

**Christian Katlein, Stefanie Arndt,
H. Jakob Belter, Giulia Castellani, Marcel Nicolaus**



Seasonal evolution of light transmission through sea ice

Spatial variability



Why light transmission?

- Energy fluxes:
 - Sea ice → mass balance
 - Ocean → warming
- Light availability:
 - ecosystem



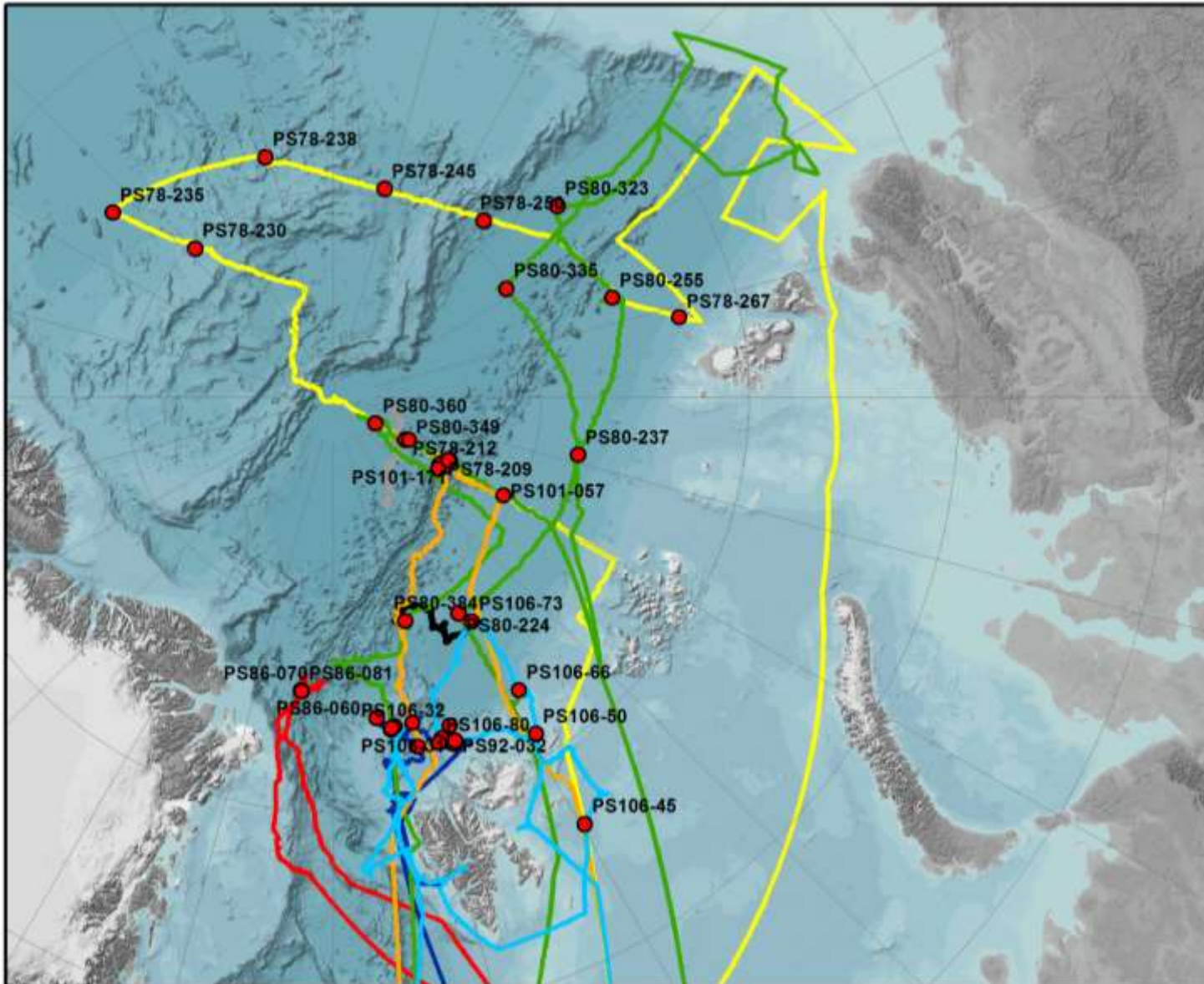
Typical sea ice sampling vs. ROV



Deployment



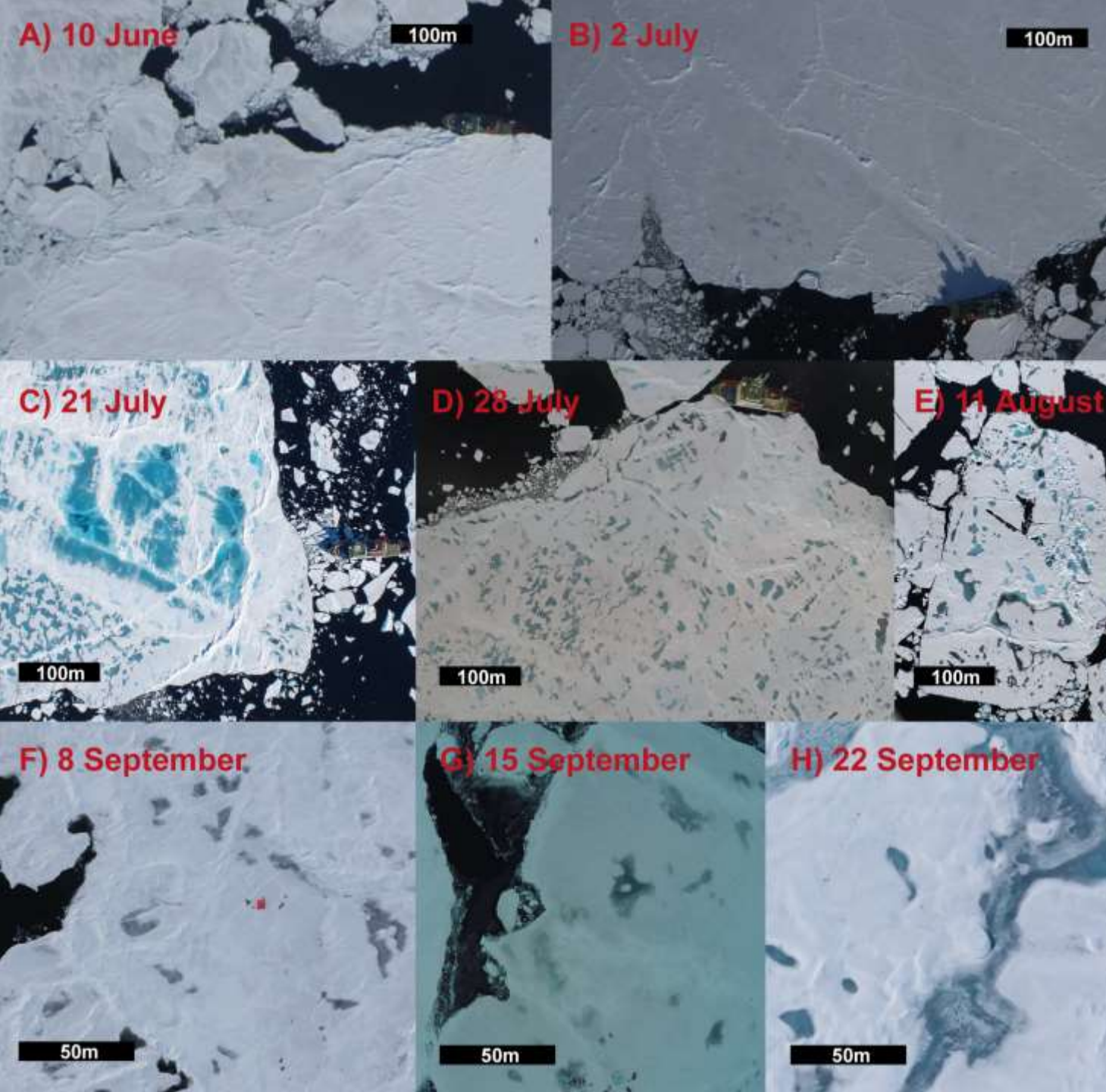
Data from six cruises



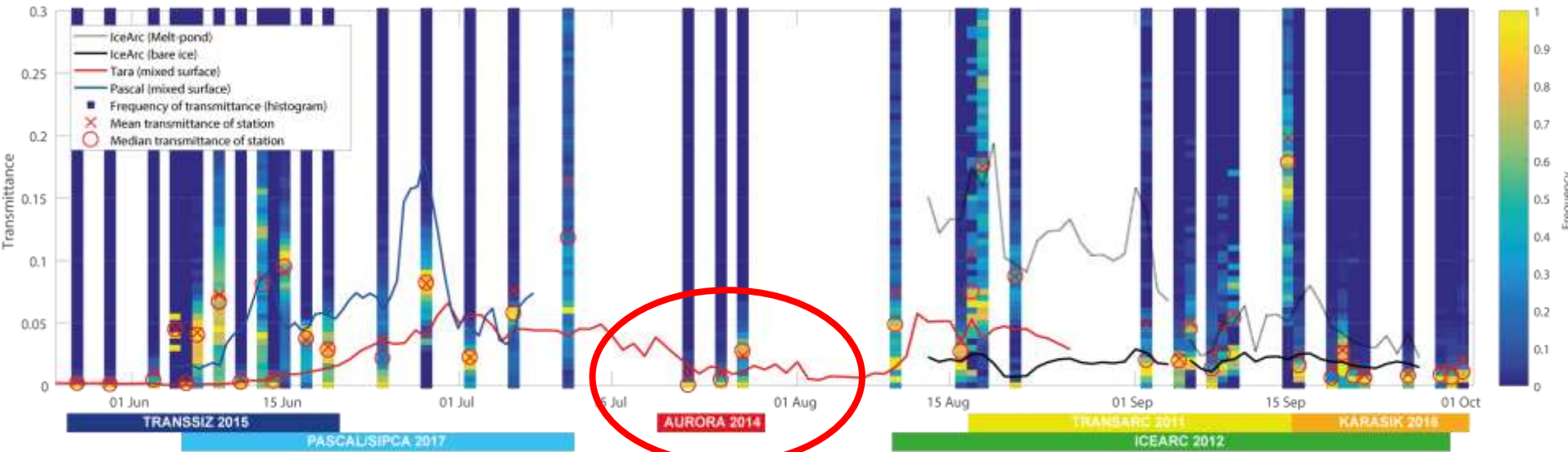
- 2011
- 2012
- 2014
- 2015
- 2016
- 2017

