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

Recent achievements in sea ice thickness derived from radar altimetry

Robert Ricker[1], Stefan Hendricks[1], Stephan Paul[2], Lars Kaleschke[3], Xiangshan Tian-Kunze[4]

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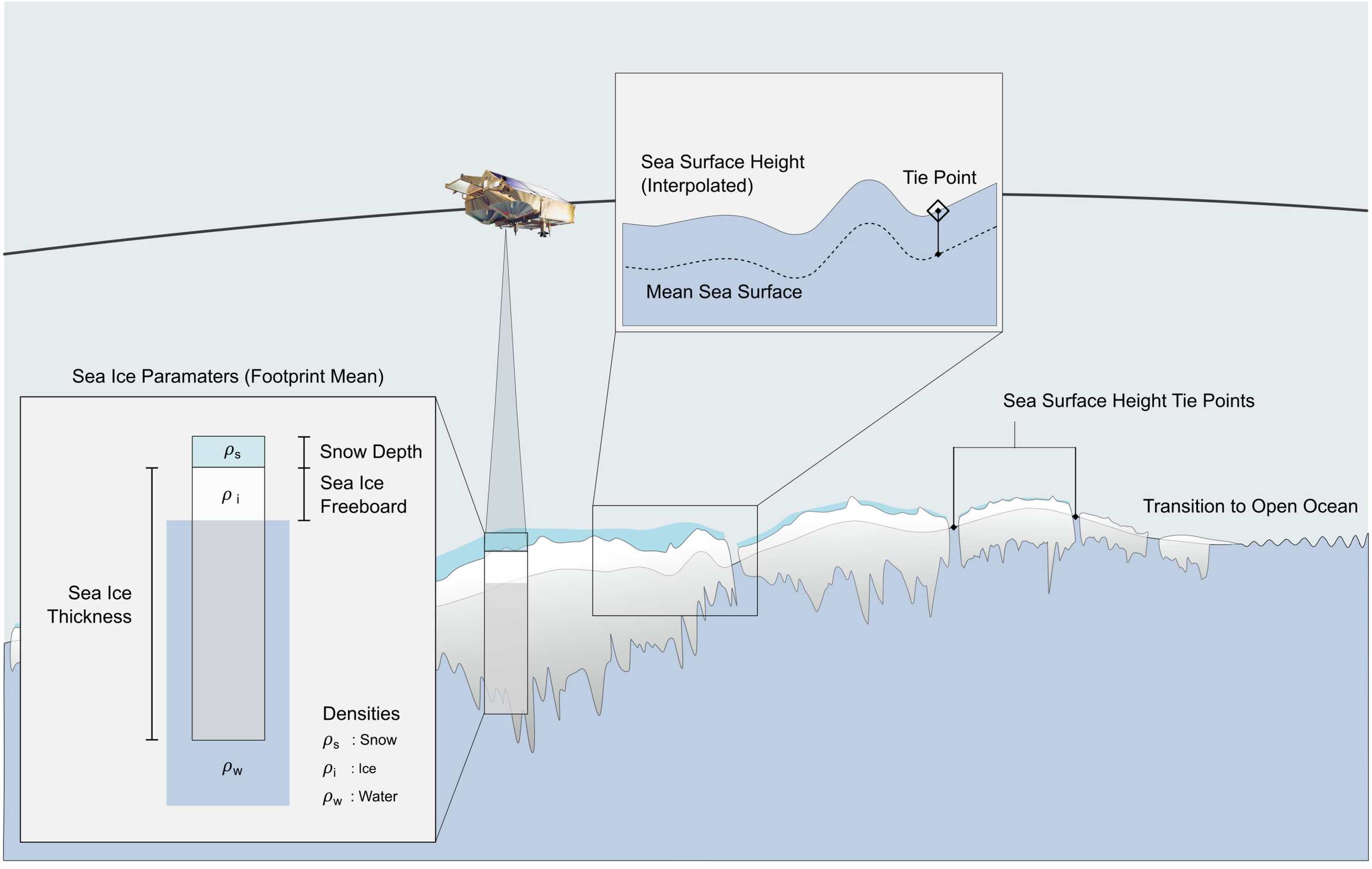
[3] Max-Planck-Institut für Meteorologie,Hamburg
[4] University of Hamburg

Radar altimetry over sea ice



Credit: Stefan Hendricks

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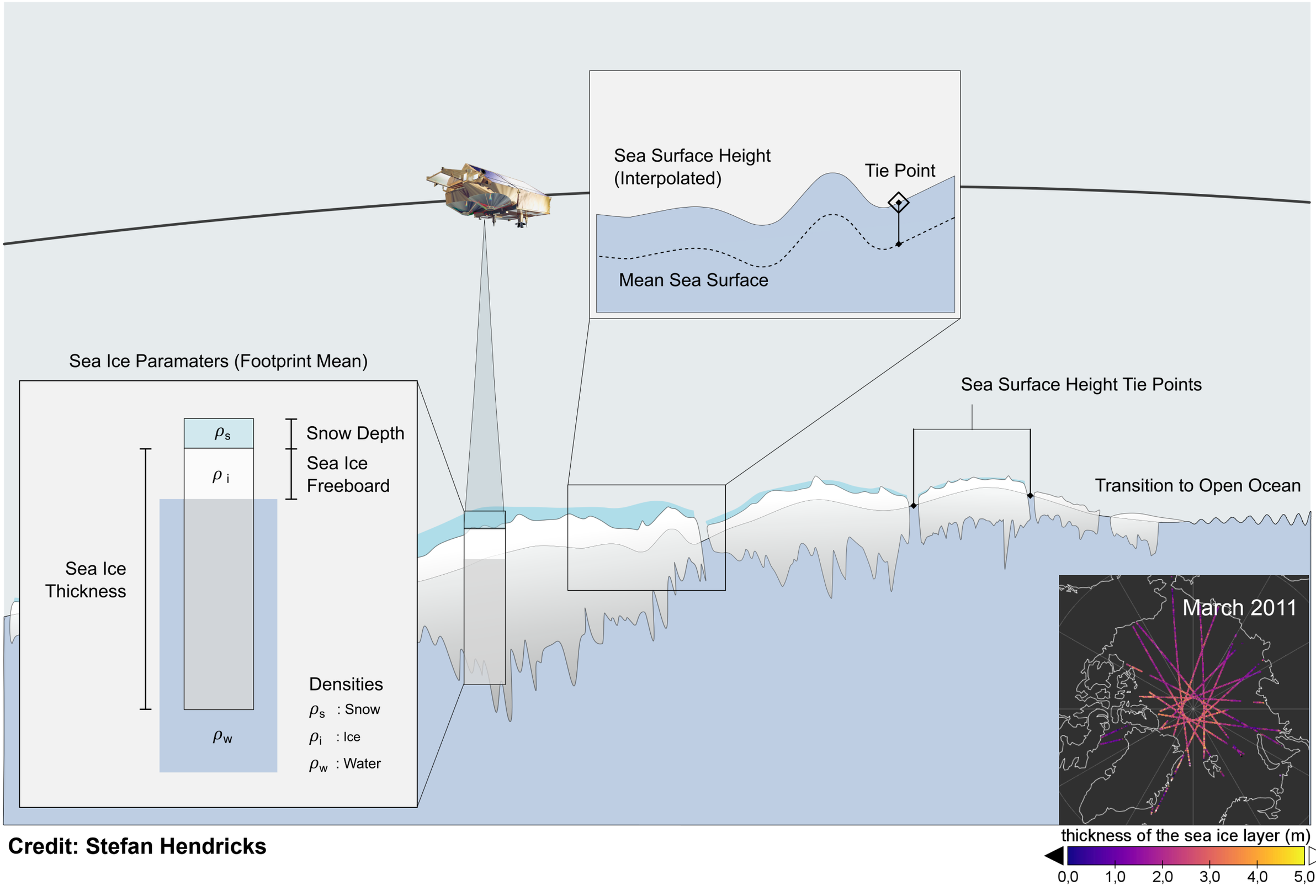

