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MOSAiC
International Arctic Drift Expedition

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

Sea ice mass balance buoys during MOSAiC in the context of long-term buoy data in the Transpolar Drift system

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HELMHOLTZ

ARCTIC PASSION

Pan-Arctic Observing System of Systems: Implementing Observations for Societal Needs

Happy valentine's day! ☺

meets

MOSAiC

International Arctic Drift Expedition

EU-funded project consortium (> 30 partners) *that targets a* ***sustained and accessible "all-inclusive" observing system*** *that is* ***tuned to the diverse needs of users****, ranging from local inhabitants to academia through to industry and decision-makers*

10 different work packages in total

WP1: "Establishing an adaptive and more complete Arctic observing system" (Lead: NPI / LUND)

Collaborative project *with regard to providing & sharing* ***high-quality observational data sets****, common observation protocols and data processing standards that are beneficial to the observing community*

Among hundreds of instruments deployed

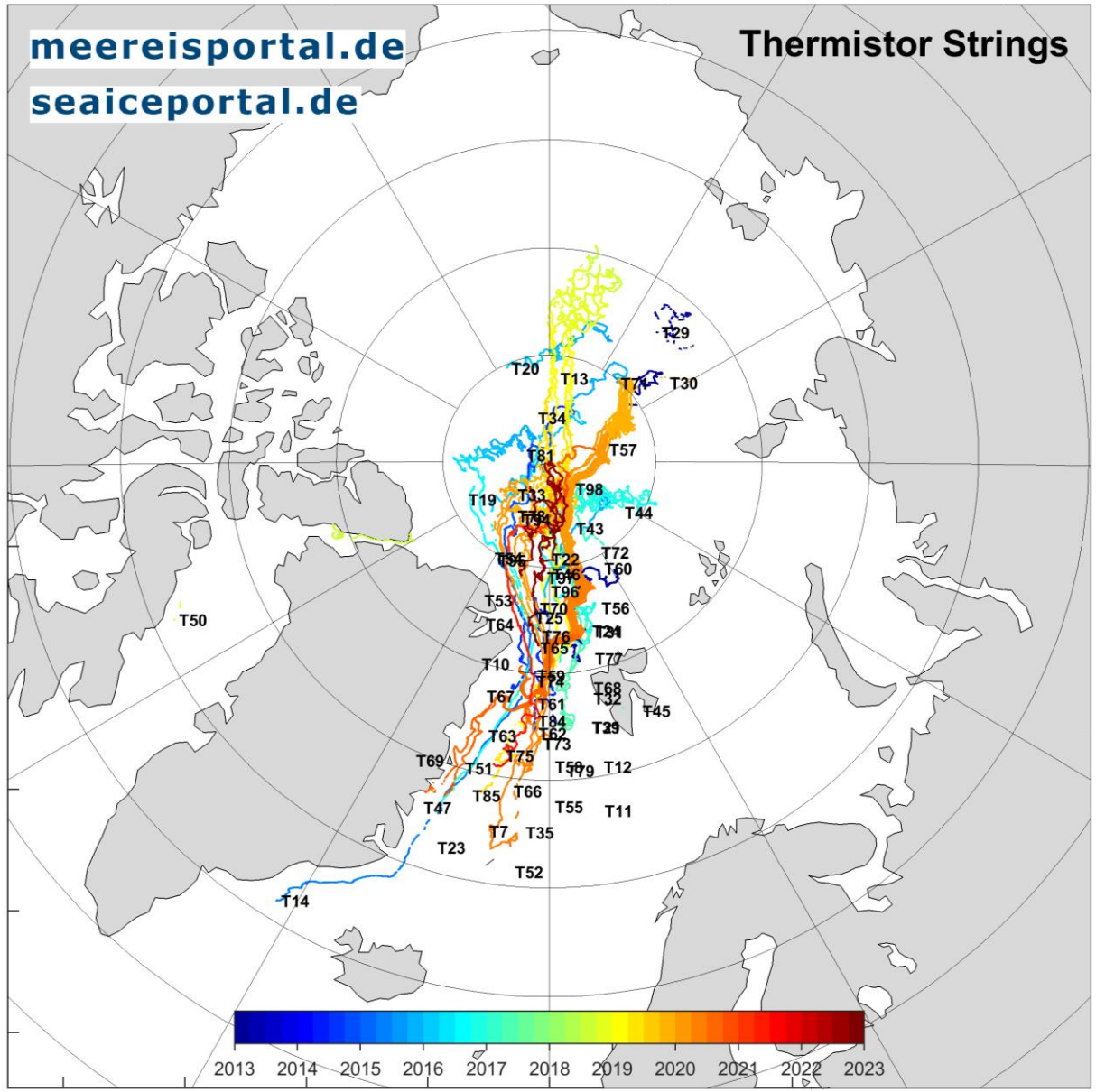
Large network of thermistor buoys (SIMBA), Seasonal IMB (SIMB3) & DTC

