1. Introduction

Accumulation is the main source of input to the Greenland Ice Sheet (GrIS), and it has significant impact on the surface mass balance, which is crucial to understand the response of the GrIS to climate change.

Direct measurement of accumulation has temporal and spatial limitations.

Precipitation and evaporation from reanalysis data have been used to estimate accumulation over the GrIS.

How well the reanalysis data represent the accumulation of the GrIS has led to interest in the intercomparison and validation of output from different reanalysis data.

3. Results

- Annual precipitation, evaporation and calculated accumulation from reanalysis model outputs have been investigated for the GrIS, based on the common period of 1989–2001.

- ERA-40 and ERA-interim have better spatial distributions of precipitation than NCEP-1 and NCEP-2, particularly in their depiction of the moderate precipitation (more than 400 mm yr⁻¹) region along the western flank of Greenland. Concerning temporal variability, ERA-interim shows the best correlation with observations at five synoptic stations, but it still overestimates precipitation over the GrIS, particularly along the coastal region.

- Evaporation from ERA-40 and ERA-interim has more a reasonable spatial distribution than that from NCEP-1 and NCEP-2.

- Accumulation calculated from ERA-interim shows the closest spatial distribution to the observation-based accumulation, but it still overestimates accumulation along the southeastern coastal regions.

- Concerning temporal variations, ERA-Interim showed the best correlation with precipitation observations at five synoptic stations, and the best correlation with in situ measurements of accumulation at nine ice core sites (See Table 1.2 in Chen et al, 2011). Because the reanalysis model grid and surface site are clearly not spatially equivalent, this may bring inherent mismatches.

- Further analysis by using ERA-interim reanalysis data indicated that the estimated accumulation over the GrIS is increasing in autumn & winter, but decreasing in spring & summer during the period of 1979-2010.

2. Data

- The gridded precipitation and evaporation data used in this research are reanalysis products derived from ECMWF, NCEP/NCAR and NCEP-DOE.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Resolution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERA-40</td>
<td>T159 (~125km)</td>
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<td>T62 (~210km)</td>
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</tr>
<tr>
<td>NCEP-2</td>
<td>T62 (~210km)</td>
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</tbody>
</table>

- In situ measurements used to validate the reanalysis data was obtained from the Program for Arctic Regional Climate Assessment (PARCA) ice cores drilled in 1997/98 (Source: http://nsidc.org/data/parca/) and Danish Meteorological Institute (DMI) synoptic station (Source: http://www.dmi.dk/DMI/index/). Location of the coastal DMI synoptic stations and the PARCA ice core sites are shown in the above figure. Also shown the 2000 m and 3000 m elevation contours in meters as reference.

4. Conclusion

- The results in this research give useful information about the reliability of the reanalysis data in Greenland area.

- To different extent, both ERA-interim and NCEP-2 are improvements over ERA-40 and NCEP-1, respectively.

- ERA-Interim shows the best accumulation spatial distribution and temporal variation when compared with in situ measurements.

- The decreasing trend of accumulation in spring and summer time can partly contribute to the increasing mass loss of the GrIS recently. When the accumulation is below average, it helped to maintain low albedo through the melting season. Warm conditions, with the positive albedo feedback mechanism, became a major contributor to the increasing surface mass loss since 1979.

5. Reference


6. Acknowledgments

We wish to thank NOAA/CAR/ESRL PSD for providing NCEP Reanalysis data at http://www.esrl.noaa.gov/psd/ and the ECMWF data server for providing reanalysis data at http://data.ecmwf.int/data/. We also thank Prof. Roger C. Bales for providing the accumulation data at http://www.colorado.edu/icefocus/PARCA/ Dr. Marco Cagnée for providing the topography data, and Prof. Lennart Bengtsson for the useful comments. The first author was funded by Nansen Scientific Society and Troms Mohn donation, Bergen, Norway.