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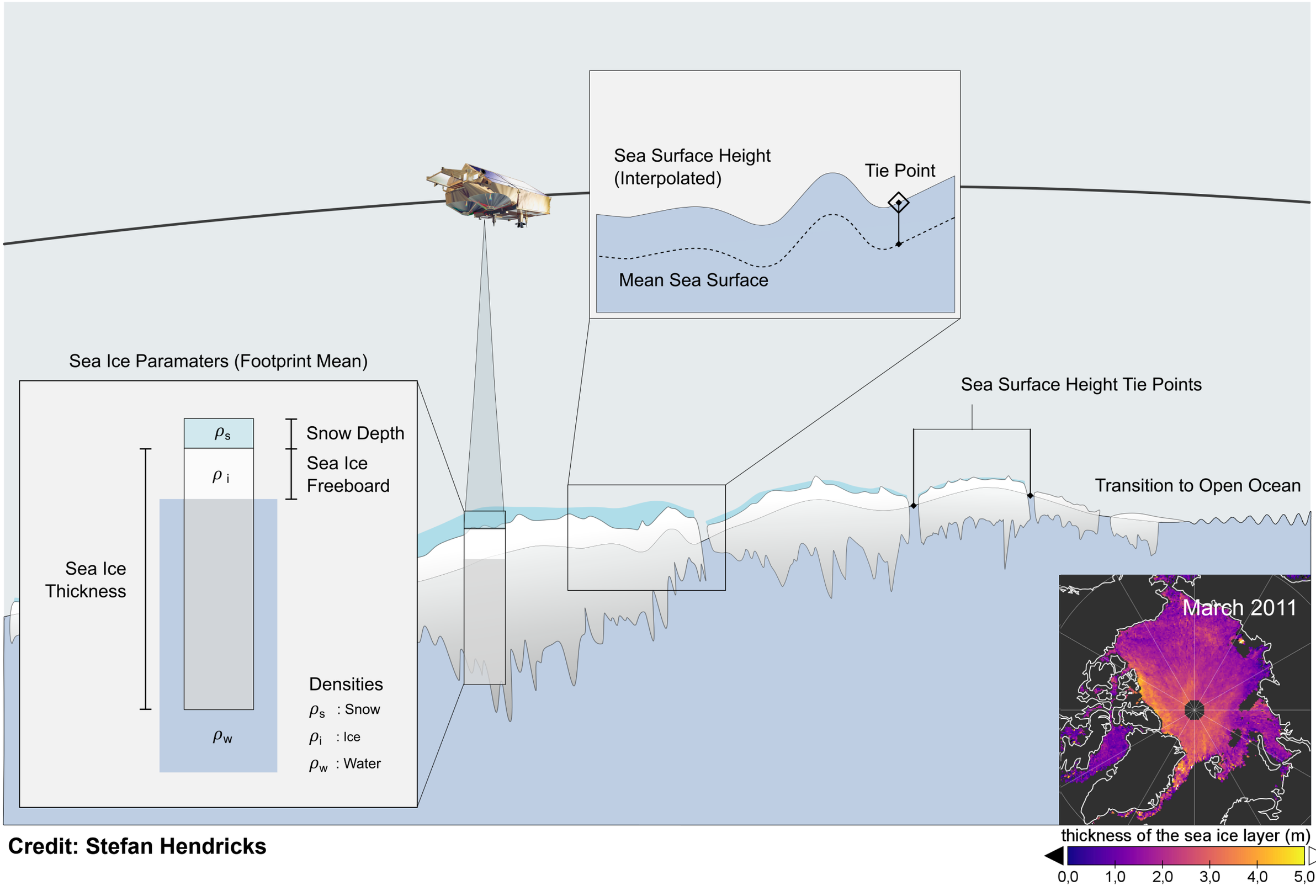
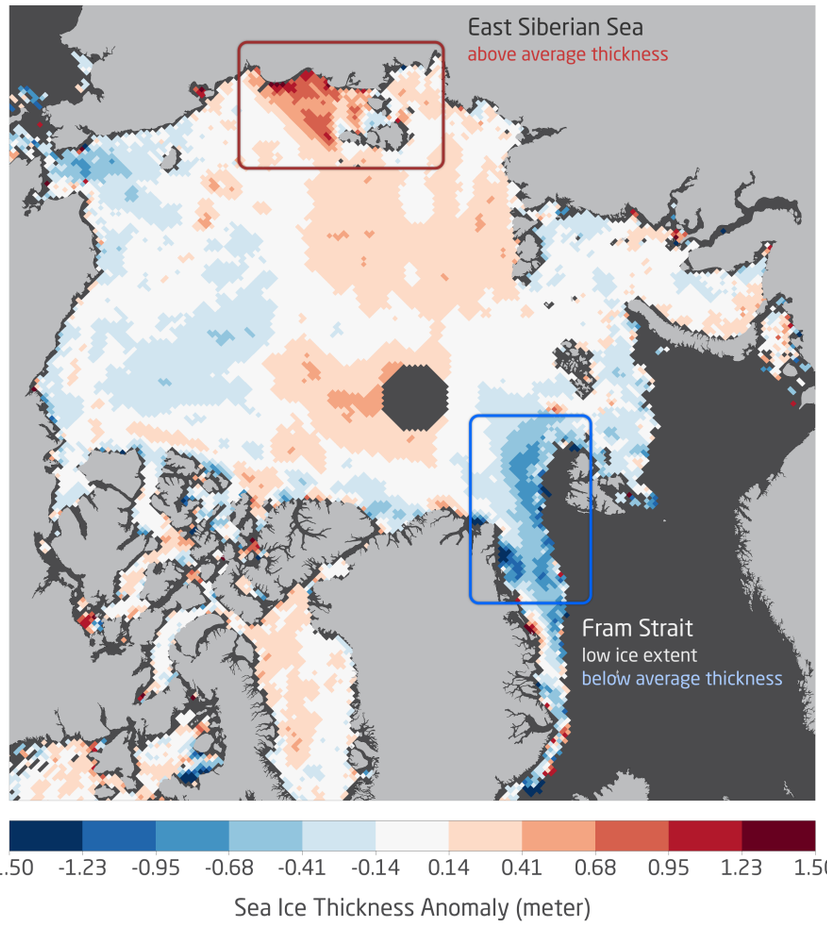


Credit: Stefan Hendricks

Last winter mean Arctic sea ice thickness

- Winter 2017/2018 thickness anomaly
- referenced to 2010-2017 winter mean ice thickness