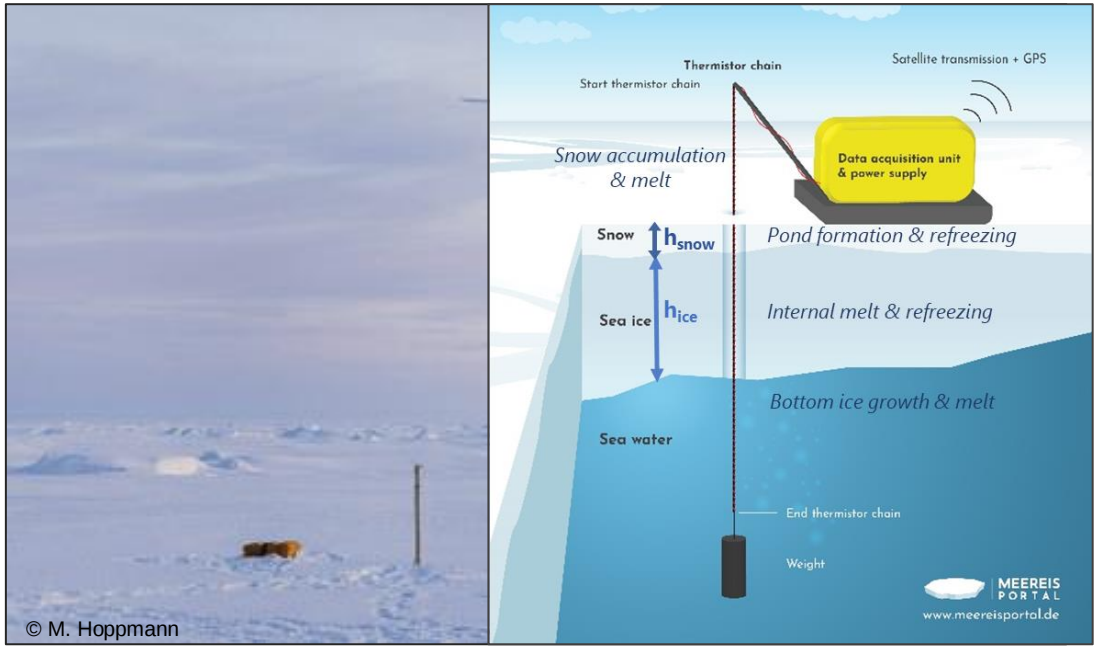
Main question here:

How do SIMBA buoys from MOSAiC compare with earlier buoys deployed in the Transpolar Drift?

*That's no SIMBA

SIMBA (T-buoy) archive on seaiceportal.de





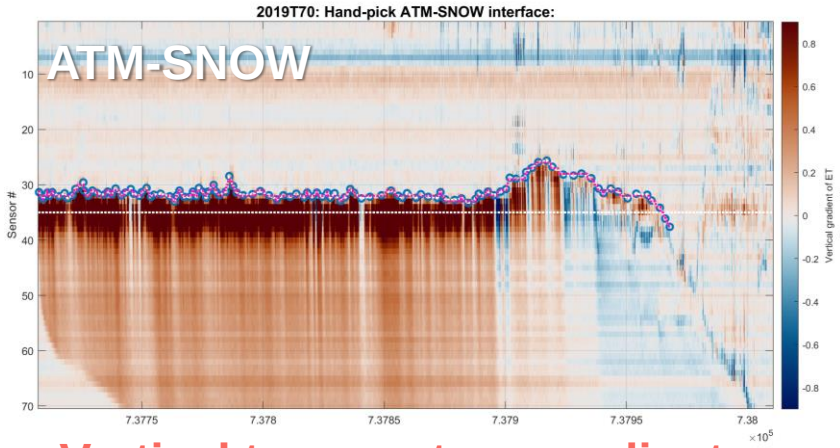
Thermistor-buoys (SIMBA)

- **~ 90 T-buoys** deployed/archived (29 MOSAiC)
- **Both hemispheres** (64 Arctic)
- **2012 – 2023**
- **Drift and temperature** data

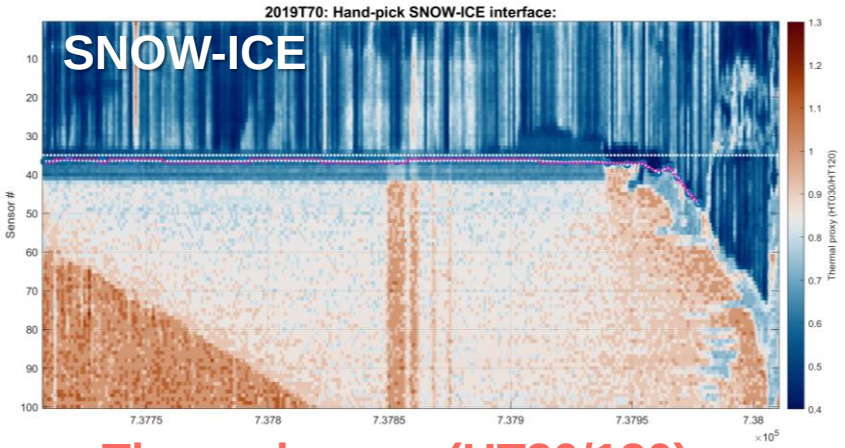
No thickness data yet – consistent processing wanted for Arctic PASSION WP1

