

# Christian Katlein

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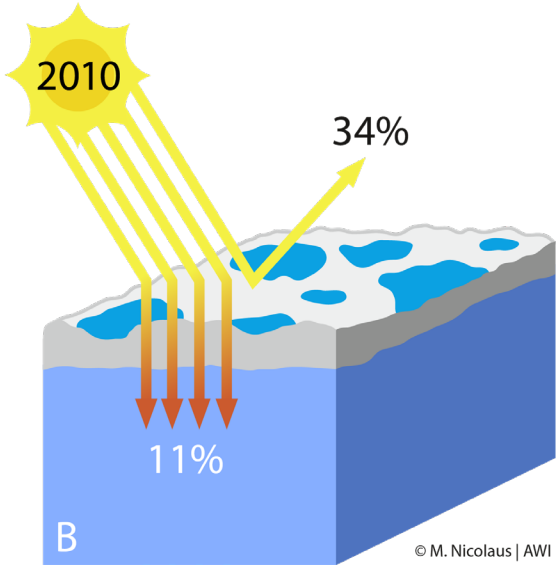
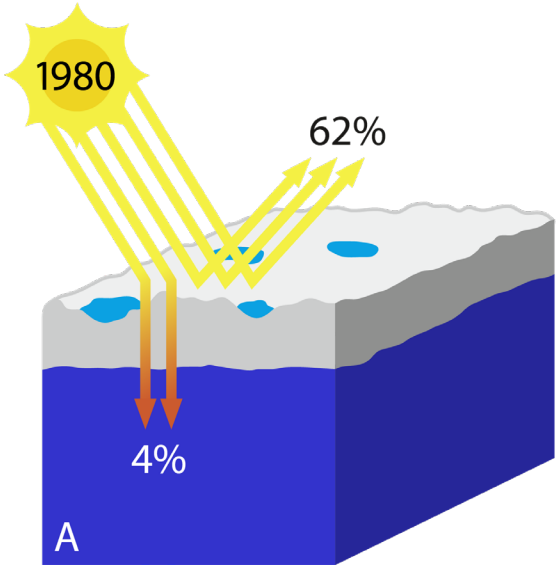
Marcel Nicolaus

Mario Hoppmann

**A new tool for  
Radiative transfer  
within sea ice**



# Monitoring light in the sea ice system



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# Advances in IOP understanding: a missing link



novel observation technologies:  
In-ice measurements



physical properties  
(ice thickness, type,...)

Structural  
optical  
model

inherent optical  
properties  
(absorption/scattering)

Radiative  
transfer  
model

apparent optical  
properties  
(albedo/transmittance)

climate model  
parameterizations

# Light chain



Katlein, C., et al. (2020) New insights into radiative transfer in sea ice derived from autonomous ice internal measurements, in press in *The Cryosphere*

