THE INVESTIGATION OF TEMPERATURE TREND IN THE ANTARCTIC USING GPS RADIO OCCULTATION

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The Antarctic plays a vital role in the global atmospheric and oceanic systems and circulations because of its unique geographical and meteorological features. In recent years, abnormal melting of Antarctica ice sheet has been considered as a strong evidence of global warming. Climate change in the Antarctic and its impacts on global climate have drawn more and more attention. Some studies have identified a general warming trend of near-surface temperature in the Antarctic but cooling trends some regions and different seasons (King 1994 and Steig et al., 2009). Turner (2006) reported a warming trend in the upper troposphere (UT) and a cooling trend in the lower stratosphere (LS).

Most studies on the Antarctic climatology predominately rely on only 18 weather stations. 17 of the stations are distributed along the coastline. The number and locations of these stations is not ideal for the Antarctic meteorological observation. The recent GPS radio occultation (RO) technique has demonstrated a great potential for advancing weather and climate studies, especially for remote areas such as the oceans and polar regions. The CHAMP mission provides nearly eight years (2001 - 2008) atmospheric data by using the GPS RO technique. COSMIC generates about 2,500 atmospheric profiles daily (approximately 10 times of the number of CHAMP profiles) since 2006. Due to the global coverage of the GPS RO observations, a great number of high quality atmospheric information can be obtained worldwide. Detection of atmospheric temperature changes in the tropical UT and LS using GPS RO has been conducted (Steiner et al., 2009)

This study aims to investigate the potential using the GPS RO technique for the Antarctic climate monitoring. Although only eight years of CHAMP data available, the result has shown the significance of the GPS RO technique for reliable and long-term atmospheric monitoring. The study firstly evaluated GPS RO atmospheric retrievals (from both CHAMP and COSMIC) using radiosonde data in Antarctica. The mean difference in temperature between radiosonde and CHAMP is 0.065 C with a standard deviation of 1.272 C, and the mean difference for COSMIC data is 0.021 C with a standard deviation of 1.293 C. An analysis of temperature changes using CHAMP RO data then was also conducted. Temperature trends at ten standard pressure levels and their seasonal and spatial variations were analysed. In the upper troposhere, two notable findings were 1) a warming trend was found in the West Antarctic and Peninsula and a cooling trend in the East Antarctica, and 2) a general warming trend was identified in Winter but cooling in Summer. These findings are in agreement with previous studies that used the radiosonde

and other satellite data. With future Global Navigation Satellite Systems and more RO missions available, it is promising that the GPS RO technique will enhance the Antarctic climatologic studies significantly.

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