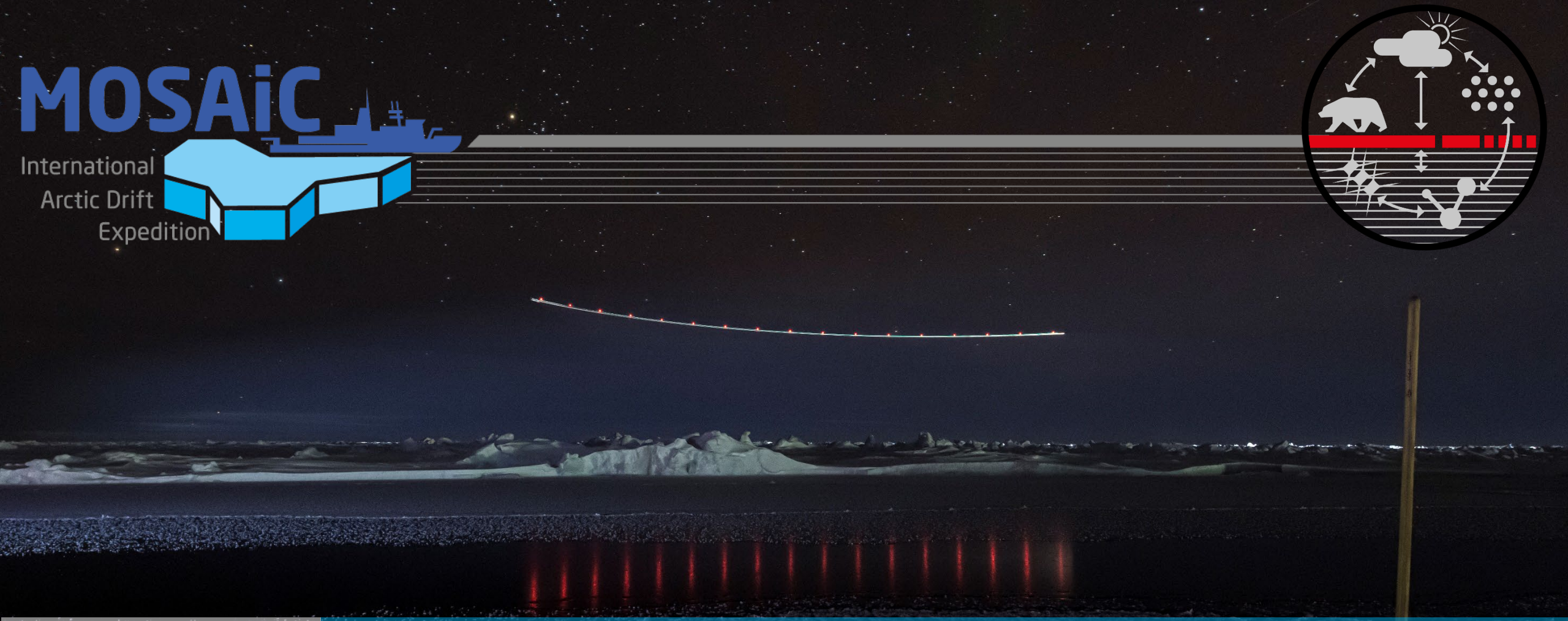

MOSAiC airborne laser scanning of the sea-ice surface: data product overview and insights to seasonal roughness evolution

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with contributions from Nils Hutter, Stefan Hendricks, Robert Ricker, Luisa von Albedyll, Gerit Birnbaum, Christian Haas

2nd MOSAiC Science Conference | 13-17 February 2023
University of Colorado, Boulder, Colorado, USA

Photo: Steffen Graupner

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

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Outline

MOSAiC airborne laser scanning of the sea-ice surface:

data product overview and **insights to seasonal roughness evolution**

Part 1

- Different data product levels & availability
- Assumptions & important notes to users

Part 2

- Roughness definition
- Small scale: CO1 floe grids
- Large scale: L-site triangle flights

