ICESat-2 Data Products and New Features and Improvements Coming in Release 007

CRYO2ICE Symposium 2024

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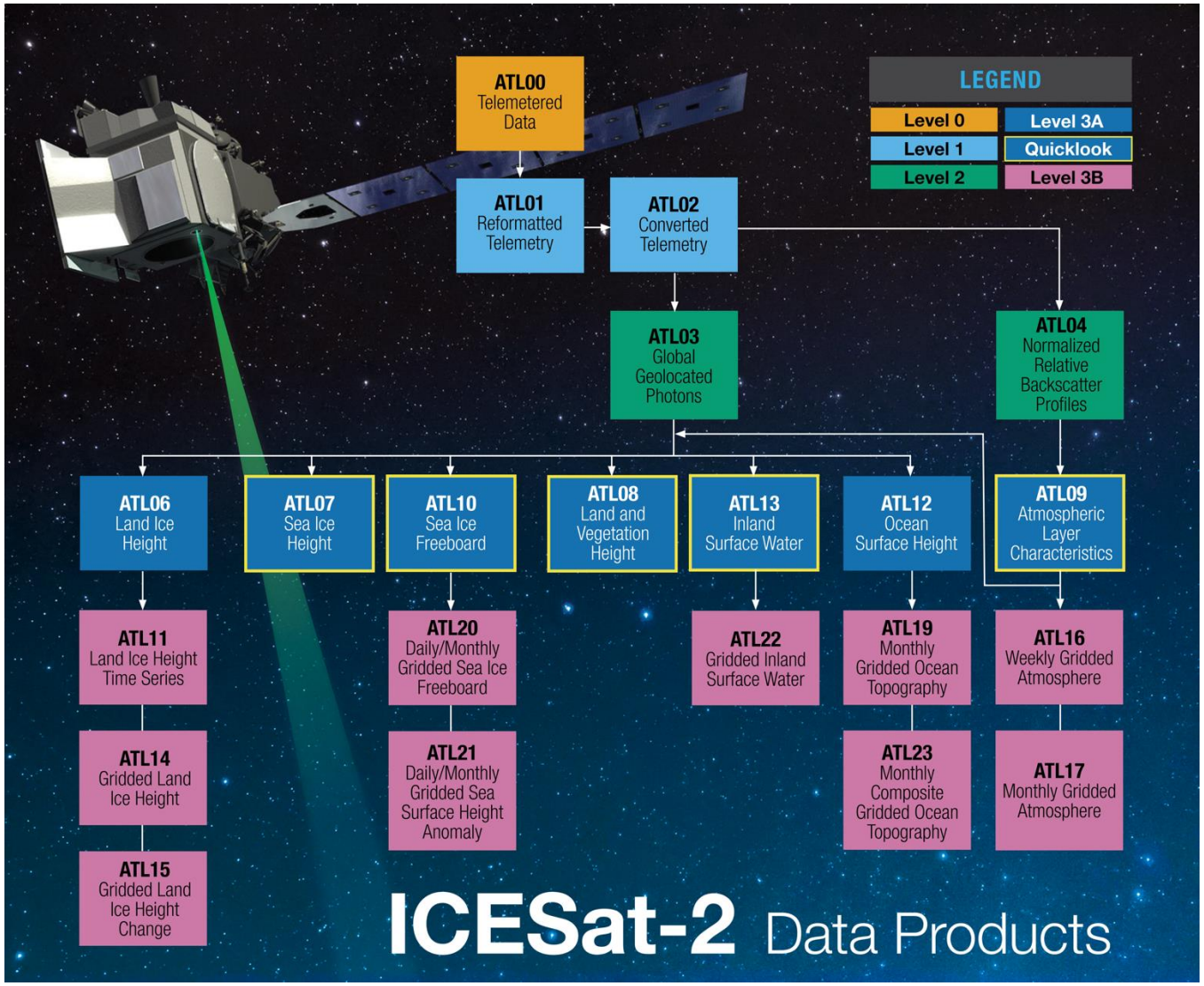
Overview of ICESat-2 Data Products