45 stations

Surface evolution

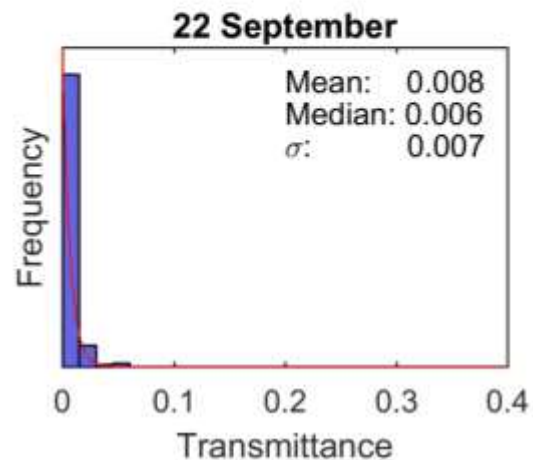
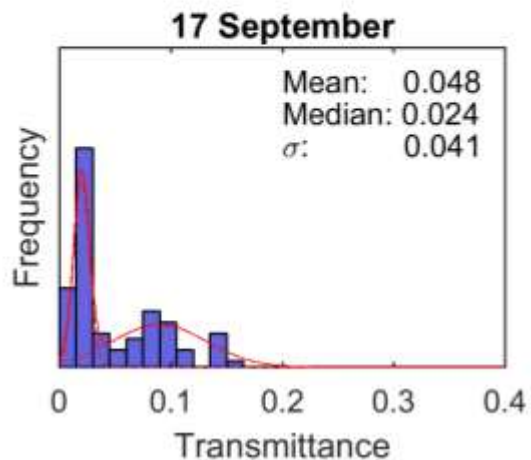
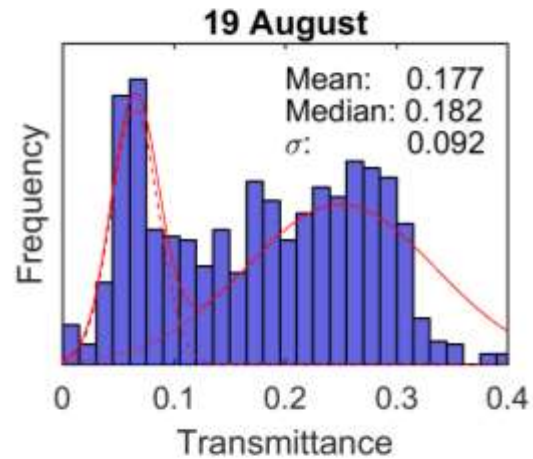
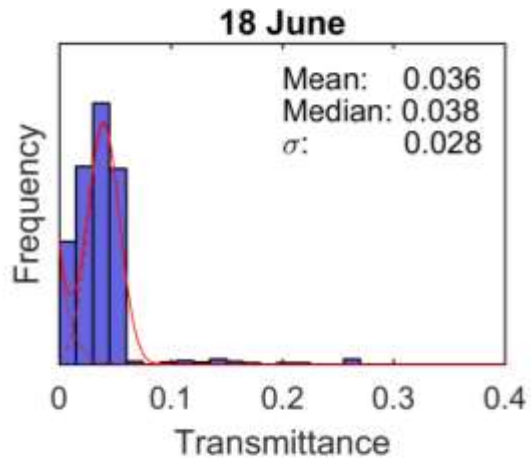
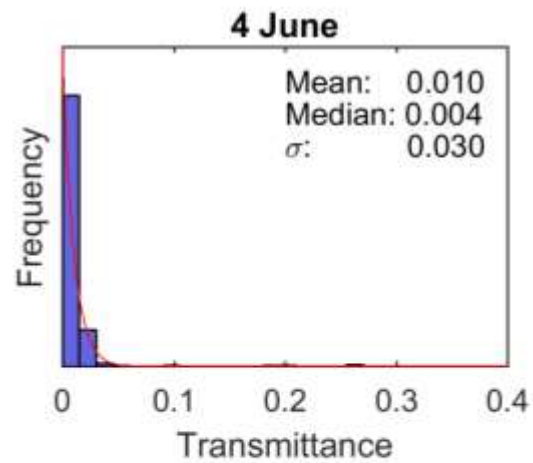
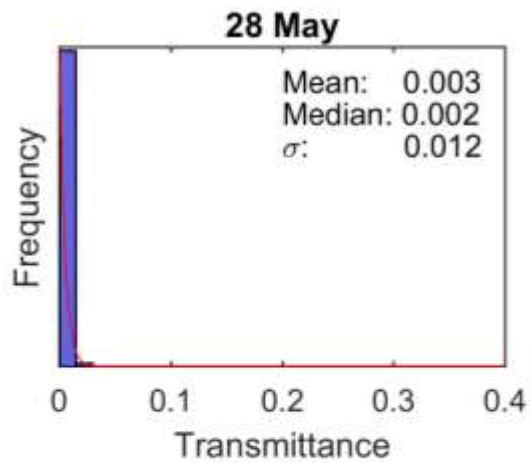


