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.

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Note 1. Data coverage

Currently ATL20 (and eventually ATL21) is configured to generate monthly freeboard composites across both hemispheres for all months since November 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 to be generated from just single day of ATL10 data (there is no minimum number of days needed to produce a monthly gridded freeboard estimate in a given grid-cell).

Following the safehold, the data through July 9 to 26 2019 were compromised (discussed below) but are included still in ATL10 and now ATL20/21:

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.

ATL10 granules that are failed or held (see ATL07/10 Known Issues document, Note #7) are not integrated into these gridded data.

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 R004 and its use in filtering out such returns is being explored for inclusion in R005 data.

Note 3. ATL21 development

The gridded sea surface height product (ATL21) was released in spring 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 (SSH) estimates (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) inter-beam differences, especially with strong beam 1 (Bagnardi et al., submitted). Despite this, the SSHA estimates from ICESat-2 show good agreement with SSHA estimates obtained from ESA's CryoSat-2 during the fall 2020 CRYO2ICE orbit alignment and on basin/seasonal-scales across the Arctic (Bagnardi et al., submitted). Work is on-going to better understand and 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 exactly the same as the reference surface height calculation (MSS/Geoid sampled at the lead locations, combined into 10 km along-track averages, binned to the 25 km grid) for consistency. MSS and Geoid are provided in a tide-free system.

Note 4. Release notation

The ATL20 and ATL21 products follow a different release notation to ATL07/10. rel001 ATL20 was generated using rel003 ATL10s, while rel001 ATL21 was generated using rel004 ATL10s. For every new release of ATL10 data after this, the ATL20/21 are incremented in-turn. Thus for rel004 ATL10 we now have rel002 ATL20 and rel001 ATL21.

See

/METADATA/Lineage/ATL10/version

in ATL20 and ATL21 data products.

Issue X1. Negative segment lengths (resolved in rel004)

As noted in the ATL07/10 Known Issues document (Issue #X2), an error was found in R003 data whereby in rare cases, segments are listed as having an unphysical negative segment length. This was caused by a software bug in how the ATL03 data was being ingested. This has been fixed for rel004 data production.

Our testing (on January, June, October 2019 data) suggests this affected only ~0.002-0.003% of the freeboard segments in a given month and introduces errors that are only significant at the $5^{th}/6^{th}$ decimal level.

References

Bagnardi, M. N. Kurtz, A. Petty, R. Kwok, Sea surface height anomalies of the Arctic Ocean from ICESat-2: a first examination and comparisons with CryoSat-2 (submitted, preprint available at https://www.essoar.org/doi/abs/10.1002/essoar.10506377.1).

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