Related research products also published at NSIDC DAAC

Level 2 Track Products

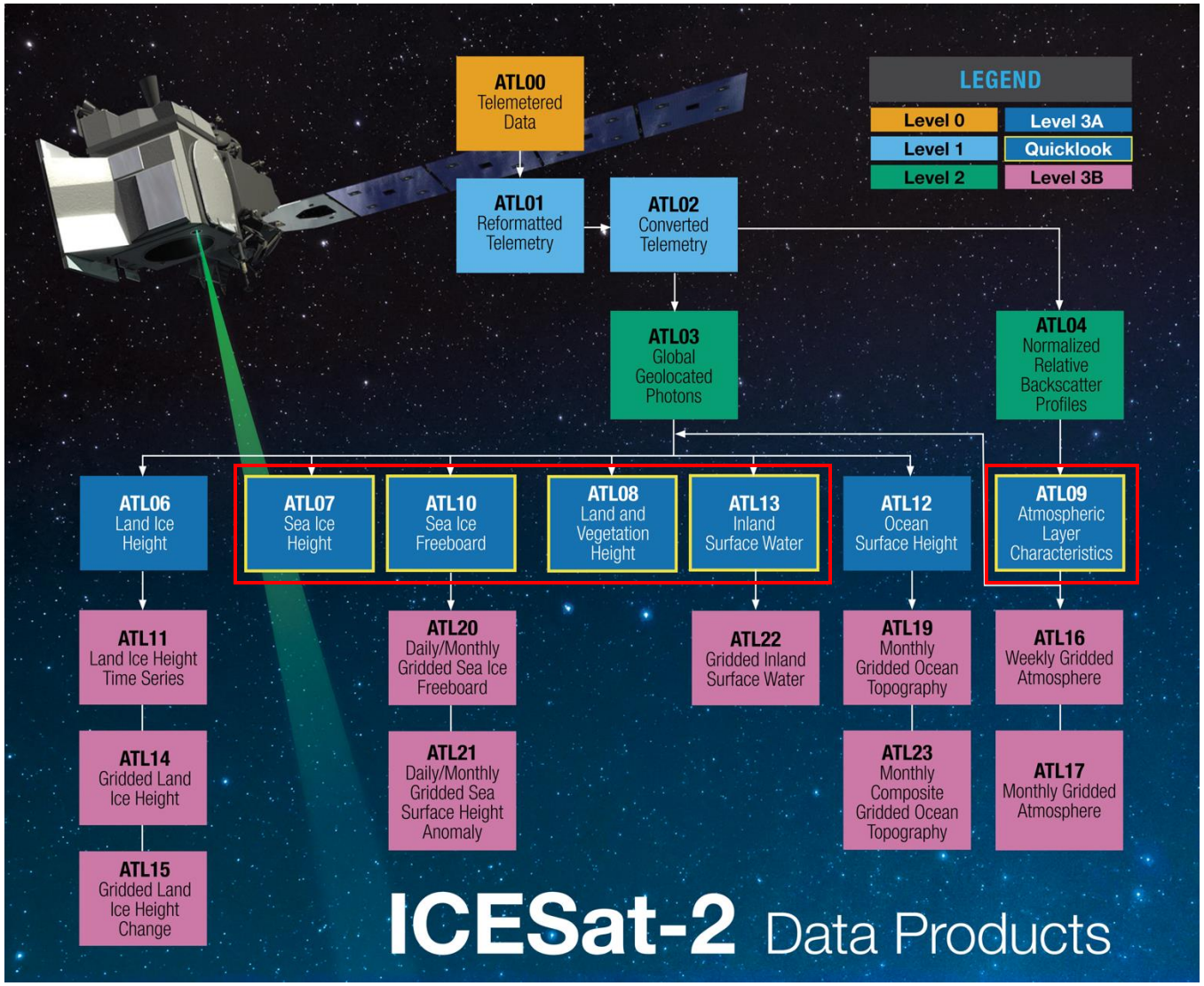
Level 3A Track Products

Level 3B Gridded Products

Standard products available in the cloud!