Compiled Data

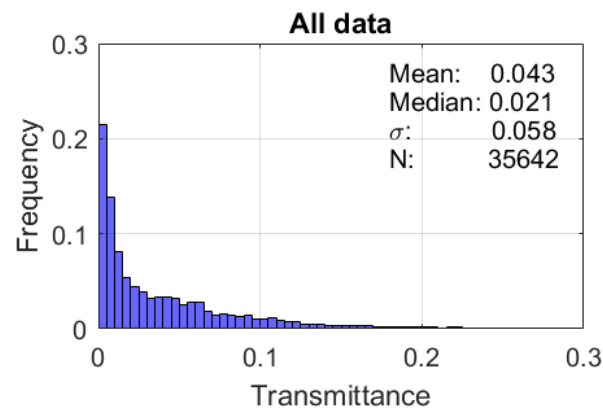
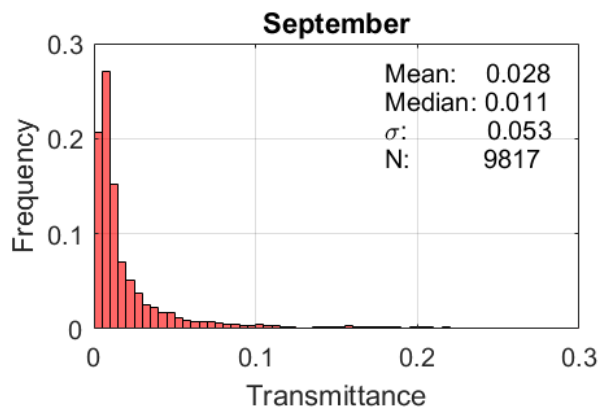
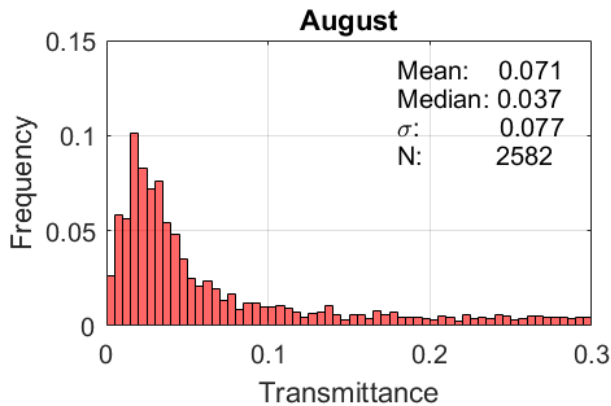
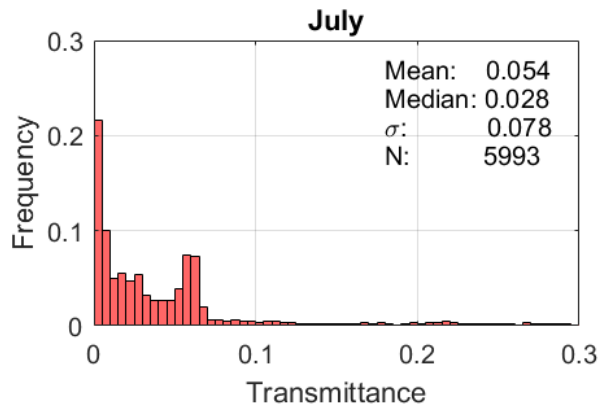
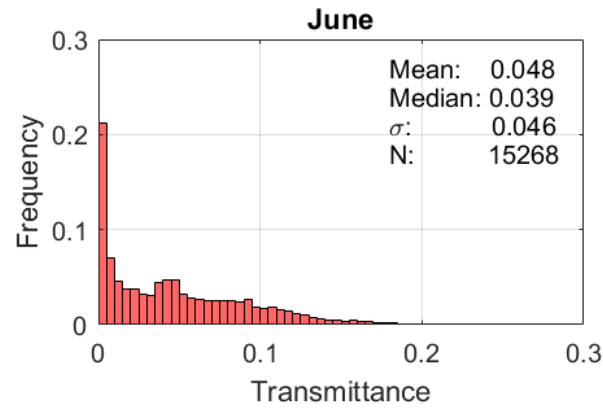
