Boundary-Layer Ozone Production at South Pole, Antarctica

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During the 2003/2004 Antarctic Tropospheric Chemistry Investigation (ANTCI), a tethered balloon sampling platform shown in Figure 1 was deployed for high spatial and temporal resolution measurements of ozone in the boundary layer at South Pole, Antarctica, from December 13-30, 2003. Approximately 130 vertical profiles of ozone, temperature, wind speed, and wind direction were obtained between the surface and 500 m above ground. Ozone was measured with electrochemical ozone sondes. Additionally, a 120-m long sampling line was lifted with the balloon and air was drawn through the line to gas monitors located inside a building where ozone was measured with a TEI 49C instrument and NO was measured with a chemiluminescence analyzer.

During several occasions ozone enhancements of up to 10-15 ppb were observed in the surface layer. These periods lasted several days during conditions with suppressed vertical mixing (stable atmospheric conditions) and coincided with substantial increases of NO in the surface layer. These observations confirm earlier surface measurements by NOAA and previous photochemical model calculations. The latter showed that ozone is expected to be produced in the Antarctic planetary boundary layer during the austral summer because of the presence of large amounts of NO emitted from the snow. The tethered balloon data give further insight into the meteorological conditions that determine ozone production and transport at South Pole. This experiment also offers new insight into the observed spikes in the archived surface ozone data from South Pole during the spring and summer periods.

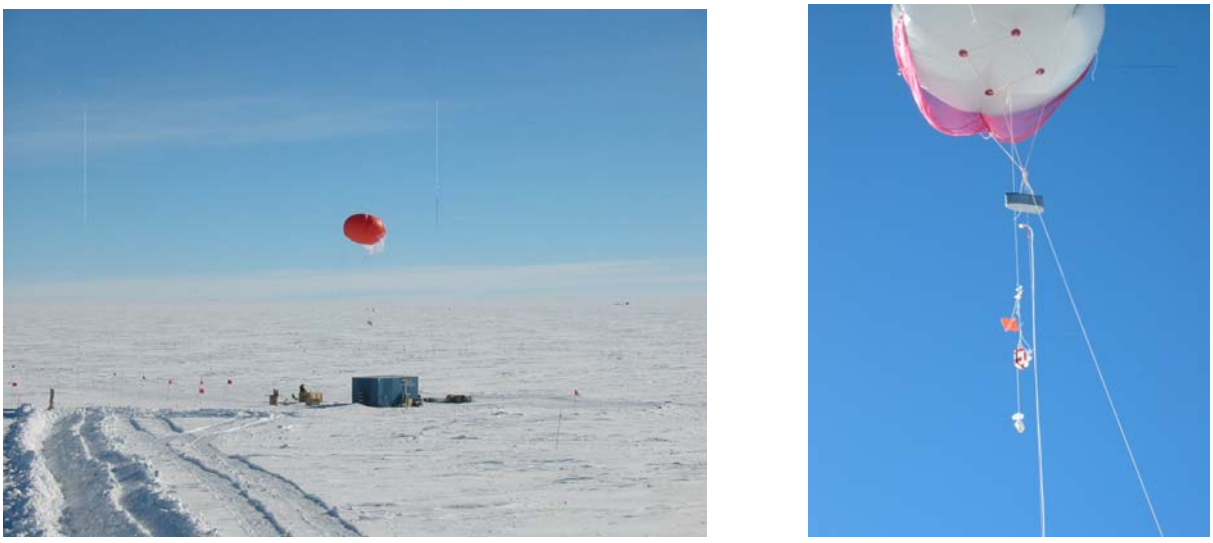

Figure 1. Sky-Doc tethered balloon deployed at South Pole with meteorological instrumentation, ozone sonde, and sampling line inlet.