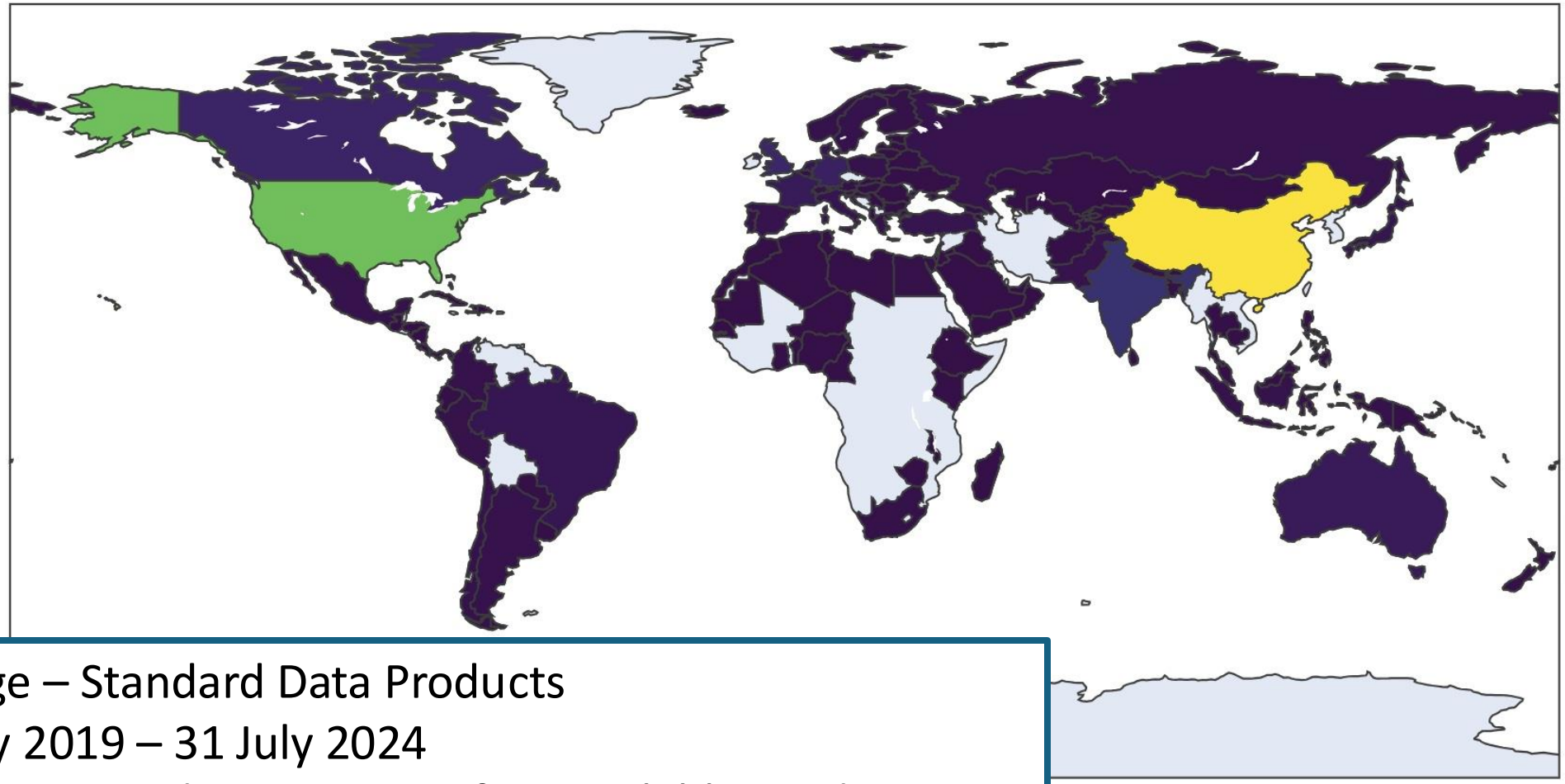
Final data out through **31 July 2024**

Overview of ICESat-2 Data Products



- Quick Look (QL) datasets have a latency of 3 days from acquisition
  - Standard datasets have an average latency of ~45-60 days
- Main differences are in the height and geolocation of the data:
  - QL products are lower (by ~2.7 m) and less precise (about a 5 m standard deviation) than final products (depends on length scale).
  - Reported location errors of QL data are ~10 m in across-track direction, and up to ~100 m in along-track direction.