SIMBA processing: From temperatures to geophysical parameters

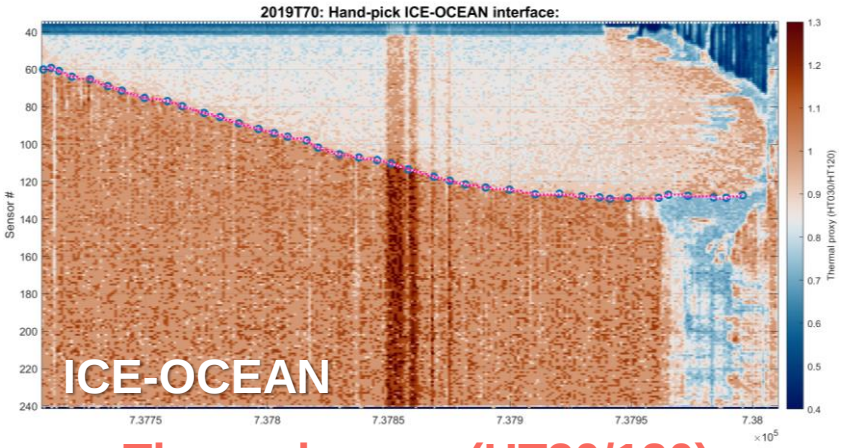
Snow & sea ice interfaces mainly through manual classification
(but: consistent & time-saving processing framework)



Vertical temperature gradient



Thermal proxy (HT30/120)



Thermal proxy (HT30/120)

Yields time series of:
Ice thickness
Snow thickness
Interface temperatures
Air temperature
Surface pressure
Ice growth & melt (rates)
…and more

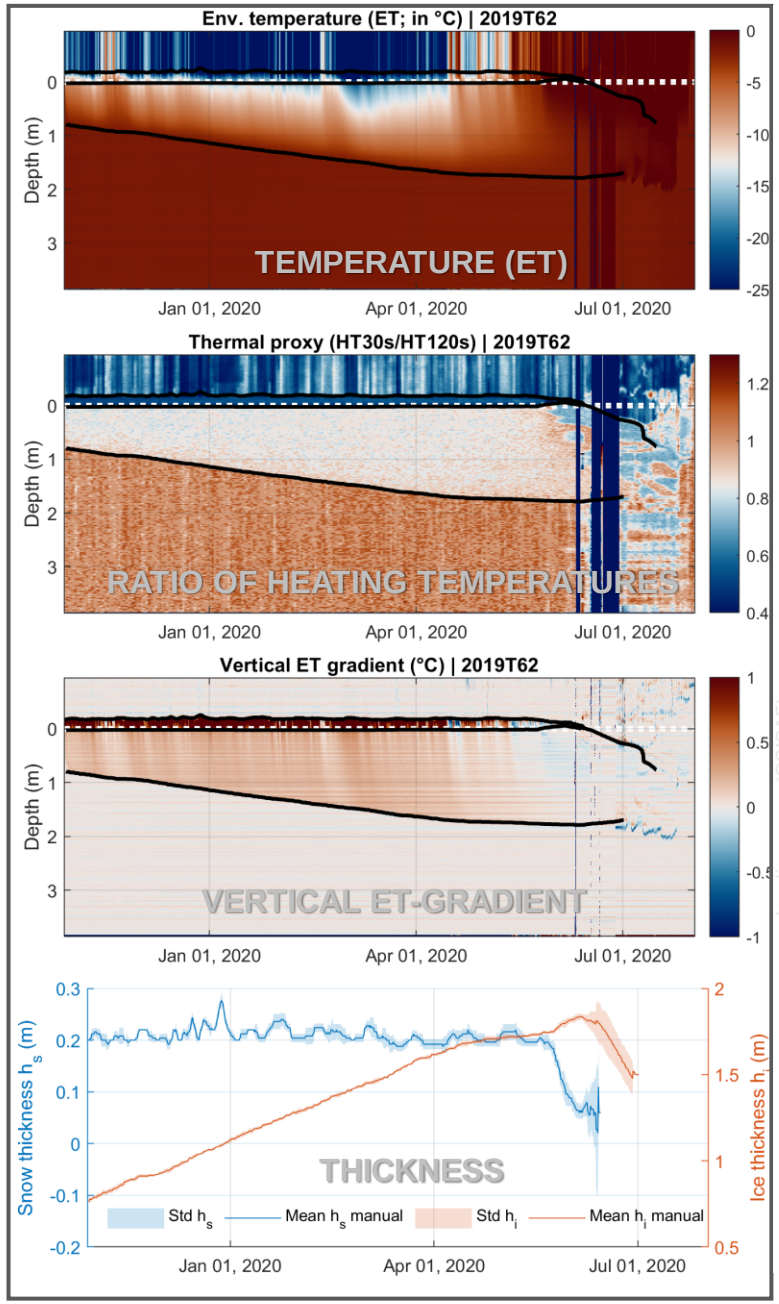
Uncertainty estimation

Assumption: manually derived vs. interpolated points cause different uncertainty levels for h_{ice} & h_{snow}