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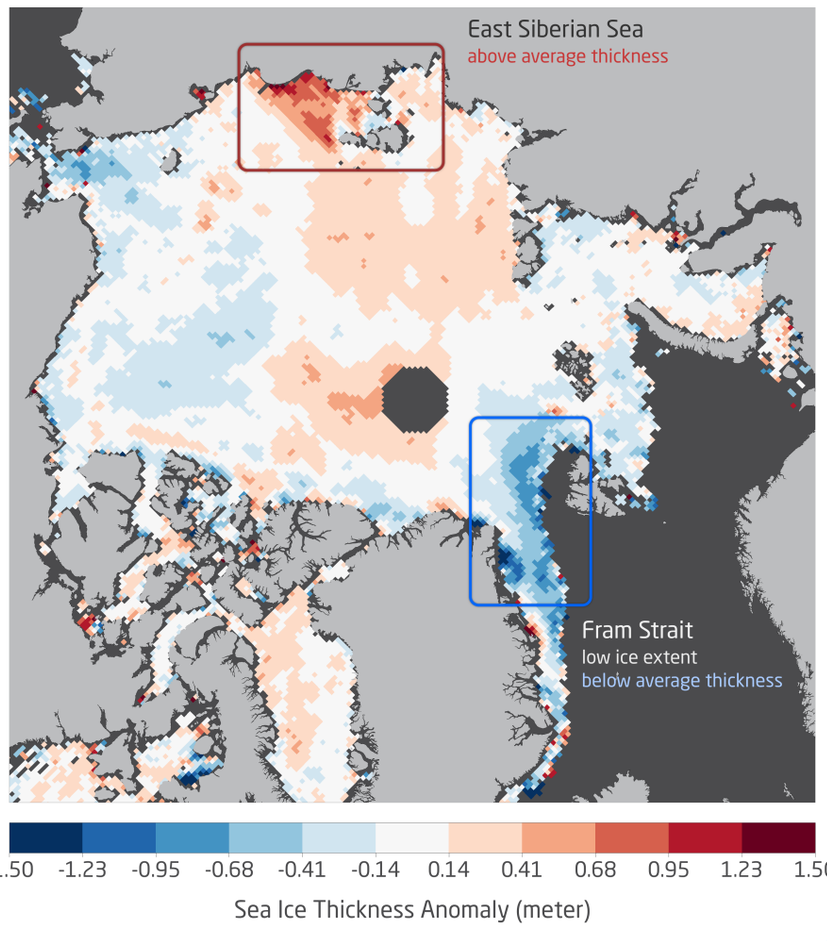
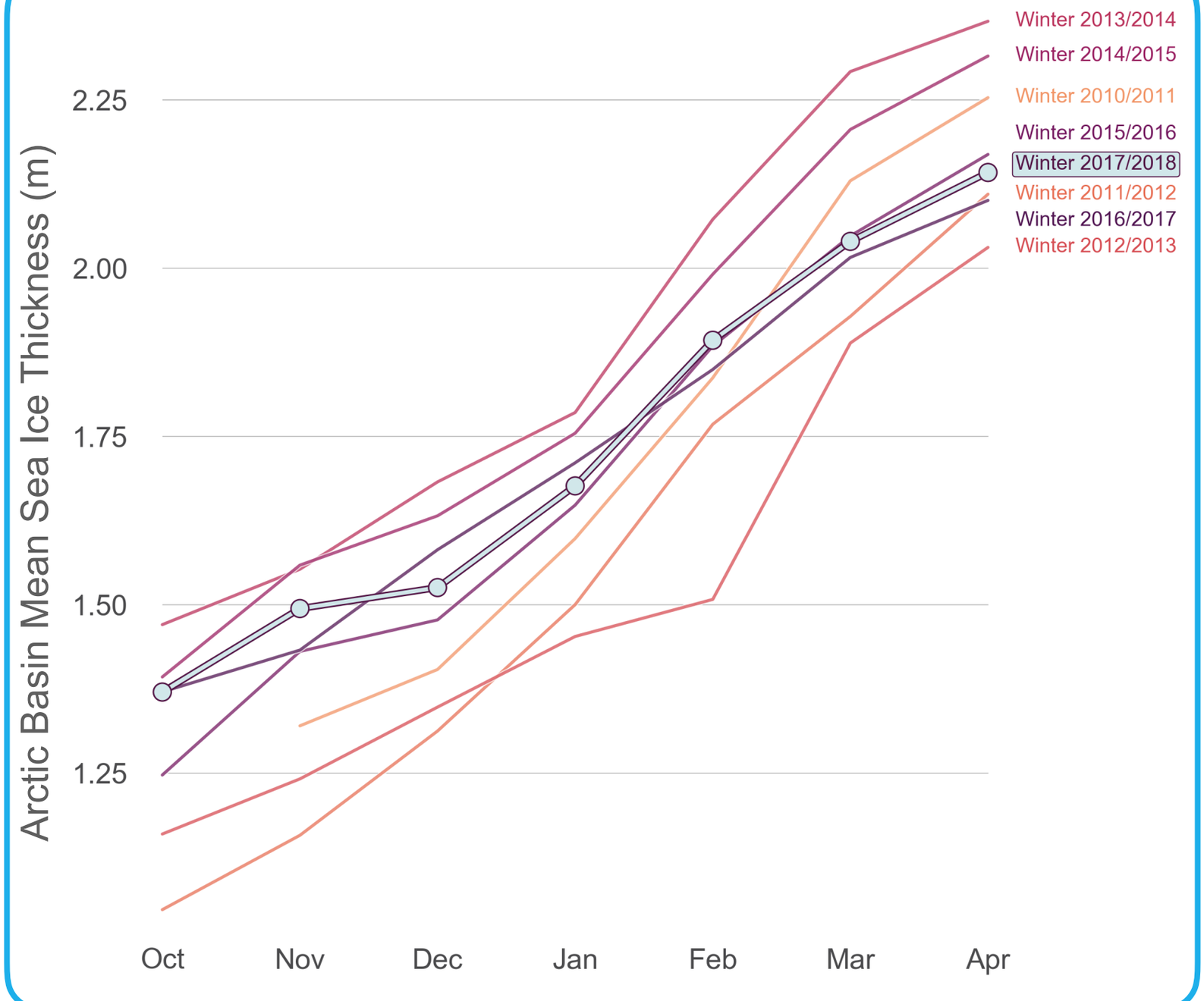
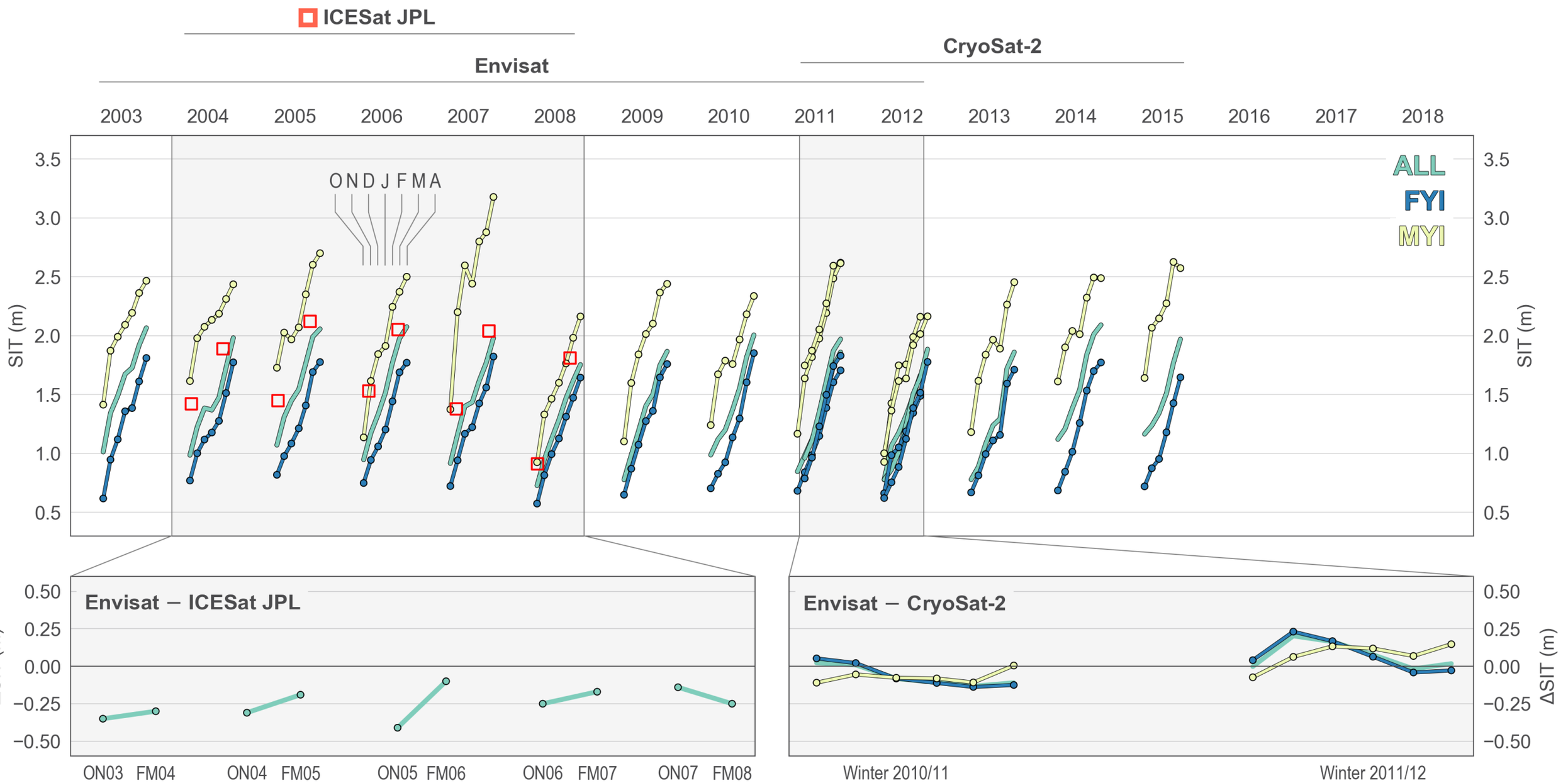