ICESat-2 Data Product Metrics



Data Usage – Standard Data Products

- 28 May 2019 – 31 July 2024
- 8,914 registered usernames of 20 available products
- 54,852,912 science file downloads
- Users from 133 countries

Release 007: New Features & Improvements

- ATL02
  - Improved TOF and Radiometry and DeadTime Calibrations
  - Addressed timestamp issues in S/C data
- ATL03
  - Improvements to quality_ph and weight_ph
  - Includes beam-to-beam height offset corrections
- ATL04
  - Improved background
  - Improved identification of folded cloud
- ATL07
  - Improved Fine Tracker
- ATL08
  - Additional filtering of photons processed by DRAGANN
  - Improved Ground/Canopy identification
- ATL09
  - Improved thin-layer (dust/smoke) detection
  - Improved folded cloud detection/identification of below ground clouds
- ATL12
  - Integration of ATL07 sea ice heights
  - Improved along 10 meter height data and provide first photon bias correction
  - Weak beam heights improvements
- ATL13
  - Improved surface height estimates (less influenced by bottom returns in clear shallow water)
  - Improved/added bathymetry parameters
- ATL16/17
  - Improved data filtering
  - Improved usage and reporting of folded cloud
- ATL19/23
  - Added Polar ice-free DOT
  - Added DOT uncertainty
- ATL22
  - Added additional statistics
  - Added additional geometry
- All Products
  - ITRF2020
  - Cloud optimization

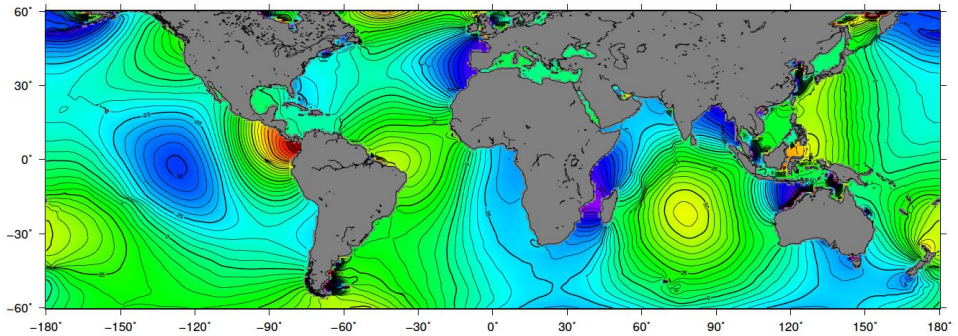
Release 007: New Features & Improvements

Replacement of Ocean Tide Model: from GOT4.8 to FES2014b

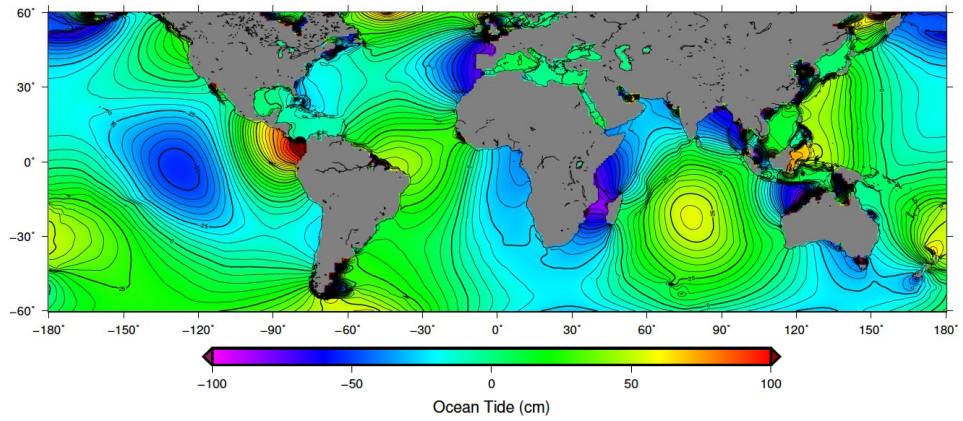
ICESat-2 mission initially adopted Richard Ray's GOT4.8 ocean tide model. Used from rel001 through rel006.