For 2cm spacing: Between 4cm and 8cm uncertainty for manual derivation
→ *hand-picked = ± 1 thermistor-spacing*
→ *interpolated = ± 2 thermistor-spacing*

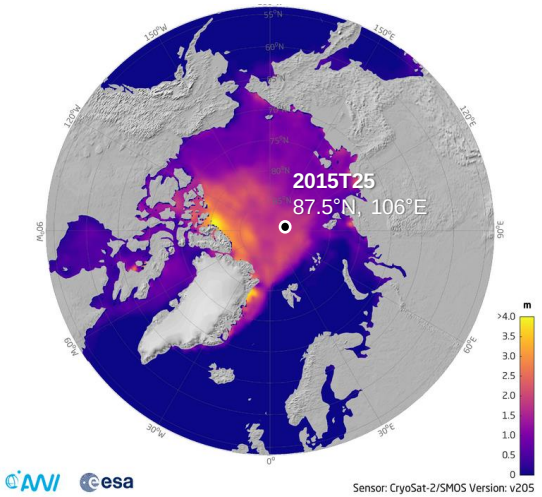
Derived thickness estimates & auxiliary drift parameters

BUOY (here: 2019T62)

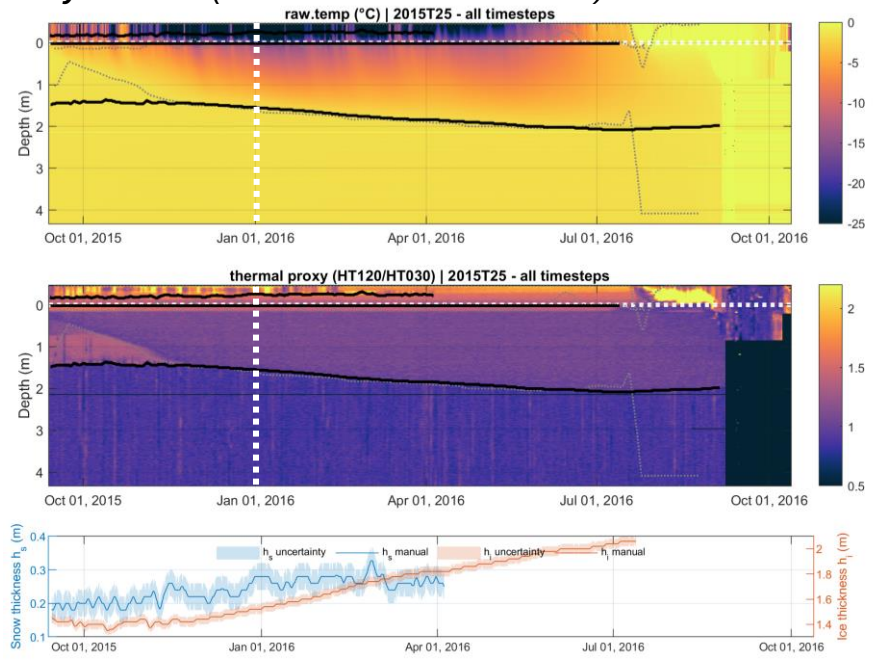


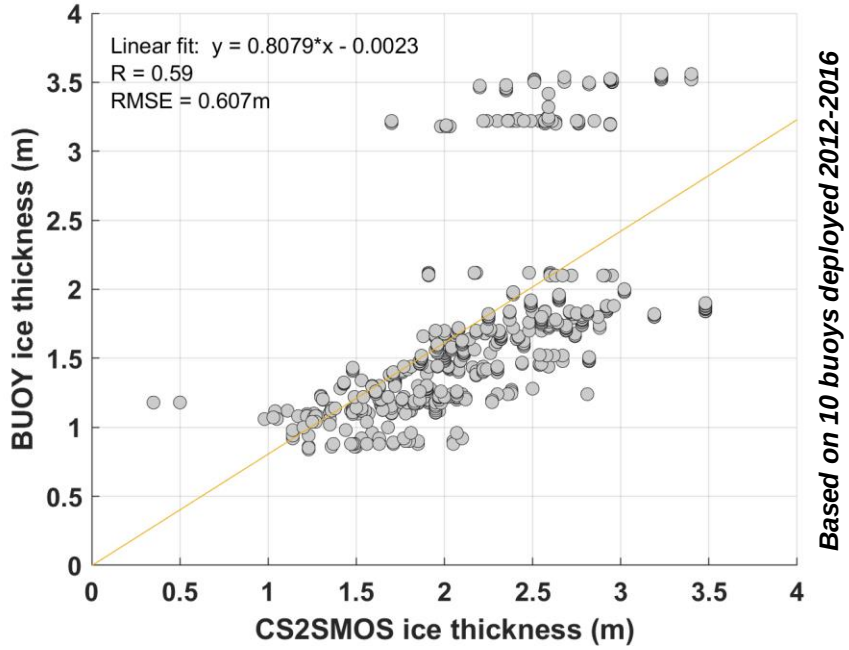
Ice thickness: Buoy vs. satellite (CS2SMOS)