Credit: Stefan Hendricks

Consistent sea ice thickness time series

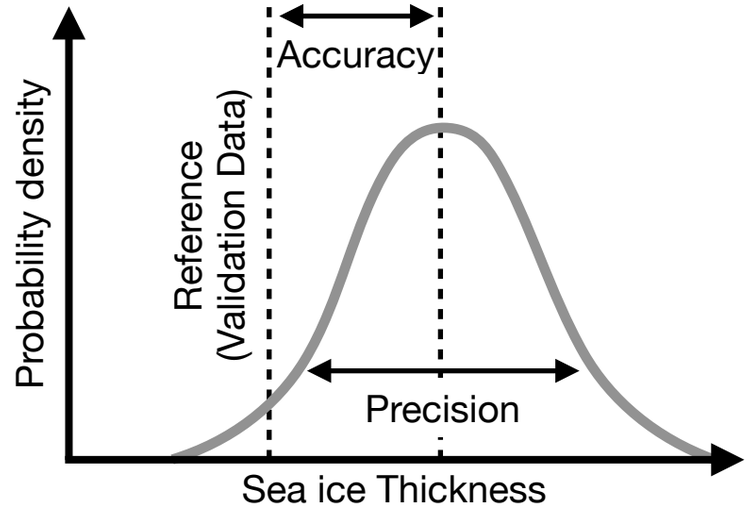
- Minimizing inter-mission biases between subsequent satellite missions, **Paul et al. (2018), TCD**
  - Consistent surface-type classification scheme
  - Adaptive retracker threshold that depends on waveform-characteristics



Hendricks et al., in preparation

Assessing sea ice thickness uncertainties

- The precision is accessed with an orbit crossover analysis
- All CryoSat-2 and Envisat crossovers within 24h
- The accuracy can be evaluated with Airborne EM and ULS sea ice thickness data sets



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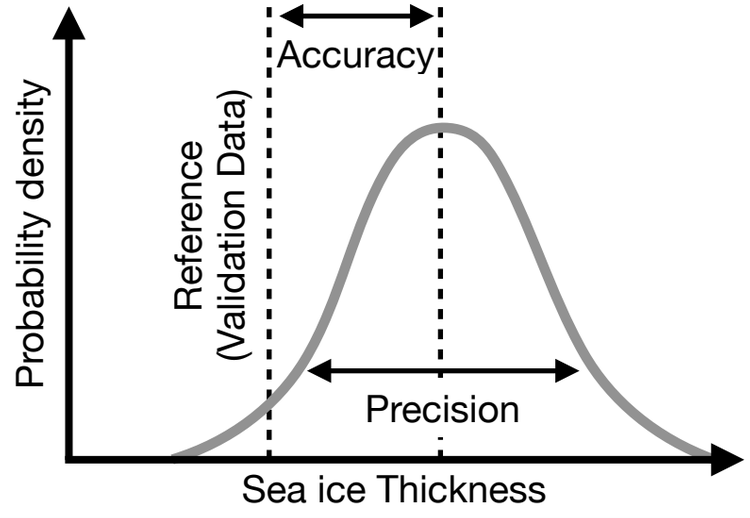