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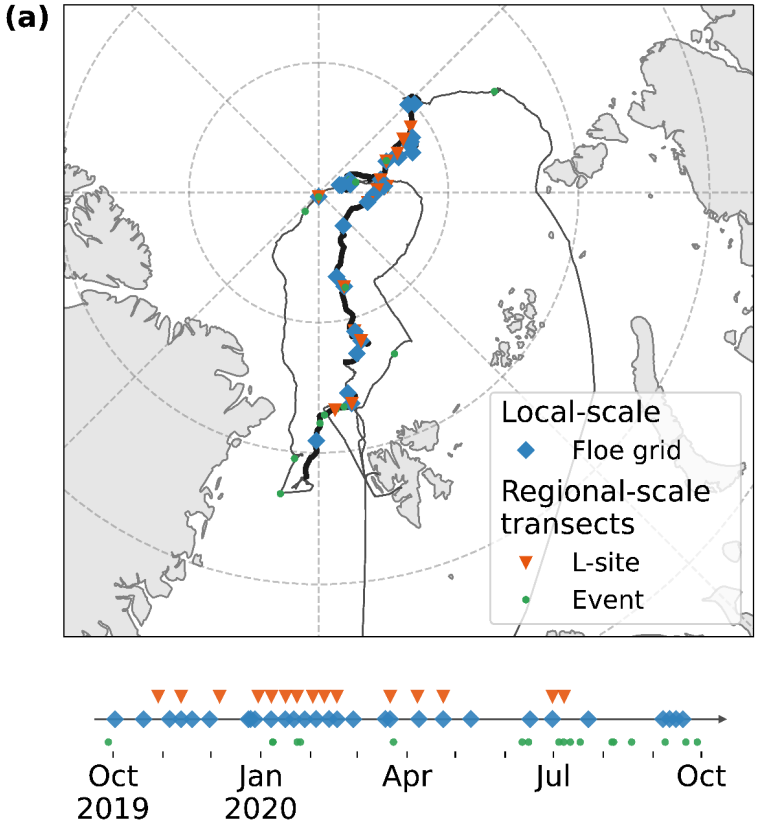
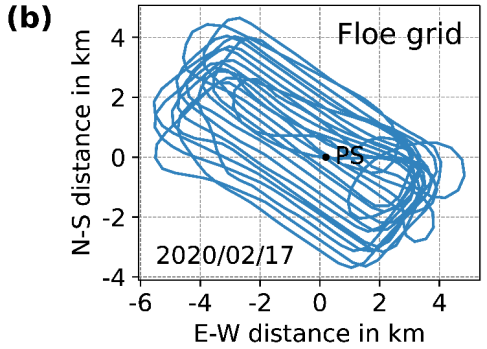
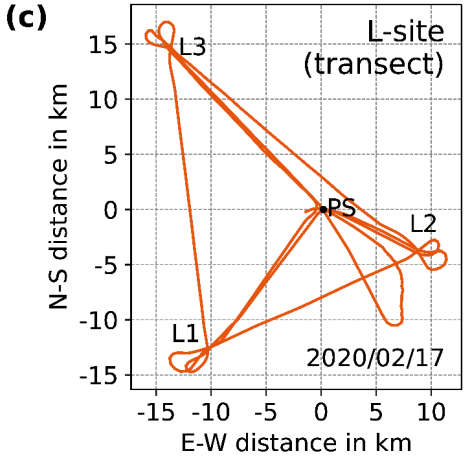
Data set



35 floe grid flights **(b)**





29 transect flights **(c)**

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Data processing levels

Expect big data, up to TBs!