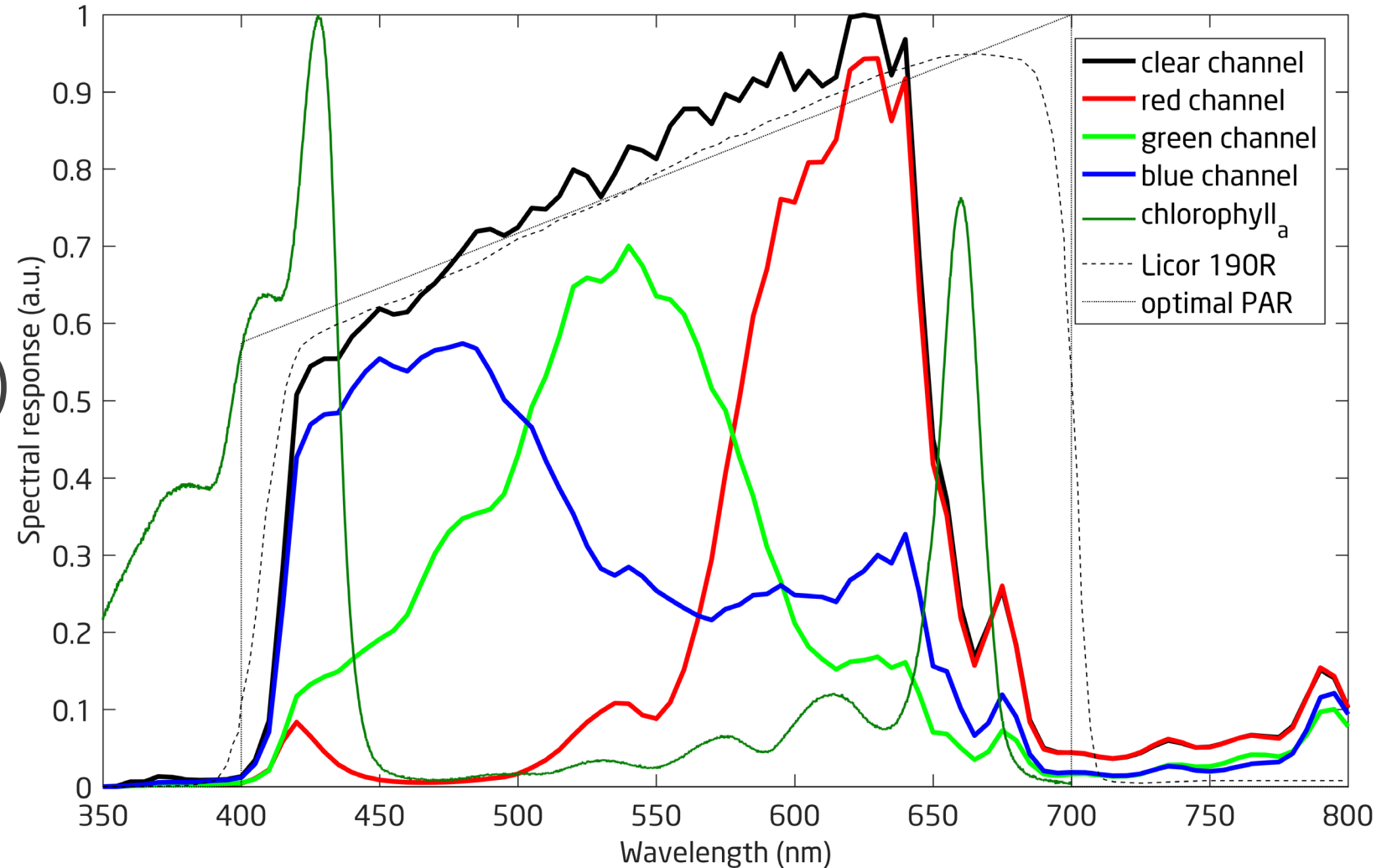
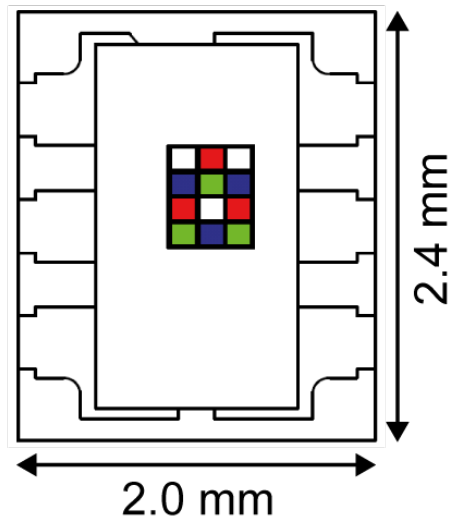


- First prototype 2018
- 3.5m long
- 64 sensors → each 5cm
- RGB light sensors
- Development ~10k€
- Cost (chain only) ~2k€
- Iridium SBD data transmission