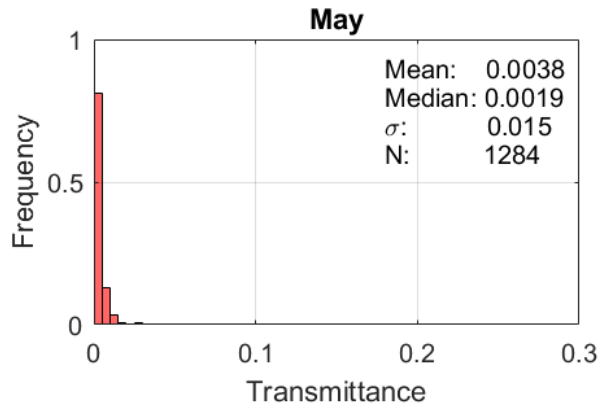


algal absorption?

- Pseudo timeseries from ROV observations
- Comparison to drifting stations



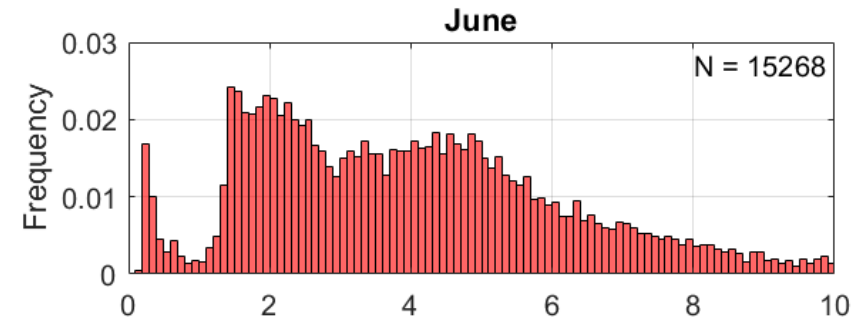
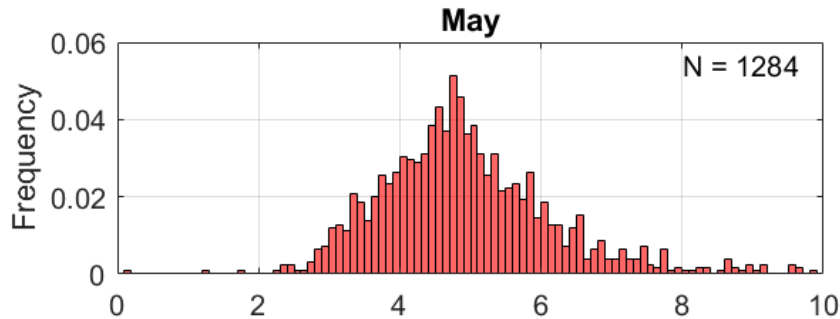
Monthly histograms