INS/GPS data

- 10 Hz / 200 Hz

Point clouds

- Custom binary →`awi-als-toolbox`
- 5-min segments
- Elevation (DTU21), reflectance, echo width

Gridded segments

- netCDF
- 30-sec segments
- 0.5-m grid
- Elevation-corrected*
- Drift-corrected*
- Freeboard (estimate)*

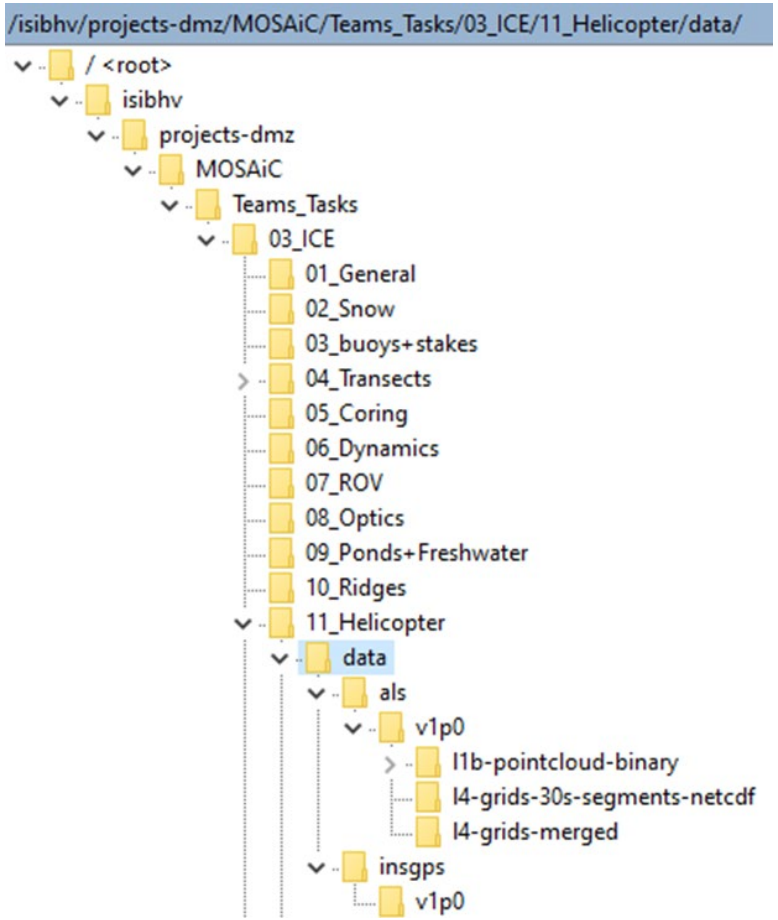
Merged floe grids

- netCDF, individual GeoTIFFs
- 0.5-m grid
- Elevation-corrected
- Drift-corrected
- Freeboard (estimate)

For more detailed info, see our data descriptor manuscript at Microsoft Teams: `MOSAiC_all > Documents > General > Teams > ICE > publications > Hutter_ALS_data_paper > Hutter-et-al-ALS-data-paper-submitted.pdf`

