parcels draining off the high plateau. The results of ANTCI from 2003 thus argue for more complete observations in the future of boundary layer conditions over the high Antarctic Plateau and determination of the spatial and temporal variability in snow nitrate concentrations.