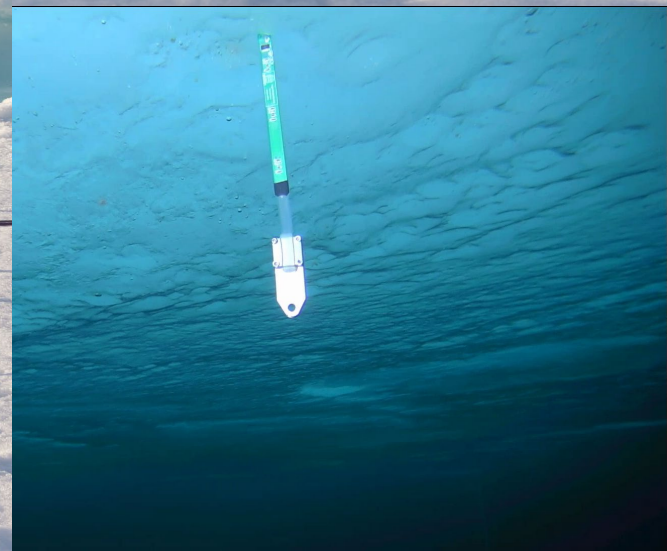
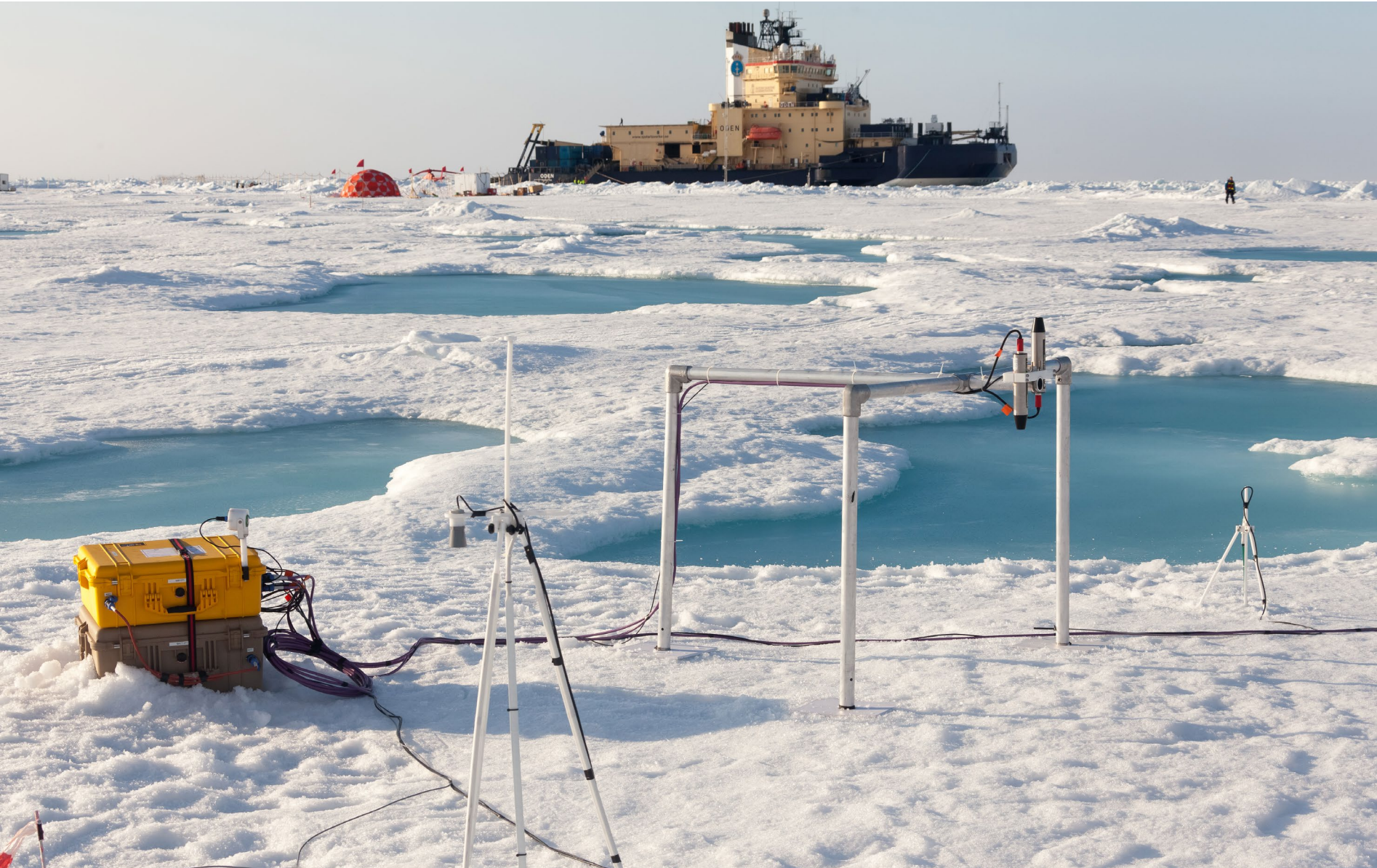


