ATL20/21

Notes to users and known issues

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Notes to users and known issues
This document contains notes, which are of use in the analysis of the gridded sea ice products, and issues that are known to the developers, which may be fixed in future releases of these products. Notes and issues from the ATL07/10 Known Issues document relevant to these gridded products have been copied here also (in italics).
Feedback from the community will be added to future revisions of this document.

Contents

Note 1. Data coverage

Updated 11/09/21 for rel003 ATL20 and rel002 ATL21

ATL20 and ATL21 are configured to generate daily and monthly freeboard and sea surface height anomalies composites, respectively, across both hemispheres for all months since October 2018, regardless of the number of valid days of ATL10 data that exist in that month.

Data gaps in ATL10 do exist, due mainly to anomalous spacecraft issues. So far, the primary data gap was due to a safehold event on 26 June, 2019 that lasted until July 9, 2019. The monthly gridded June/July 2019 estimates are still produced but are thus based on incomplete monthly coverage. Due to the orbit cycle of ICESat-2, it is also very common for monthly grid-cells in ATL20/ATL21 to be generated from just single day of ATL10 data (there is no minimum number of days needed to produce a monthly gridded freeboard/SSHA estimate in a given gridcell).

Following the safehold, the data through July 9 to 26 2019 were also compromised (discussed below) and were initially held for assessment but have since (rel003 ATL07/10 onwards) been publicly released:

Copied from the ATL07/10 Known Issues document - Data collected between 9-26 July 2019 have a small timing bias resulting from an erroneous Earth orientation parameter uploaded during the spacecraft's return to operations following a safehold event on 26 June 2019. This caused an error in spacecraft pointing, resulting in an extra approximately 1 degree of forward pitch, and shifted the onboard attitude control system interpretation of spacecraft time by roughly 19 seconds. The primary manifestation of this issue is telemetry band errors at steep coastal areas, at times resulting in loss of surface returns. We note that there may be some increased height errors from data collected during this time period, those errors are generally within the conservative estimates of geolocation and height uncertainty currently provided on the ATL03 product.

In rel005 ATL10 QA, it was noticed that the 9-26 July 2019 data were automatically failed, and are thus not integrated into rel003 ATL20 and rel002 ATL21. This was traced to the introduction of the new pointing angle filter in rel005 ATL10. All these files are now automatically failed (see ATL07/10 Known Issues document, Note #7) as they now contain no valid freeboard segments. We still provide ATL20/21 in July 2019 but the temporal coverage is limited and thus they do not represent a full month of freeboard retrievals.

In rel003 ATL20 and rel002 ATL21, we also include data from October 2018 (previously held). These gridded files are generated from data collected during 14-31 October 2019 only and thus also do not represent a full month of freeboard retrievals.

Note 2. High freeboard samples (near the ice margins) due to sea state*
We advise users to be cautious of erroneous freeboards in grid-cells near to the ice edge for the reasons provided in the ATL07/10 Known Issues document (Issue #3): *The reference sea surfaces used to calculate freeboards are based on sea surface heights identified in ATL07. Near the ice edge, the reference surfaces within the ice cover are affected by sea state, likely due to scattering from the troughs of waves propagating into the ice cover, resulting in surfaces that may be tens of centimeters below the local mean sea level. This can result in higher freeboards and can affect sporadic 10-km freeboard segments. Most of these anomalous retrievals are thought to have been filtered out (mainly through the 50% passive microwave ice concentration filter) but they still likely occur on occasion.*

Added 03/20/21: A new reference surface height slope variable has been introduced in rel004 ATL10 and its use in filtering out such returns is being explored for inclusion in ATL10 processing.

Note 3. ATL21 development
The gridded sea surface height product (ATL21) was released in August 2021.

Copied from the ATL07/10 Known Issues document (Issue #2): *As the ATL03 data across the six beams have not been fully aligned (Issue #1), differences are apparent in the ICESat-2 polar sea surface height anomalies (SSHA) (reference surface heights in ATL10). Care must be taken when using these data to carry out absolute SSH analyses or comparisons with other satellite data.*

Our analysis of SSH anomalies (SSHA) has indicated some significant (centimeter-scale) interbeam differences, especially with strong beam 1 (Bagnardi et al., 2021). Despite this, the SSHA estimates from ICESat-2 show good agreement with SSHA estimates obtained from ESA's CryoSat-2 during the summer-fall 2020 CRYO2ICE orbit alignment and on basin/seasonalscales across the Arctic (Bagnardi et al., 2021). The biases are known to have a large-scale spatial and long-period temporal dependence. Work is on-going to reduce the inter-beam biases.

For rel001 ATL21 onwards we choose to utilize just the middle strong beam (beam 3) for the gridded SSHA to avoid issues of inter-beam biases.

The MSS and Geoid are also provided in ATL21 to enable assessments of absolute SSH and Dynamic Ocean Topography (DOT). Both the MSS and Geoid have been sampled in ATL10 consistently with the reference sea surface data (MSS/Geoid sampled at the lead locations, combined into 10 km along-track averages).

In rel004, we changed the ATL07/10 products to tide-free to be consistent with ATL03 (by converting the MSS to tide-free, see ATL07/10 Known Issues document Note #8). However, for oceanographic purposes, a mean-tide system is generally preferred as this is the more realistic representation of the Earth's surface (it includes the tidal/geopotential impact of the solid earth

deformation from external bodies, e.g. the Sun and Moon). The ICESat-2 ATL12 Ocean Surface Height product is in a mean-tide system for this reason. As such, we have converted ATL21 to mean-tide by applying the geoid/solid-earth free2mean corrections as described in the ATBD (Section 6.2) to the SSHA, MSS, and Geoid.

Note 4. Release notation
Added 10/26/21
The ATL20 and ATL21 products follow a different release notation to ATL07/10. Rel004 ATL20 and rel003 ATL21 were generated using rel006 ATL10.

Note 5. ATL10 granule hold/fail changes
As of rel005, ATL07 and ATL10 processing an automatic filtering of calibration scan data is now done. In general, all freeboard data collected during off-pointing/calibration scans are filtered out.

References

Bagnardi, M. N. Kurtz, A. Petty, R. Kwok (2021), Sea surface height anomalies of the Arctic Ocean from ICESat-2: a first examination and comparisons with CryoSat-2, Geophysical Research Letters, 48, e2021GL093155, doi:10.1029/2021GL093155.

Kwok, R., A. Petty, M. Bagnardi, N. T. Kurtz, G. F. Cunningham, A. Ivanoff (2021), Refining the sea surface identification approach for determining freeboard in the ICESat-2 sea ice products, The Cryosphere, 15, 821–833, doi:10.5194/tc-15-821-2021