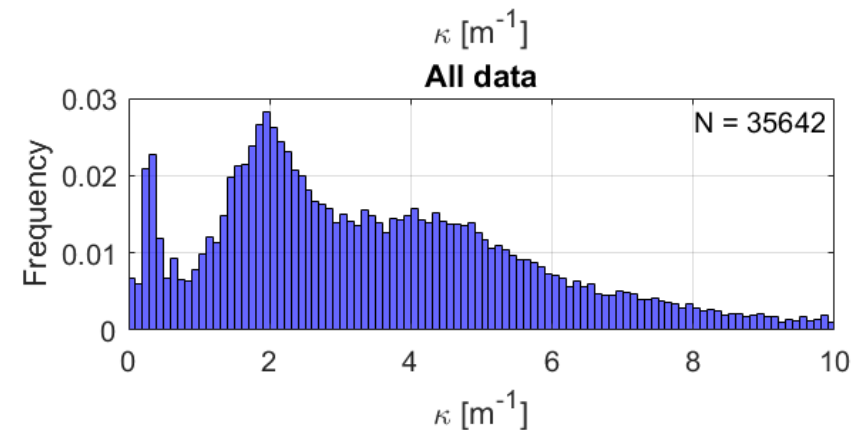
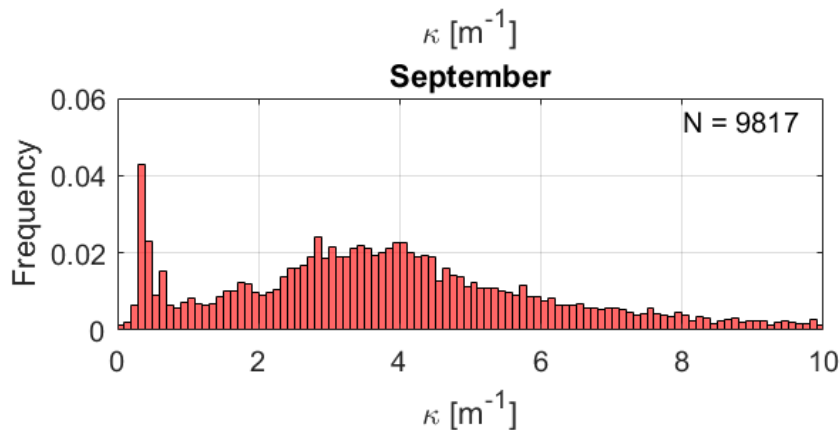
Bulk extinction coefficients