Data availability, version 1.0

mosaic-data.org



MOSAiC Central Storage

`/isibhv/projects-dmz/MOSAiC/Teams_Tasks/03_ICE/11_Helicopter/data/als/v1p0`

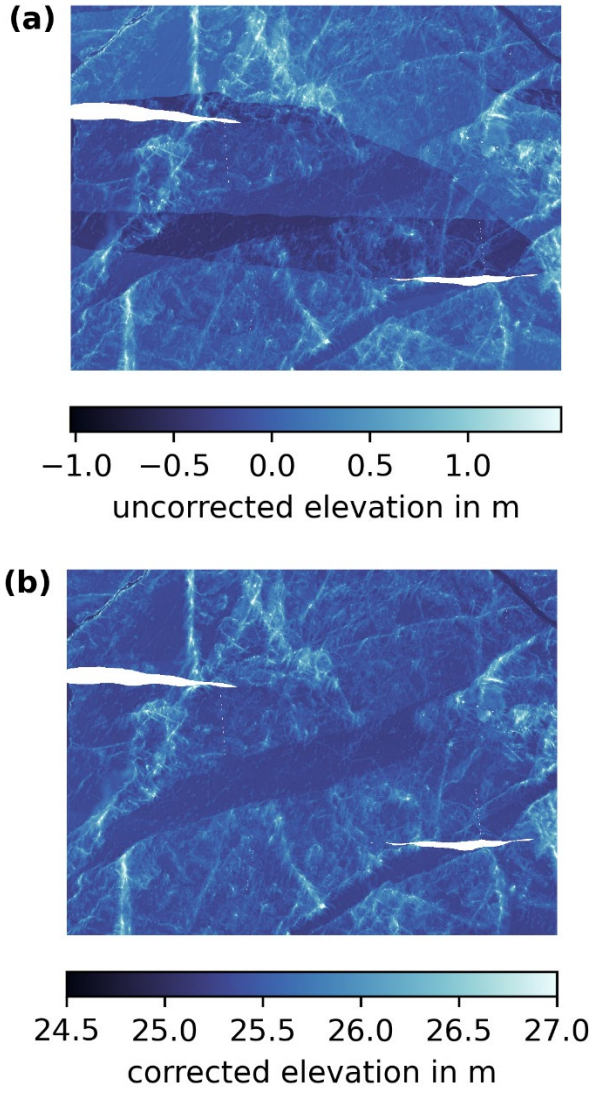
`/isibhv/projects-dmz/MOSAiC/Teams_Tasks/03_ICE/11_Helicopter/data/insgps/v1p0`

PANGAEA

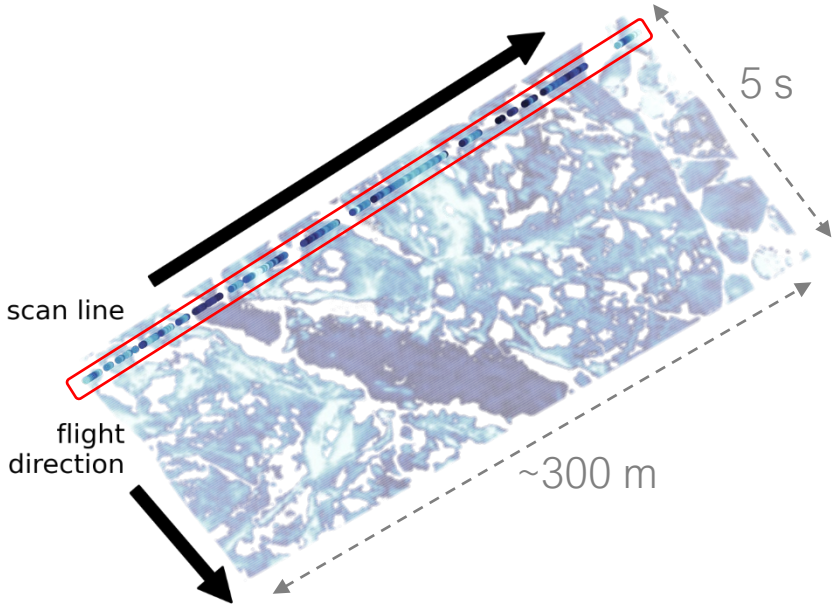
under review together with the data paper

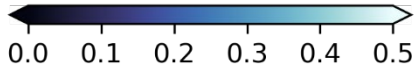
Important notes

- Degraded GPS data
  - 67 % flights
  - Especially high-latitude/mid-winter coinciding with lack of open water
- Inaccurate altitude propagates to surface elevation
- Lots of corrections necessary, not possible for transects