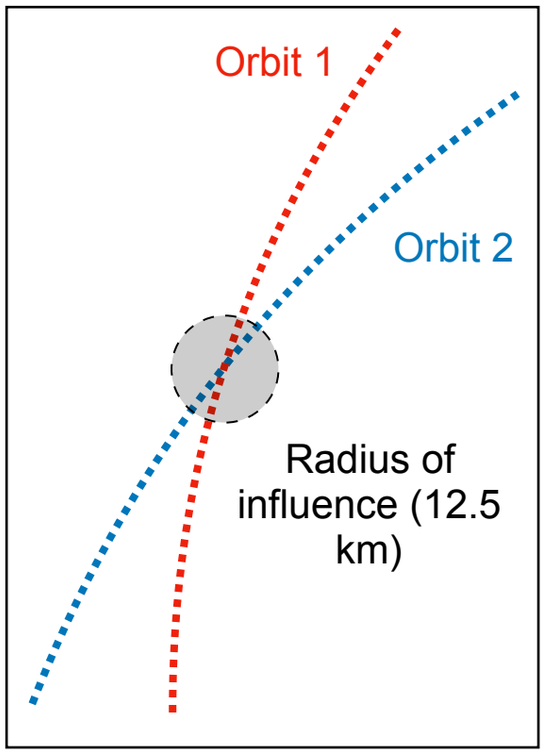

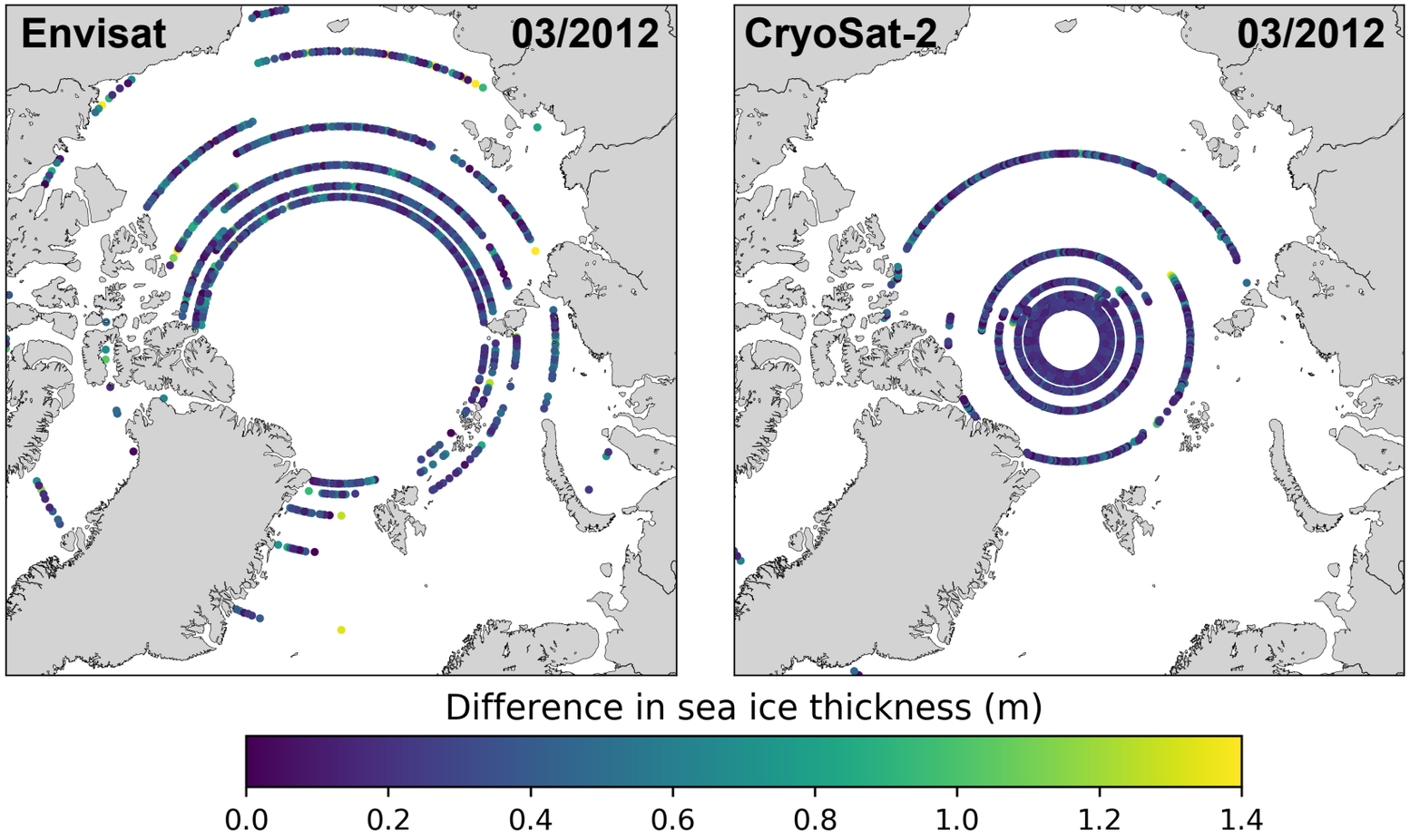

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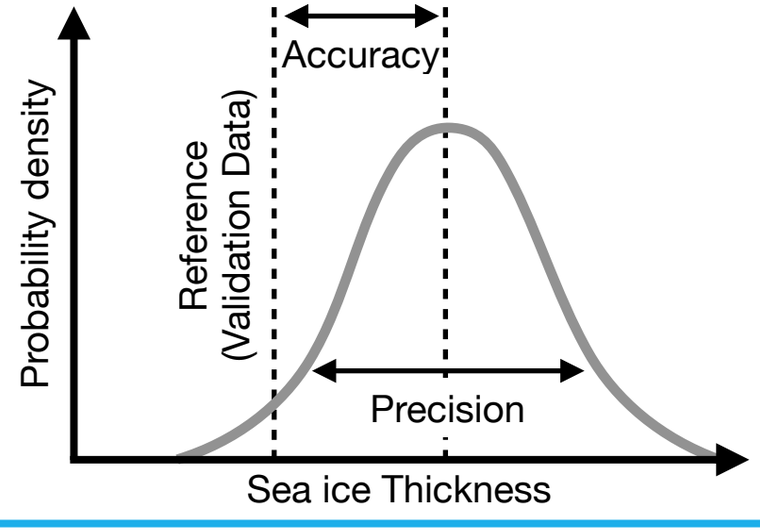
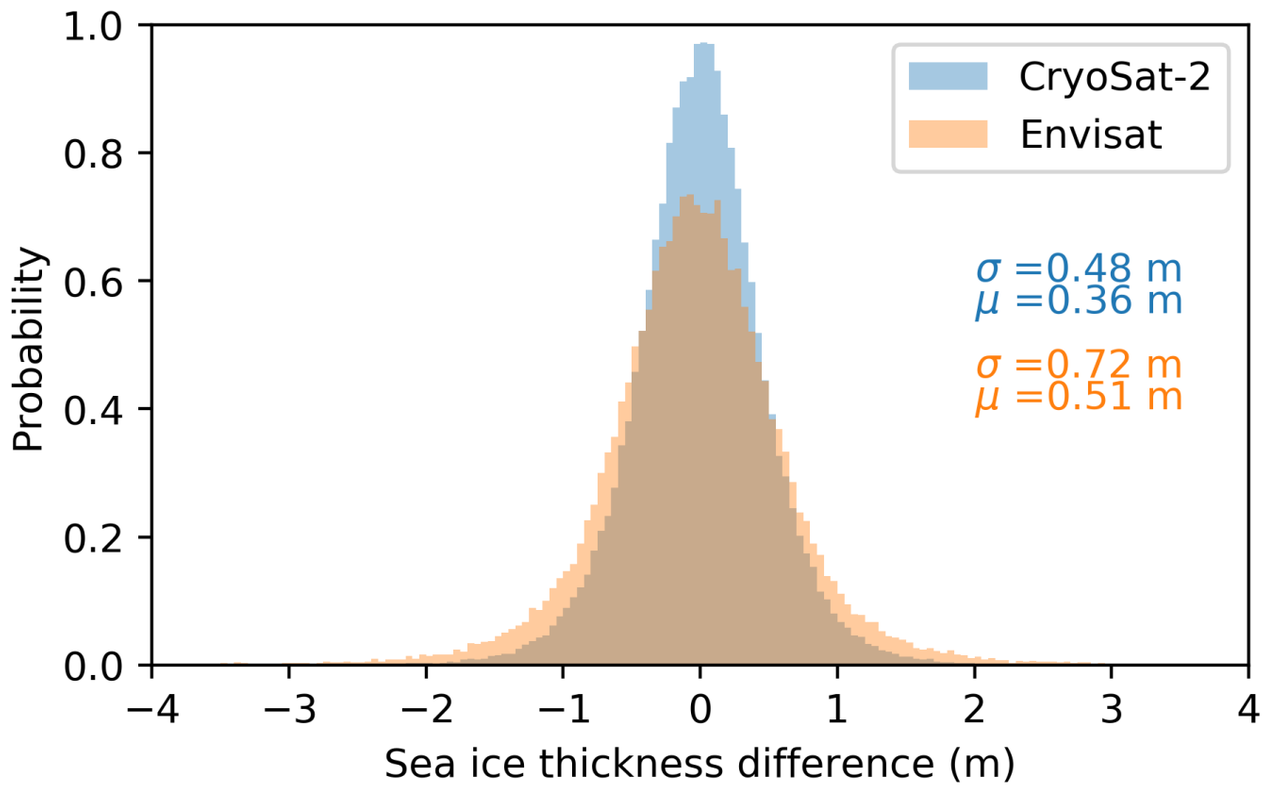
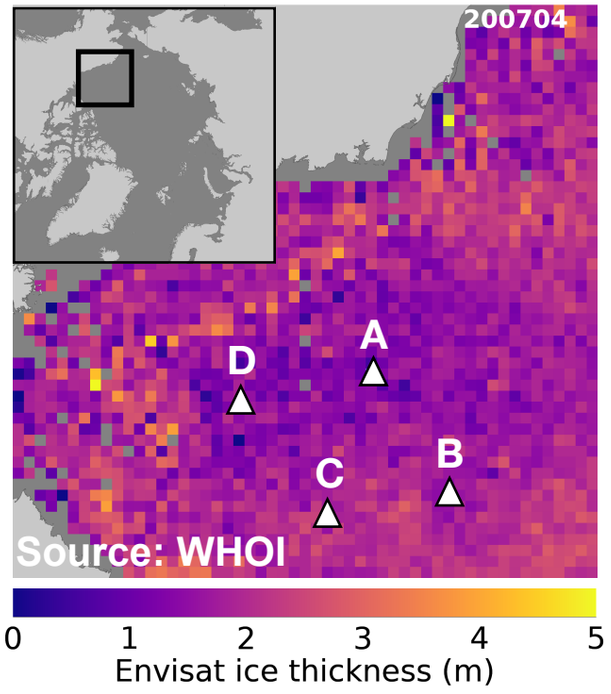