*Exemplary **CS2SMOS ice thickness map** (JAN01-07, 2016)*



***Buoy 2015T25** (OCT 2015 to JUL/AUG 2016)*





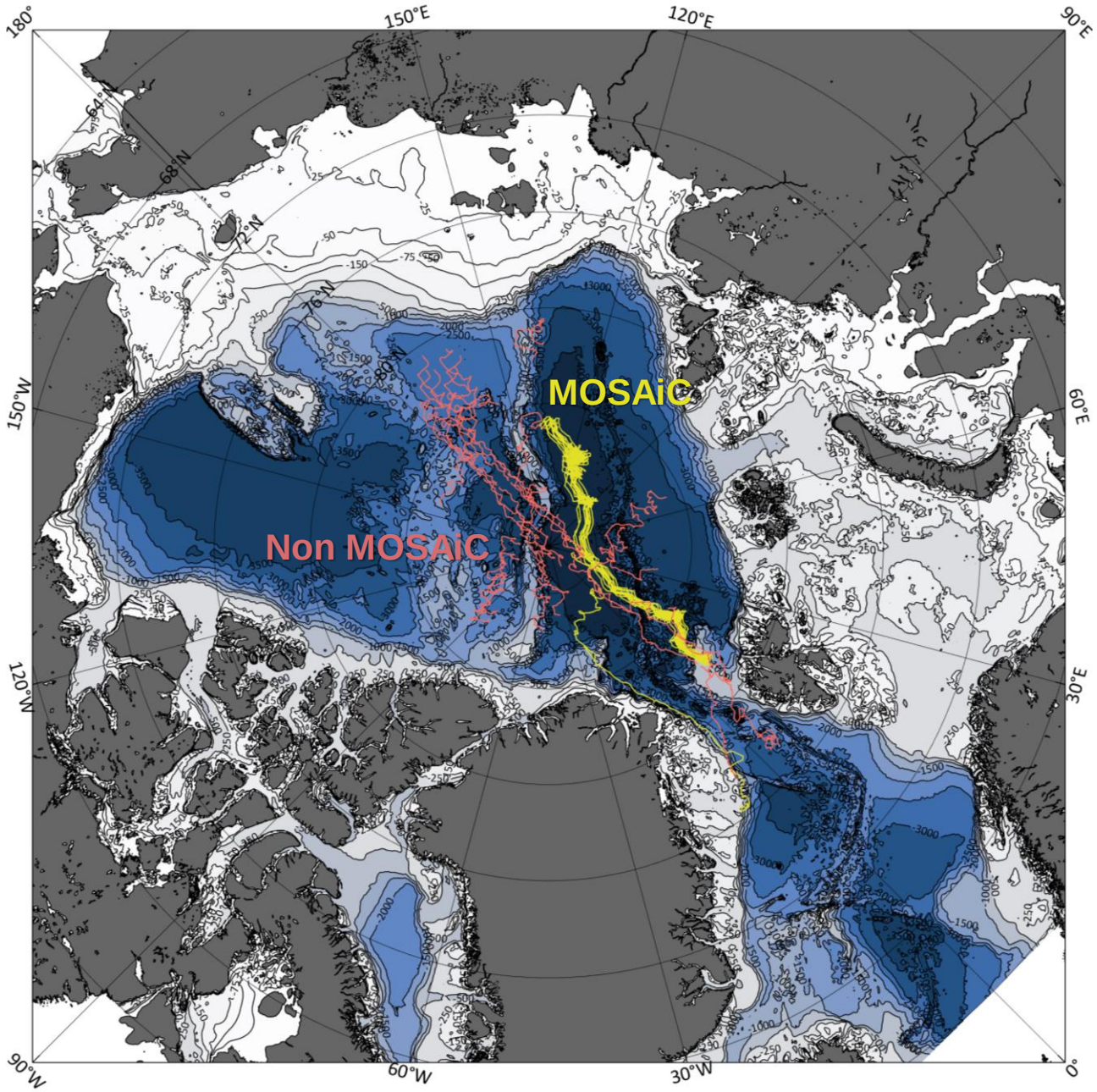
Based on 10 buoys deployed 2012-2016

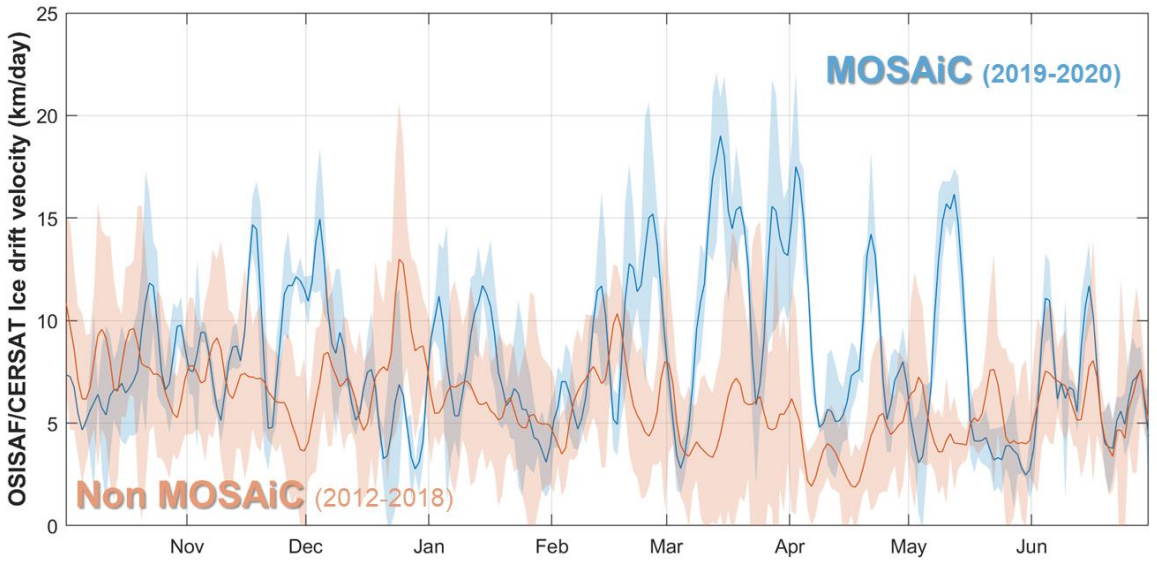
Agreement comparable with other in-situ comparisons (AEM - Ricker et al. 2017, ULS/ADCP - Belter et al. 2020).

Fair to assume a **good representativeness of derived buoy ice thicknesses** for a wider area (25x25 km² satellite grid cell)

Ricker et al. 2017: https://doi.org/10.5194/tc-11-1607-2017
Belter et al. 2020: https://doi.org/10.5194/tc-14-2189-2020

SIMBA drift tracks (Oct – Jun)





