A Big Earth Data Platform for Three Poles

**HUST-ERA5, an hourly global atmospheric de-aliasing product (2002-2020)**

1、Description

Temporal aliasing caused by the incomplete reduction of high frequency atmosphere and ocean variability contributes as a major error source in the time-variable gravity field products recovered from the Gravity Recovery and Climate Experiment (GRACE) and GRACE-Follow On (GRACE-FO), and likely future gravity missions. The current state-of-the-art of satellite gravity data processing makes use of de-aliasing products to reduce high-frequency mass anomalies, for example, the most recent official Atmosphere and Ocean De-aliasing products (AOD1B-RL06) are applied to model non-tidal mass changes in the ocean and atmosphere. The products already achieved a temporal resolution of 3 hours that greatly improved the quality of gravity inversion compared to the previous releases. In this study, we explore a refined mass integration approach of the atmosphere that considers geometrical, physical, and numerical modifications of the current AOD1B method. Then, the newly available ERA-5 global climate data of 31 km spatial and 1-hour temporal resolution are used to produce a new set of non-tidal atmosphere de-aliasing product (HUST-ERA5) that is computed in terms of spherical harmonics up to degree/order 100 covering 2002 onwards. Despite of an overall agreement with the AOD1B-RL06 (correlation of low-degree coefficients are all greater than 0.99), discrepancy is still distinguished for spatial-temporal analysis, i.e., a better consistency of HUST-ERA5 from 2007 to 2010. The factors contributing the differences, including the input data, method and temporal resolution, are therefore respectively analyzed and quantified through extensive assessments. We find the difference of HUST-ERA5 and AOD1B-RL06 has led to a mean variation of 7.34 nm/s on the the LRI (Laser Ranging Interferometry) range-rate residual on Jan 2019, which is close to the LRI precision already. This impact is invisible for GRACE(-FO) gravity inversion because of the less accurate onboard KBR(K-band ranging) instrument, however, it will be nonnegligible and should be considered when the LRI completely replaces KBR in the future gravity mission. In addition, HUST-ERA5 can also be widely used in LEO satellite orbit determination and superconducting gravimeter atmospheric correction.

2、Keywords

Theme：Gravity,Temporal gravity fields,De-aliasing,GRACE
Discipline：Solid earth
Places：on the globe
Time：1-hourly

3、Data details

1.Scale：None

2.Projection：

3.Filesize：43000.0MB

4.Data format：None

4、Space scope

|  |  |  |
| --- | --- | --- |
| - | north：90.0 | - |
| west：180.0 | - | east：180.0 |
| - | south：90.0 | - |

5、Time frame:2001-12-31 16:00:00+00:00--2020-12-31 03:59:59+00:00

6、Reference method

References to data:

YANG Fan, LUO Zhicai. HUST-ERA5, an hourly global atmospheric de-aliasing product (2002-2020). A Big Earth Data Platform for Three Poles, doi:10.11888/Geo.tpdc.2711472021

References to articles:

7、Supporting project information

Study on the Kalman fusion approach towards the de-aliasing problem in satellite gravity mission

8、Data resource provider

name: YANG Fan
unit:
email: yfan\_cge@hust.edu.cn

name: LUO Zhicai
unit:
email: zcluo@hust.edu.cn