$$\text{GM77 } T=i_0 \exp(-\kappa \cdot z_{\text{ice}})$$

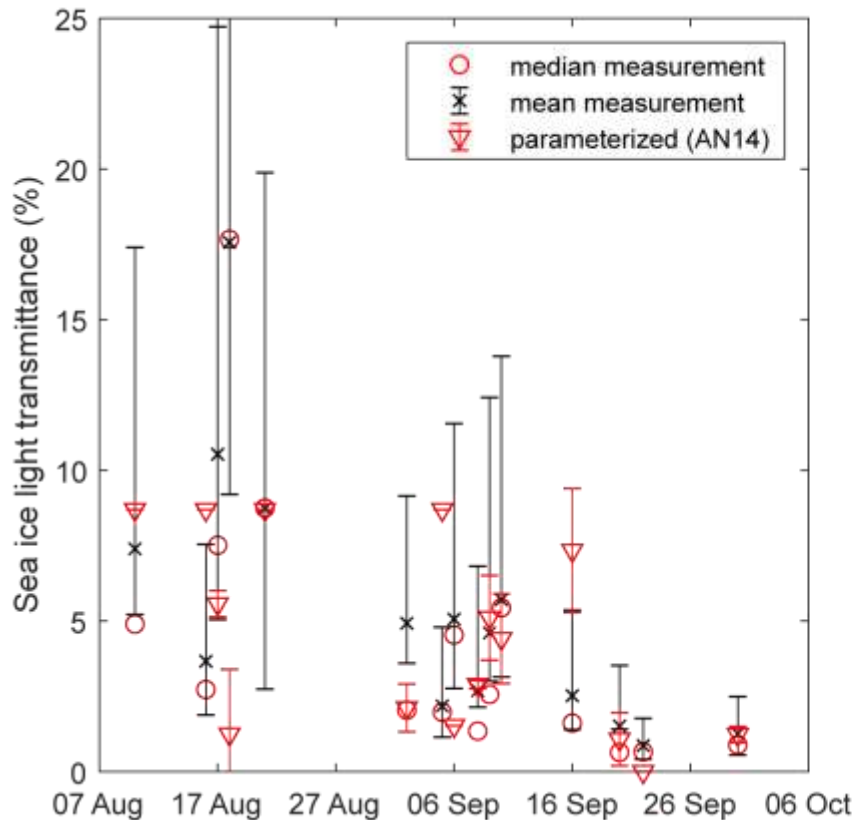


- Bulk extinction coefficients are higher than literature values during most of the year
- Biggest variability in shoulder seasons

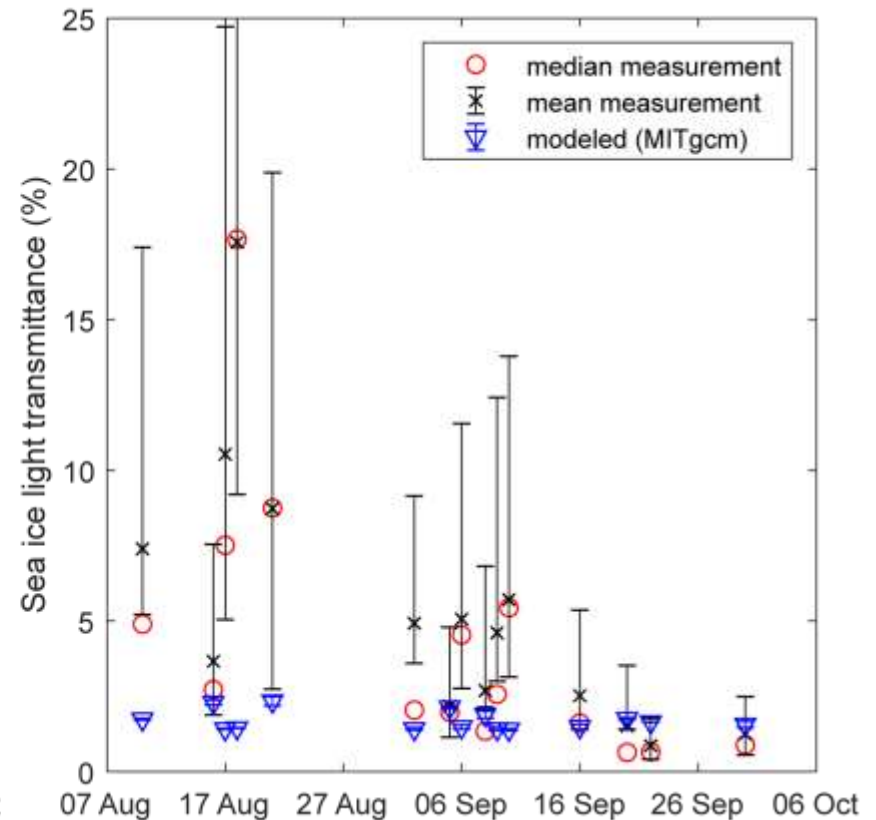


Comparing parameterizations

Arndt et al. 2014 (reanalysis)



Castellani 2017 (MITgcm)