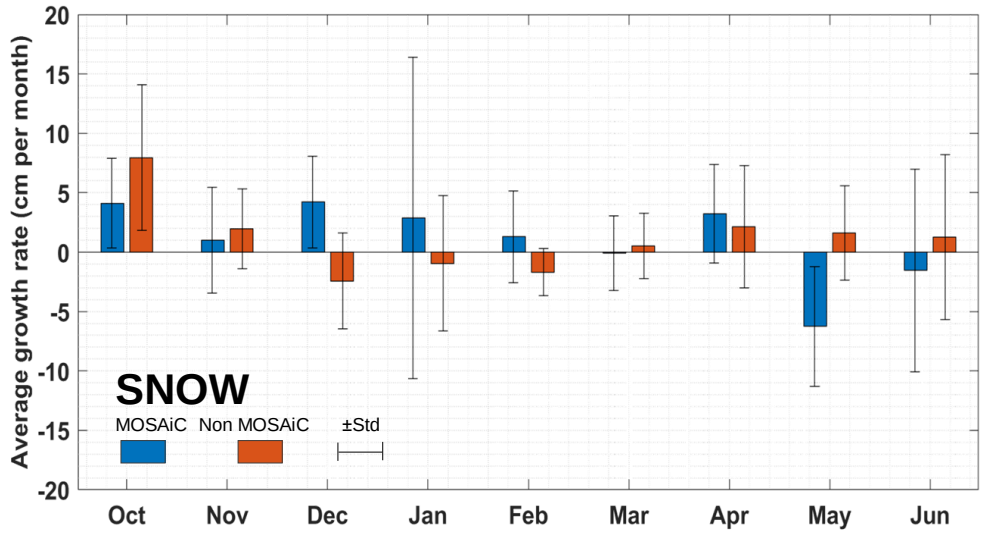
2019/2020

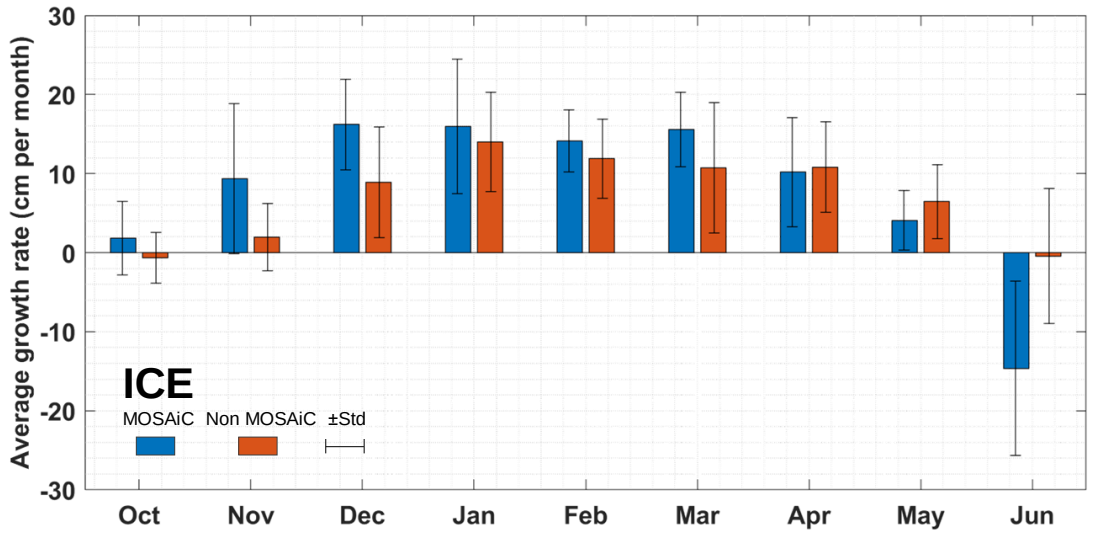
Increased drift velocity due to atmospheric forcing (enhanced Transpolar drift / positive AO)

