A Big Earth Data Platform for Three Poles

**Surface elevation time series over the Greenland Ice Sheet (1991-2020)**

1、Description

The elevation change of ice sheet is the comprehensive result of ice dynamic process and ice sheet surface process, and is sensitive to climate change. The long-term time series of ice sheet surface elevation is of great scientific value to study the stability of ice sheet and its response to climate change. Satellite altimetry observation missions have provided a large number of surface elevation observations over ice sheet. However, the life of a single satellite altimetry mission is limited. To obtain a long-term ice sheet surface elevation time series, different satellite altimetry missions need to be linked. We use an updated strategy of Plane-fit method to achieve cross-calibration the missions. After correcting the ascending-descending bias more fully, a larger amount of observations is used to correct the intermission bias. Meanwhile, an interpolation method based on the EOF reconstruction is used to suppress the influence of interpolation error. Finally, by combining the observations of ERS-1, ERS-2, Envisat and CryoSat-2, we successfully constructed the monthly surface elevation time series with 5-km grid resolution of the Greenland ice sheet for 30 years from 1991 to 2020. Subsequently, we used the airborne laser altimeter data from Operation IceBridge and the Greenland ice sheet surface elevation change product provided by ESA Climate Change Initiative (CCI) to validate the time series. It is found that our time series are reliable. The accuracy of ice sheet surface elevation changes obtained from our time series is 19.3% higher than that of ESA CCI products. Benefiting from our more accurate correction of intermission bias, the accuracy across the over the overlapping observation period of Envisat and CryoSat-2 missions are improved more, up to 30.9%. Based on this time series, we find that the volume of Greenland ice sheet has accelerated at an initial rate of -53.8 ± 4.5 km3/yr and an acceleration of -2.2 ± 0.3 km3/yr2 in recent 30 years. We also find that the transformation of the North Atlantic Oscillation has significant impacts on the surface elevation changes of the Greenland ice sheet. In addition, the dataset can be used as fundamental data for assessing the mass balance of Greenland ice sheet and its contribution to global sea level rise and studying the response process and mechanism of Greenland ice sheet to climate change.

2、Keywords

Theme：Marine Remote Sensing,Surface elevation changes,Satellite radar altimetry,Glacier(Ice Sheet),Surface elevation time series
Discipline：Ocean,Cryosphere
Places：Greenland Ice Sheet
Time：1991-2020

3、Data details

1.Scale：None

2.Projection：North\_Pole\_Stereographic

3.Filesize：1342.0MB

4.Data format：None

4、Space scope

|  |  |  |
| --- | --- | --- |
| - | north：82.0 | - |
| west：-75.0 | - | east：-10.0 |
| - | south：60.0 | - |

5、Time frame:1991-08-14 15:00:00+00:00--2020-12-14 16:00:00+00:00

6、Reference method

References to data:

GENG Hong, AN Jiachun, WANG Zemin, LIU Tingting, ZHANG Baojun. Surface elevation time series over the Greenland Ice Sheet (1991-2020). A Big Earth Data Platform for Three Poles, doi:10.11888/Glacio.tpdc.2716582021

References to articles:

7、Supporting project information

National Key Research and Development Program of China
National Natural Science Foundation of China
Strategic Priority Research Program of the Chinese Academy of Sciences

8、Data resource provider

name: ZHANG Baojun
unit:
email: bjzhang@whu.edu.cn

name: WANG Zemin
unit:
email: zmwang@whu.edu.cn

name: AN Jiachun
unit:
email: jcan@whu.edu.cn

name: LIU Tingting
unit:
email: ttliu23@whu.edu.cn

name: GENG Hong
unit:
email: genghong@whu.edu.cn