- It was among the best available at that time (2014)
- It suffered from tidal edge issues, especially along coasts
- 10 short-period constituents; 15 long-period spectral lines
- Harmonic grids with a geographic resolution of ¼°
- Includes ocean loading

GOT4.8 ocean tides at 00h on April 1, 2024



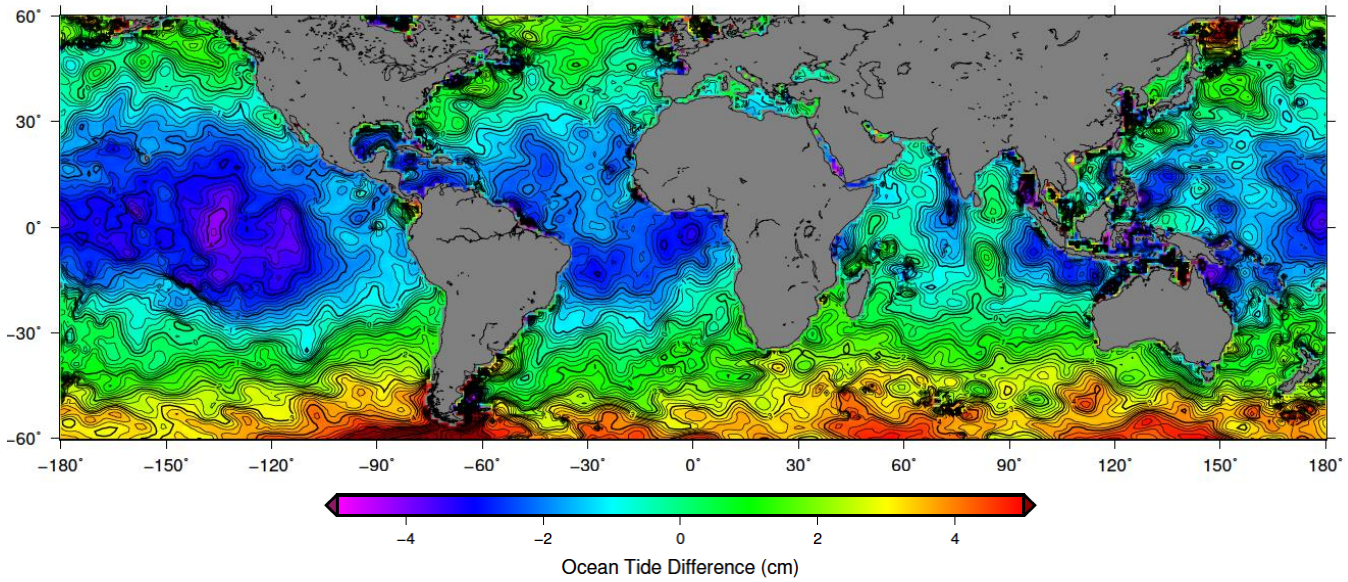
FES2014b ocean tides at 00h on April 1, 2024



For rel007, the mission adopted the FES2014b ocean tide model.