Other years

Somewhat slower drift through the central Arctic

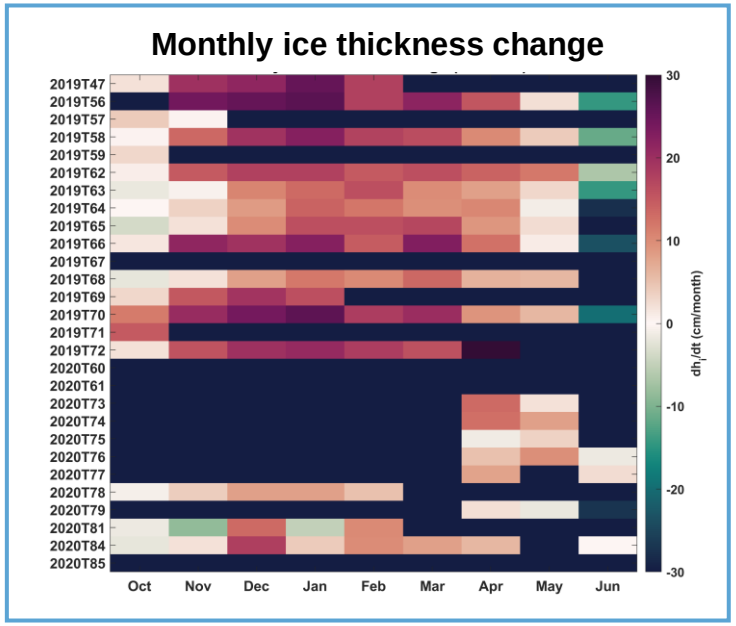
SIMBA | MOSAiC vs. historic buoys

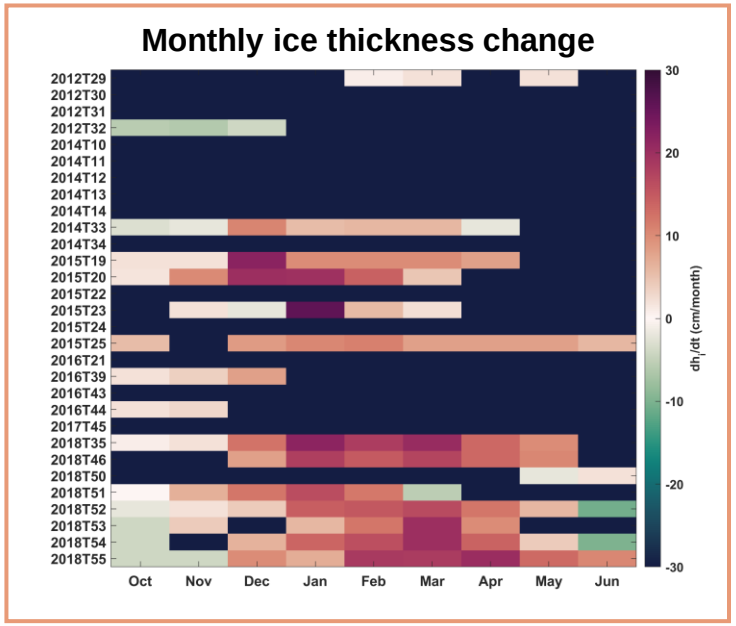




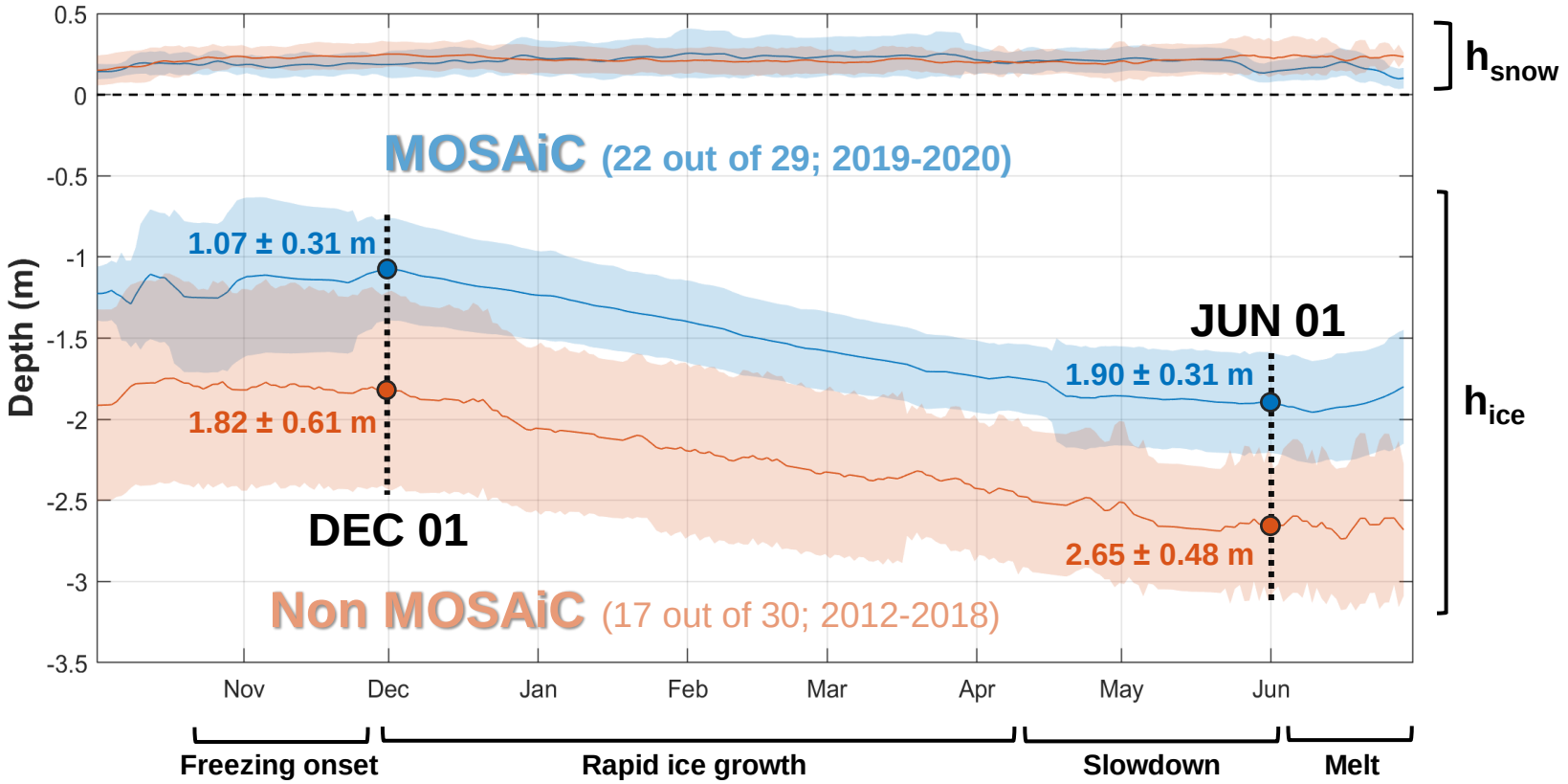
Growth & melt rates (OCT to JUN)

- **Snow**: overall high variability
- **Sea ice**: larger growth rates rather early in Nov/Dec





SIMBA | MOSAiC vs. historic buoys



Snow & ice thickness evolution (OCT to JUN)

- Snow similar; sea ice noticeably thinner & earlier melt during MOSAiC
- Avg. net ice growth between DEC & JUN not too different (~ 83 cm)

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Key points & outlook

How do SIMBA buoys from MOSAiC compare with earlier buoys deployed in the Transpolar Drift?

Little difference in terms of net **sea-ice growth** except **temporal shifts**

Ice thickness noticeably thinner & earlier bottom melt during MOSAiC

Snow: little differences overall

>> Processed interfaces / thickness data set (v1) planned for public release this spring <<
Analysis has only started! (Buoy backtracking & drift parameters, long term changes & large scale context, pot. extend approach to DTC network,…)