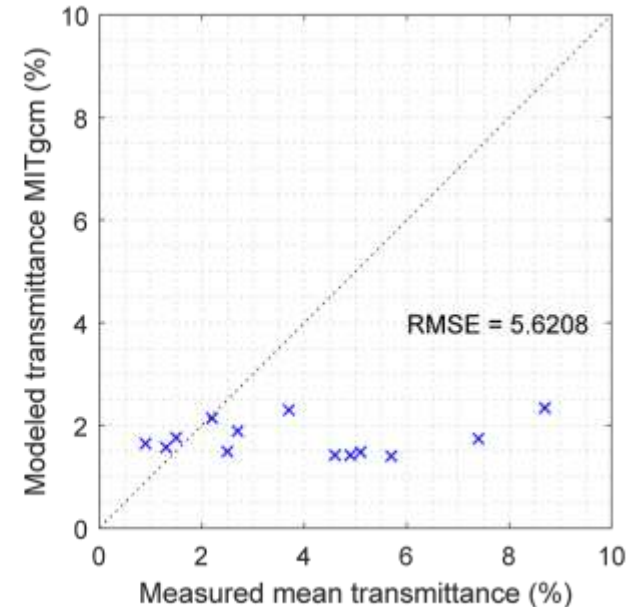
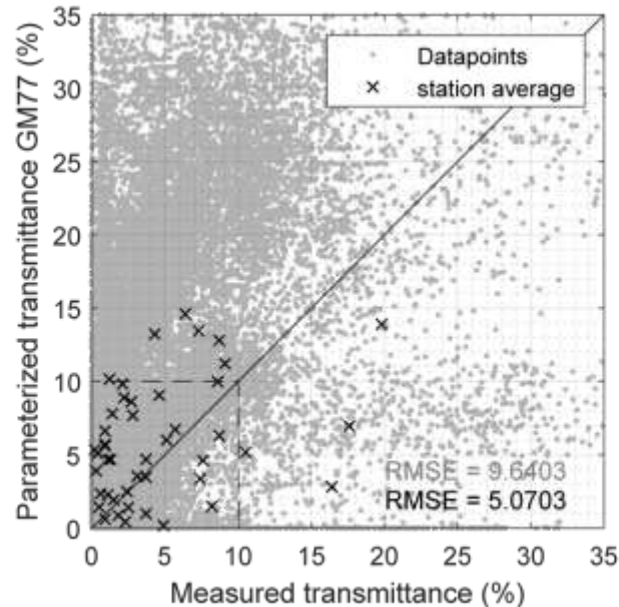
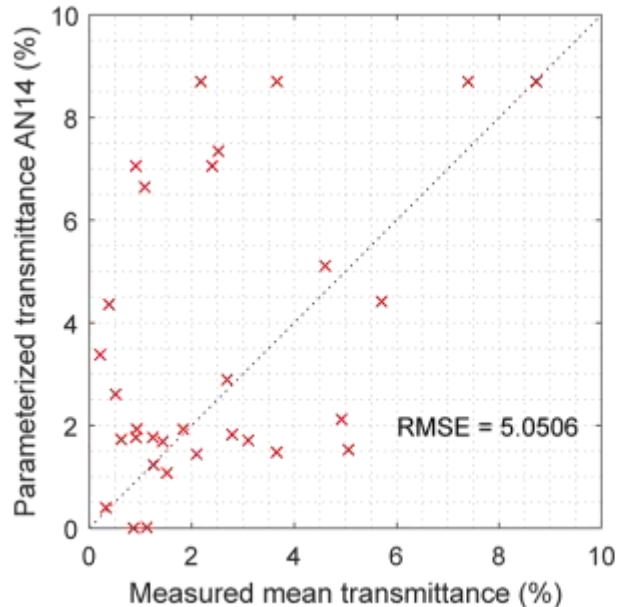
Comparing parameterizations



Arndt et al. 2014 (reanalysis)

Grenfell & Maykut 1977

Castellani 2017 (MITgcm)



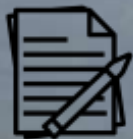
- AN2014 & GM77 parameterizations overestimate transmittance
- GM77 even though it does not include Melt-Ponds
- MITgcm does not capture regional/seasonal variability
- Parameterizations lack description of ice/snow surface layer

Outlook: MOSAiC



Summary

- Timeseries of light transmittance variability
- Impact of ponds even during freeze-up
- Model parameterizations overestimate under-ice light
- Algal growth has significant impact on light-field



Katlein, C., Arndt, S., Belter, H. J., Castellani, G., & Nicolaus, M. (2019).
Seasonal evolution of light transmission distributions through Arctic sea ice.
Journal of Geophysical Research: Oceans <https://doi.org/10.1029/2018JC014833>

Thank you for your attention!