Roughness definition



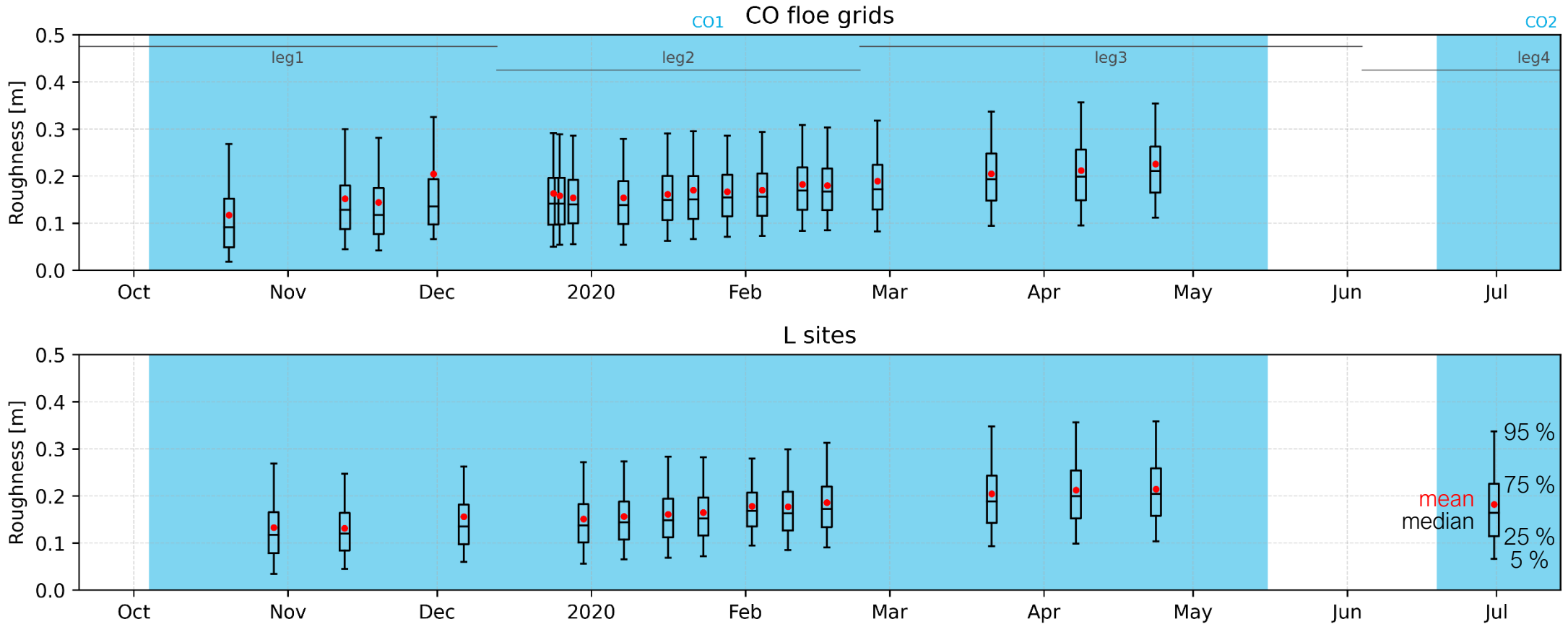


Elevation (metres above the DTU21 mean sea surface)

CO floe grid 22 July 2020

- From point cloud data
- Scan line based standard deviation of surface elevation
  (Beckers et al., AoG, 2015)
  - ~1000 values over ~300 m swath width
- Small scale: 5 × 5 km around Polarstern
- Large scale: L site triangles

Roughness evolution



Roughness distributions in typical range, similar for both small and large scale, agree with previous studies

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Take home messages

- Have a look on the data descriptor
- Approach data critically
- Choose the data product according to your purpose

🐞 Did you find a bug? Let us know at
nils.hutter@awi.de / arttu.jutila@awi.de / stefan.hendricks@awi.de

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ALS in Boulder

- Session 6B: Kortum et al. ALS + TerraSAR-X → ice classification
- Session 9A: Zampieri et al. ALS + infrared → conductivity parameterization development
- Session 9B: Anhaus et al. ALS + ROV multibeam → 3D sea ice

- Posters 1: Ricker et al. ALS + ICESat-2 → validation
- Posters 1: Hutter et al. ALS + infrared → machine learning snow&ice thickness