BALLOON BORNE ANTARCTIC FROST POINT MEASUREMENTS AND THEIR IMPACT ON POLAR STRATOSPHERIC CLOUD THEORIES

James M. Rosen, D.J. Hofmann
J. R. Carpenter and J. W. Harder
Dept. of Physics and Astronomy
University of Wyoming
Laramie, WY 82071
and
S. J. Oltmans
GMCC NOAA
Boulder CO 80303

ABSTRACT

The first balloon borne frost point measurements over Antarctica were made during September and October, 1987 as part of the NOZE II effort at McMurdo. The results indicate water vapor mixing ratios on the order of 2 ppmv in the 15 to 20 km region which is somewhat smaller than observed at mid-latitude and significantly smaller than the typical values currently being used in polar stratospheric cloud (PSC) theories. The observed water vapor mixing ratio would correspond to saturated conditions for what is thought to be the lowest stratospheric temperatures encountered over the Antarctic. Through the use of available lidar observations there appears to be significant evidence that some PSCs form at temperatures higher than the local frost point (with respect to water) in the 15 to 20 km region thus supporting the nitric acid theory of PSC composition. Clouds near 15 km and below appear to form in regions saturated with respect to water and thus are probably mostly ice water clouds although they could contain relatively small amounts of other constituents. Photographic evidence suggests that the clouds forming above the frost point probably have an appearance quite different from the lower altitude iridescent, colored nacreous clouds.