- Binned **crossover sea ice thickness differences** for Envisat and CryoSat-2 with mean absolute differences (μ) and standard deviation of differences (σ)
- CryoSat-2: 2010-2017
  Envisat: 2002-2012

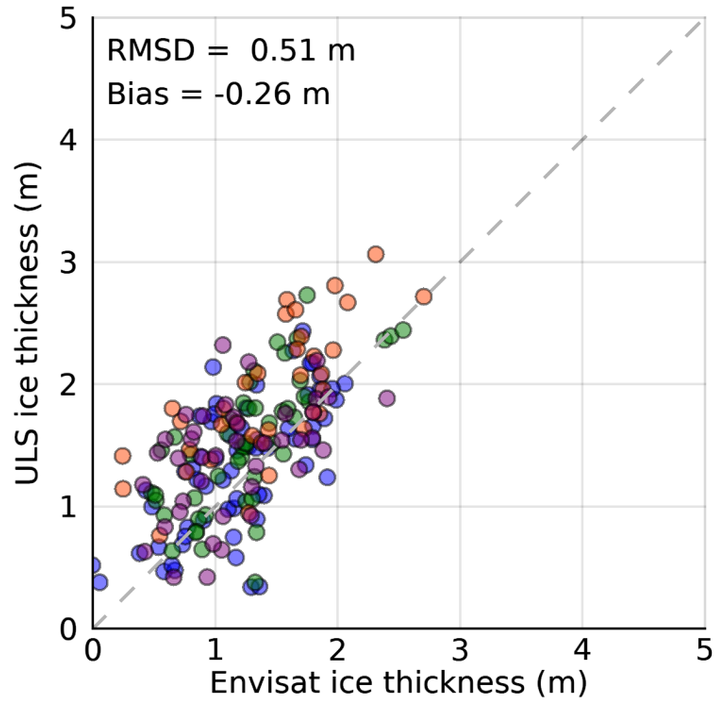


Sea ice thickness validation

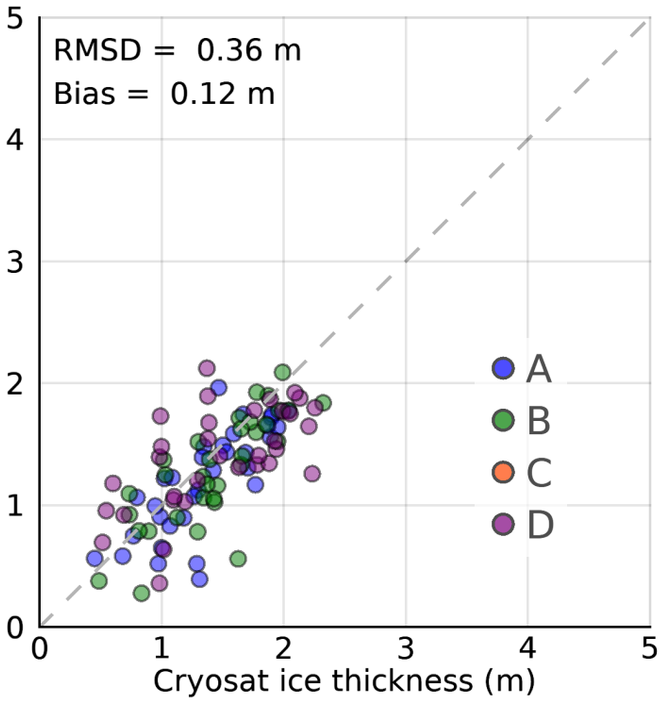
Upward Looking Sonar (BGEP-ULS)



Envisat (2002-2012)



CryoSat-2 (2010-2017)