- FES2022b was released after the decision to adopt FES2014b
- Edge issues are mitigated by using the extrapolated version which will include estimates of tides in fjords, estuaries and inlets
- 34 short- and long period constituents
- Harmonic grids with a geographic resolution of 1/16°
- Includes ocean loading
- Consistent with CryoSat2 modeling

Ocean tide Difference: FES2014b minus GOT4.8 at 00h on April 1, 2024



Mean: -0.28 ± 2.16 cm

Both GOT4.8 and FES2014b are global models – only mid-latitudes shown in graphics

Courtesy of John Robbins

Release 007: New Features & Improvements

ATL12 Dynamic Ocean Topography (DOT) will be unbiased by sea ice freeboard.

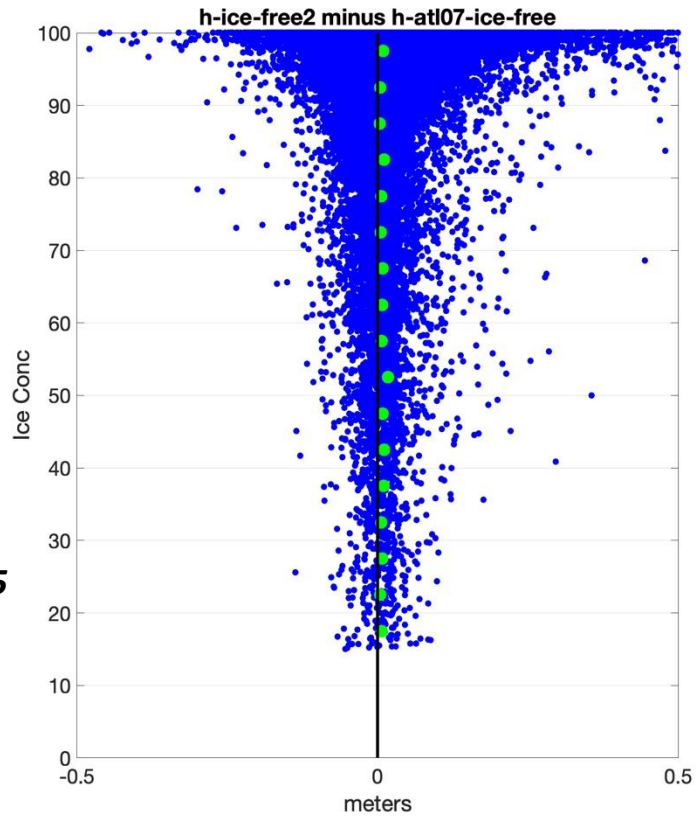
- ATL12 10-m bins in ATL07 bright leads are identified, and there, DOT from ATL12 (*h_ice_free*) and ATL07 (*h_atl07_ice_free*) agree.
- ATL12 ocean segment DOT averages will be of *h_ice_free* for IC<77.5% and

  h_atl07_ice_free for IC>77.5%
- ATL19/23 gridded averages will incorporate *h_ice_free or h_atl07_ice_free for IC>15%.*

Overall
ATL12-ATL07 = 0.0086 ±0.075

Up To IC = 77.5%
Bias = ~ 1 cm ± 4 cm

ATL12 h_ice_free - h_atl07_ice_free versus IC
~142 ATL12s, many ocean segments



Ice Conc	Mean Diff	STDev Diff
2.5		
7.5		
12.5		
17.5	0.0069	0.0344
22.5	0.0041	0.0340
27.5	0.0076	0.0377
32.5	0.0063	0.0269
37.5	0.0103	0.0373
42.5	0.0108	0.0436
47.5	0.0084	0.0412
52.5	0.0170	0.0824
57.5	0.0067	0.0414
62.5	0.0075	0.0429
67.5	0.0086	0.0523
72.5	0.0052	0.0439
77.5	0.0064	0.0448
82.5	0.0110	0.1375
87.5	0.0038	0.0583
92.5	0.0045	0.1106
97.5	0.0090	0.0712

Courtesy of Jamie Morison

Release 007: Timeline

- Late October 2024: Final code freeze for all products.
- mid-November 2024: Start reprocessing ATL03.
- ~9 weeks to reprocess ~6 years of ATL03. Downstream products follow after ATL03 completion.
- April 2024: Release 007 QLs begin.
- May 2025: All of Release 007 live at NSIDC *
- L3B products follow