# The Sensor: TCS3472

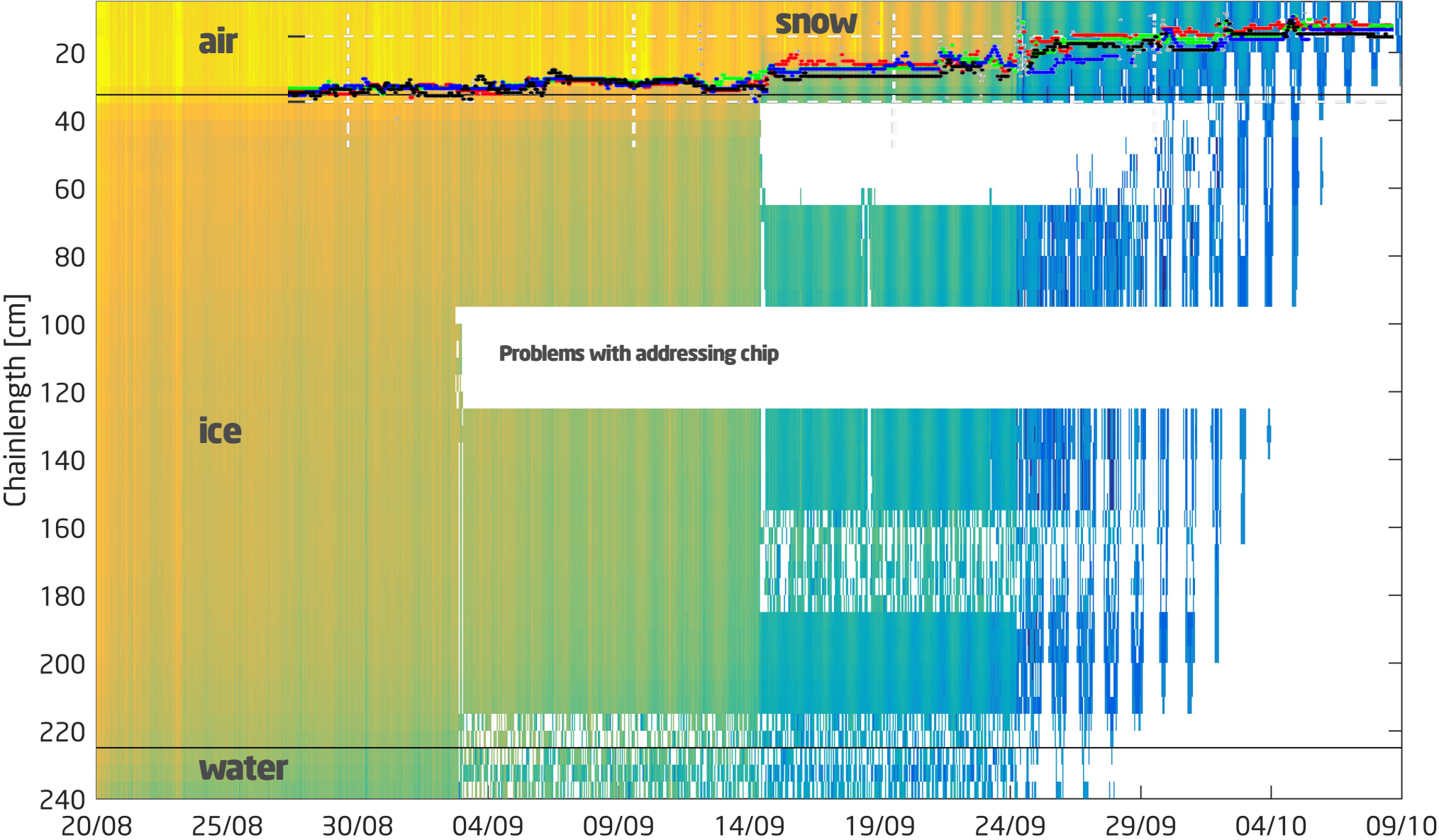
- 4 channel sensor  
RGB + clear light
- Cosine response
- IR filter
- 430-640nm (~PAR)



