5.3 ANOMALOUS SNOW ACCUMULATION OVER THE SOUTHEAST REGION OF THE GREENLAND ICE SHEET DURING 2002-2003 SNOW SEASON

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1. INTRODUCTION

The Greenland ice sheet plays a pivotal role in global climate. Its mass balance may exert significant control over sea level rise (Krabill et al., 2000). Measuring snow accumulation over the Greenland ice sheet is important to monitor the mass balance.

2. OBJECTIVE AND APPROACH

Our objective is to determine seasonal snow accumulation in the percolation zone of the Greenland ice sheet on the daily-weekly basis over the large scale. Our approach utilizes data from the Greenland Climate Network (GC-Net) and from the SeaWinds Scatterometer on the QuikSCAT satellite (QSCAT) to measure snow accumulation (SA) in the percolation zone of the Greenland ice sheet. GC-Net measurements provide crucial in-situ data to facilitate the interpretation of QSCAT backscatter signature for the development of an algorithm to map SA.

3. RESULTS

In a snow season, SA in the percolation zone attenuates QSCAT backscatter resulting in a linear backscatter decrease in the decibel (logarithmic) domain. The attenuation effect enables the retrieval of SA depth from QSCAT data. QSCAT SA maps for a period of 5.5 months in two consecutive snow seasons, 2001-2002 and 2002-2003, reveal an extensive area of large SA anomaly (a factor of 2 compared to a typical year) over the southeast side of the Greenland ice sheet in 2002-2003 and a slight decrease in accumulation on the southwest side in the same season compared to that in the 2001-2002 season. As shown in Figure 1, QSCAT results (Nghiem, 2004) compare well with GC-Net data at NASA-SE station except for exceptional snowfall events. One exceptional event occurred at NASA-SE in April 2003 when the amount of snowfall in half a day was as much as the total SA over more than 3 months in a typical year. In this case, point measurements at NASA-SE are localized data that are different from areal measurements such as QSCAT (25km x 25km). Accurate surface height measurements such as ICESat data will allow for the comparison with QSCAT results over extensive profiles. The anomalous SA pattern such as in the 2002-2003 season can also cross-verify results obtained by GRACE (Gravity Recovery and Climate Experiment Mission). These anomalies demonstrate the complexity of seasonal and interannual patterns and changes in SA, and the anomalous SA in 2002-2003 season could be another one in addition to the many recent peculiar Arctic environmental changes reported by SEARCH (Study of Environmental Arctic Change).

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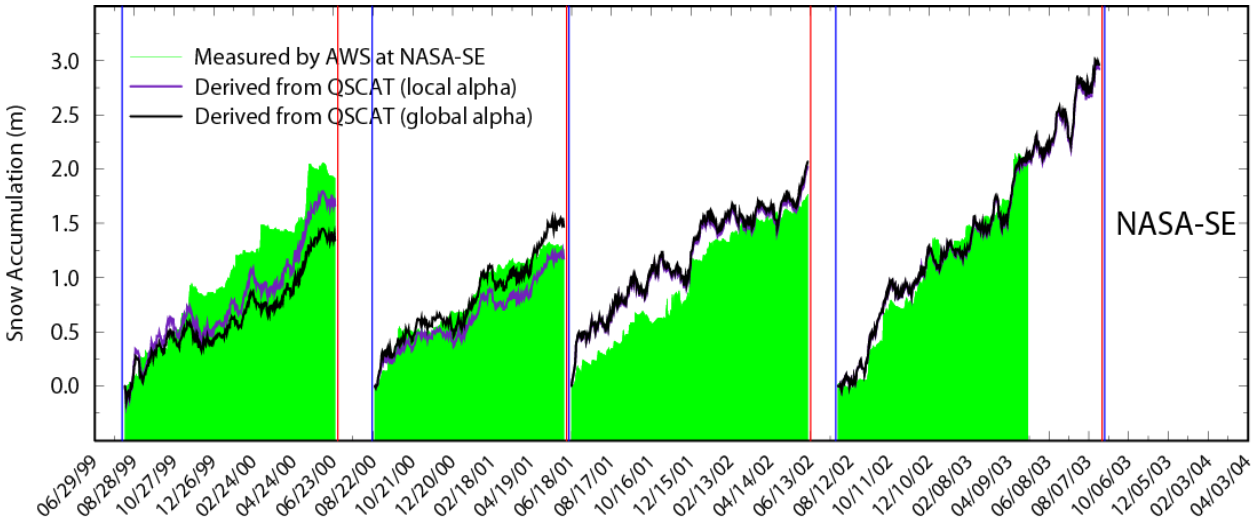

Figure 1: Snow accumulation at Automatic Weather Station (AWS) NASA-SE and snow accumulation derived from QSCAT data.