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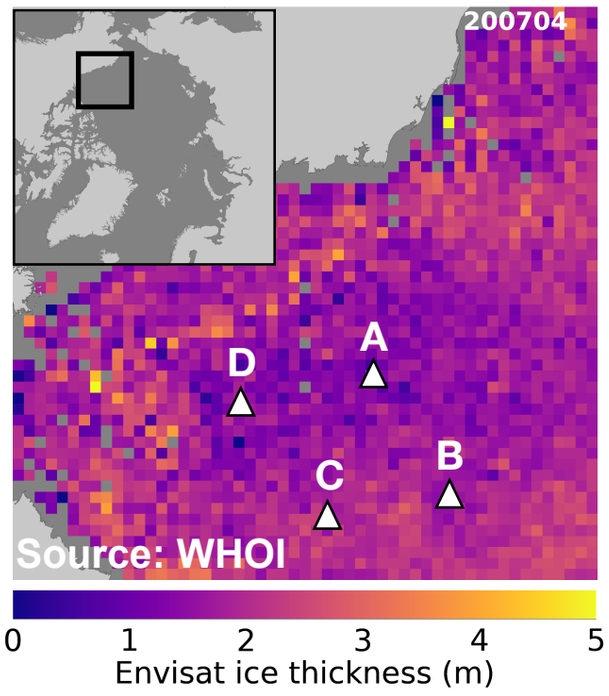

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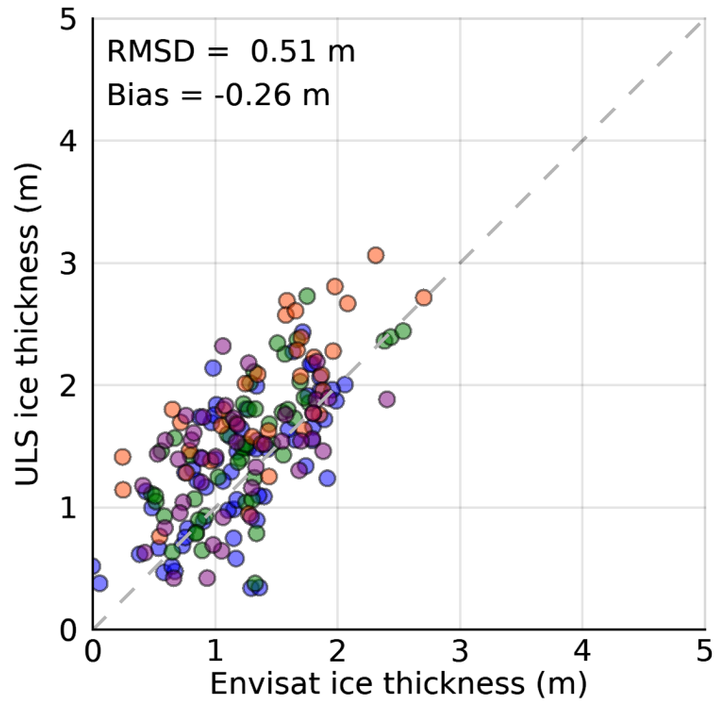

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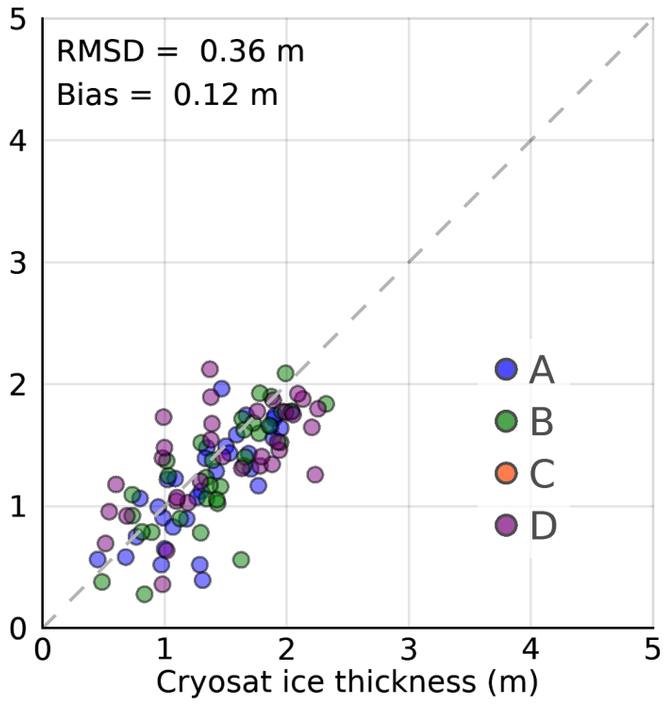
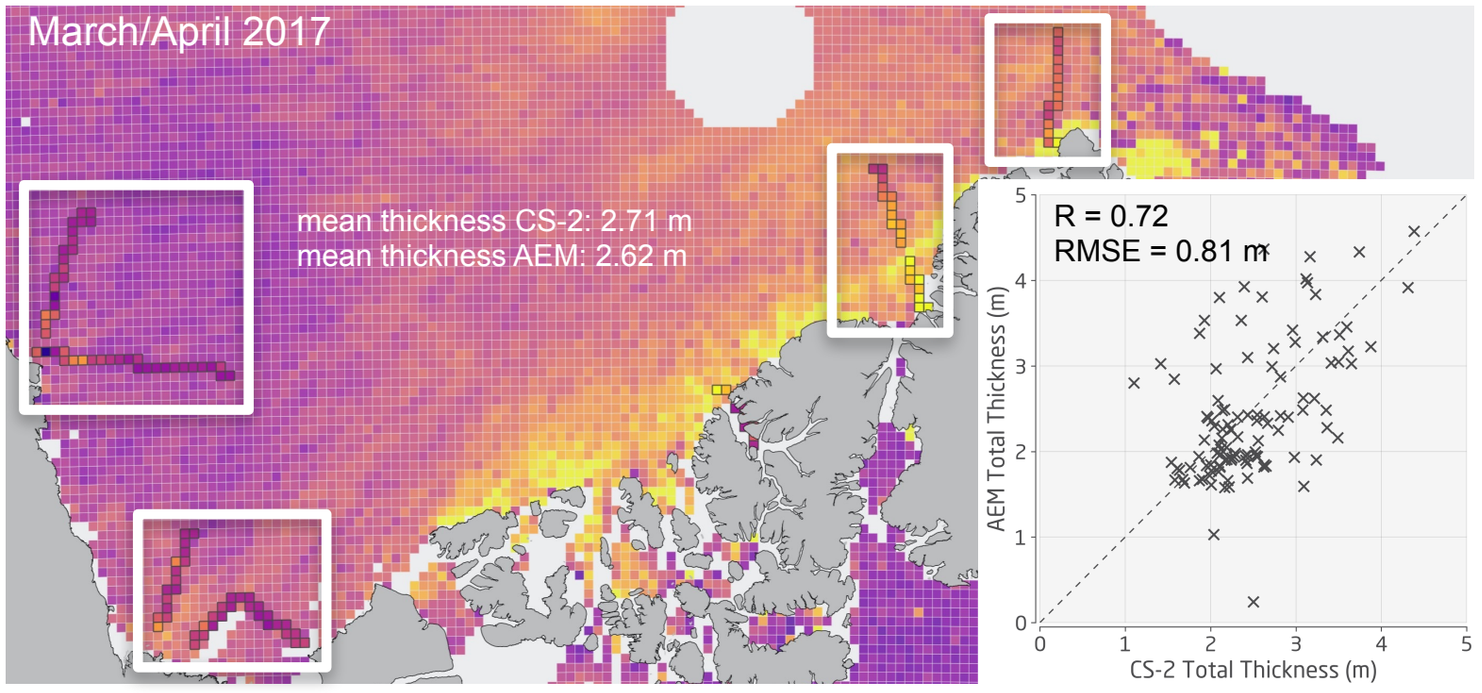