** Continue forward-processing Release 006 until Release 007 reprocessing is complete.*

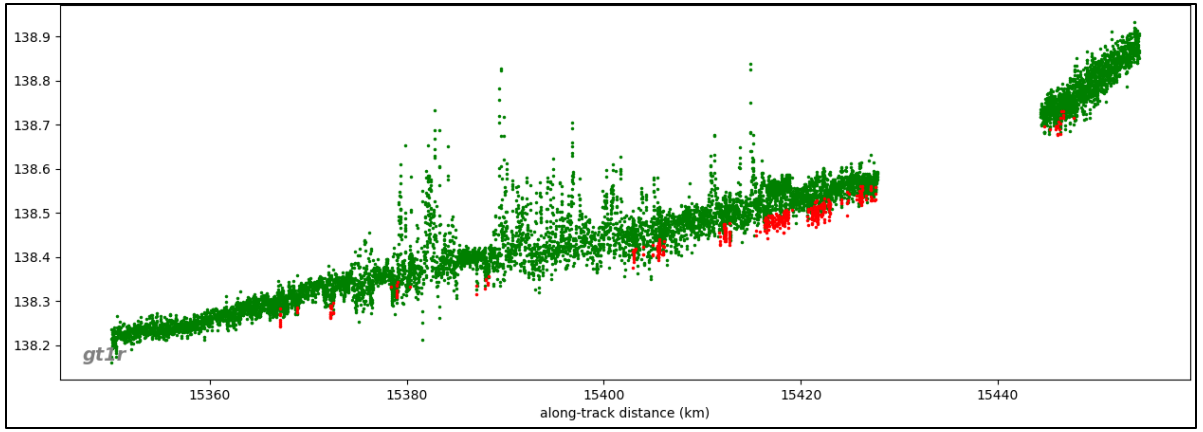
New Data Products: ATL24

- ATL24: Coastal and Nearshore Bathymetry
- Consists of refraction-corrected seafloor and sea surface heights and associated uncertainties.
- Integrated with SlideRule
  - 4 Deliverables
    - ATL24g = Gold Standard Product, hosted by NSIDC and in Earthdata cloud
    - ATL24s = public web API that provides subsetting service
    - ATL24p = public web API that provides on-demand, customizable product generation
    - Graphical web client
- Release 001 targeted for December 2024

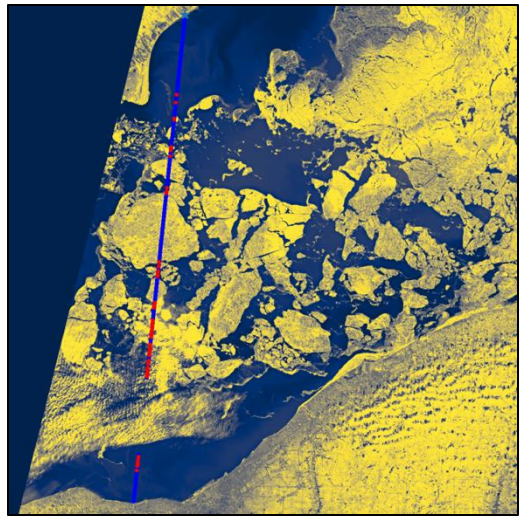
New Data Products: ATL25

Lake Ice Freeboard (ATL25)

- Uses ATL07/10 retrieval algorithm with new ellipsoidal heights and high pass filter
- Request narrowed to the Great Lakes
- Under development as a standalone product for final and quick look production
  - Lake Ice Campaign (26 Feb – 8 Mar 2024) suggests additional modifications are needed.



ATL07 uncorrected heights
ATL07 lead candidate



ATL07 corrected heights
ATL07 uncorrected heights

Lake Erie – ATL07 height and lead candidates Feb. 25, 2021

See also Isabella Peter's talk on Thursday, September 26th.


Thank you!!!
Any questions?