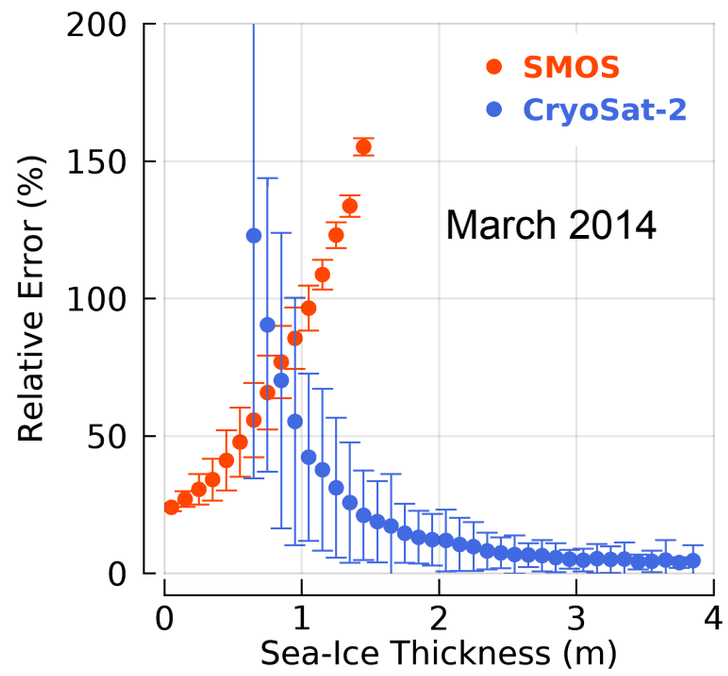
Airborne EM (AEM)

Polar 5 with EM-Bird



Reducing uncertainties over thin ice

- Taking advantage of the complementary thickness retrievals derived from the CS2 altimeter and the SMOS radiometer
- An optimal interpolation scheme is used to produce weekly Arctic-wide sea-ice thickness fields



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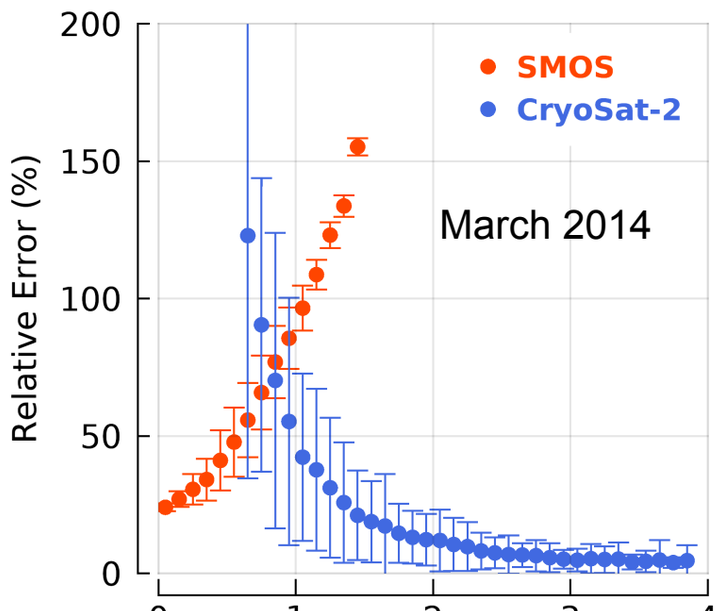

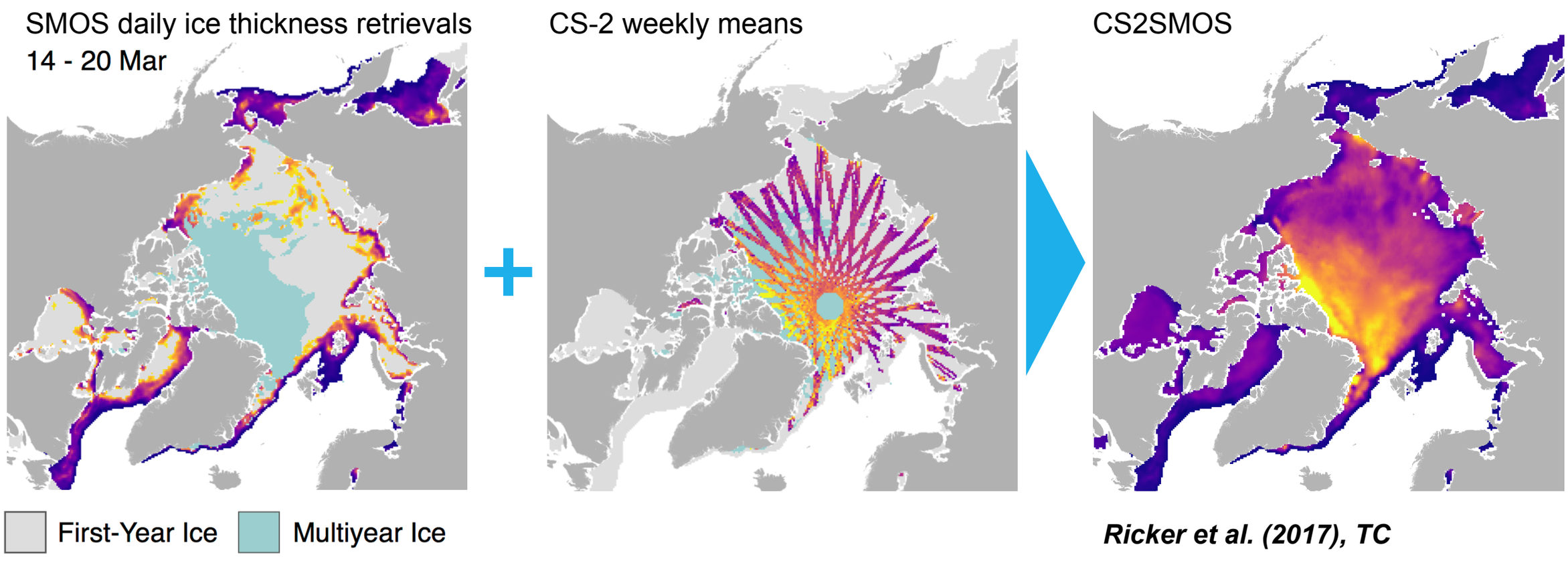

Ricker et al. (2017), TC

Applications and future plans

Application of satellite sea ice thickness records

- Application in model assimilation, model evaluation, and reanalysis data records, e.g. **Mu et al. (2018), Q.J.R. Meteorol. Soc., Kaminski et al. (2018), TCD**
- Estimates of Arctic sea ice volume export, , e.g. **Ricker et al. (2018), TCD**, Friday 10:00 (Atmosphere-Ice-Ocean interactions in the Polar Regions)
- AWI CryoSat-2 data products and CryoSat-2/SMOS products are available on: **http://data.seaiceportal.de**
- AWI CryoSat-2/Envisat timeseries: **CCI Climate Data Store, CCI Open Data Portal**

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Future Plans

- providing sea ice thickness products by a service that meets the requirements for climate applications and operational systems
- 25 years time series of sea ice thickness data records from radar altimetry