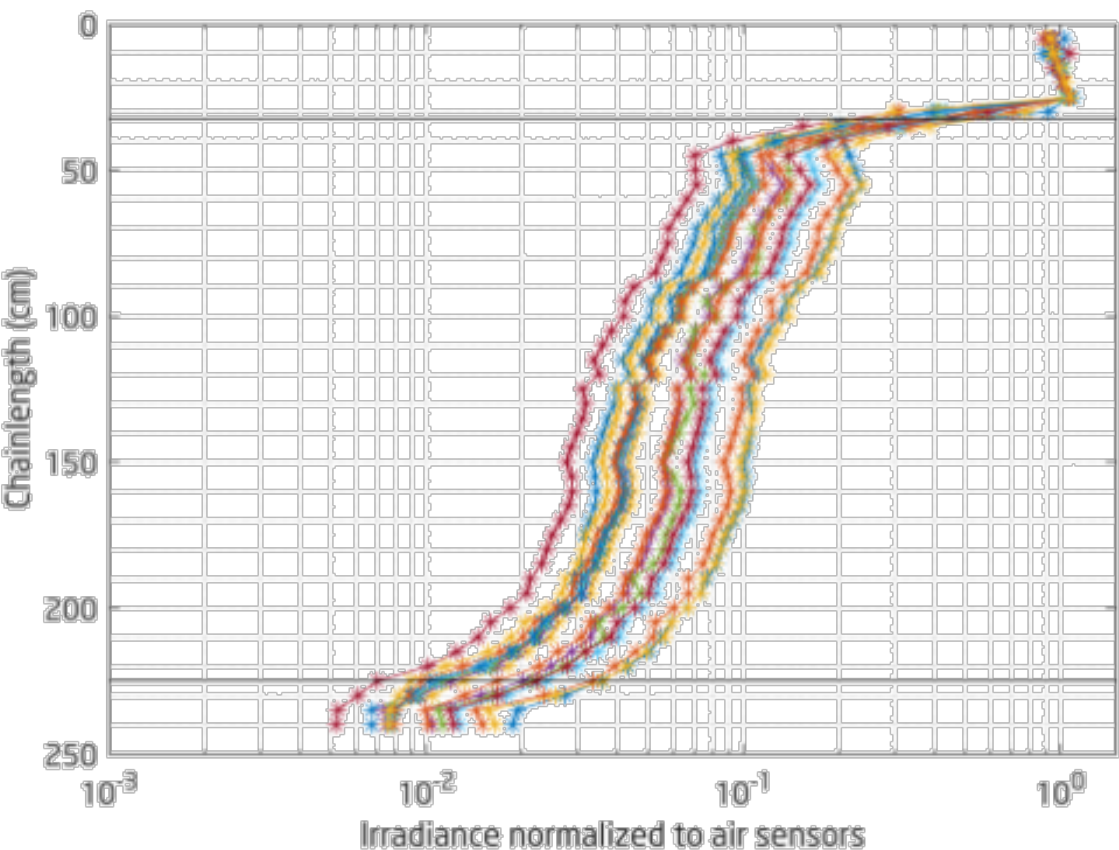
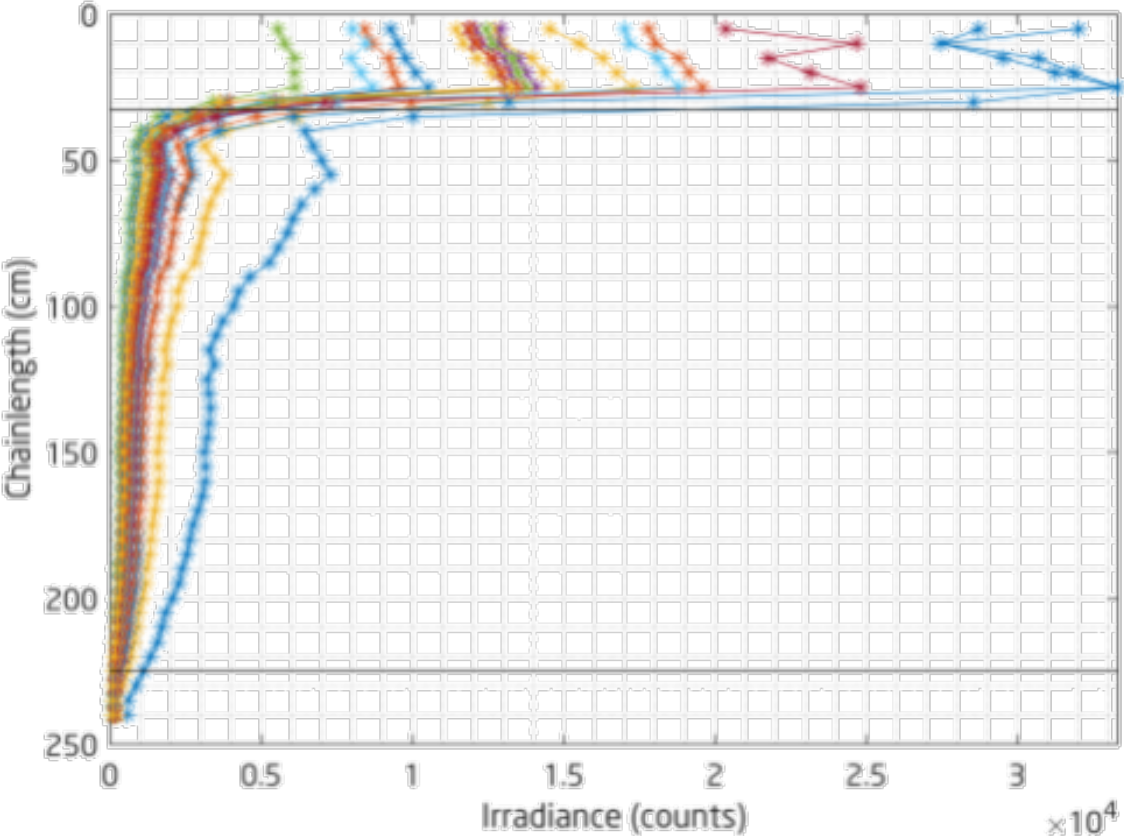
# A018 Deployment (20 August 2018)



# Data from 2018 prototype

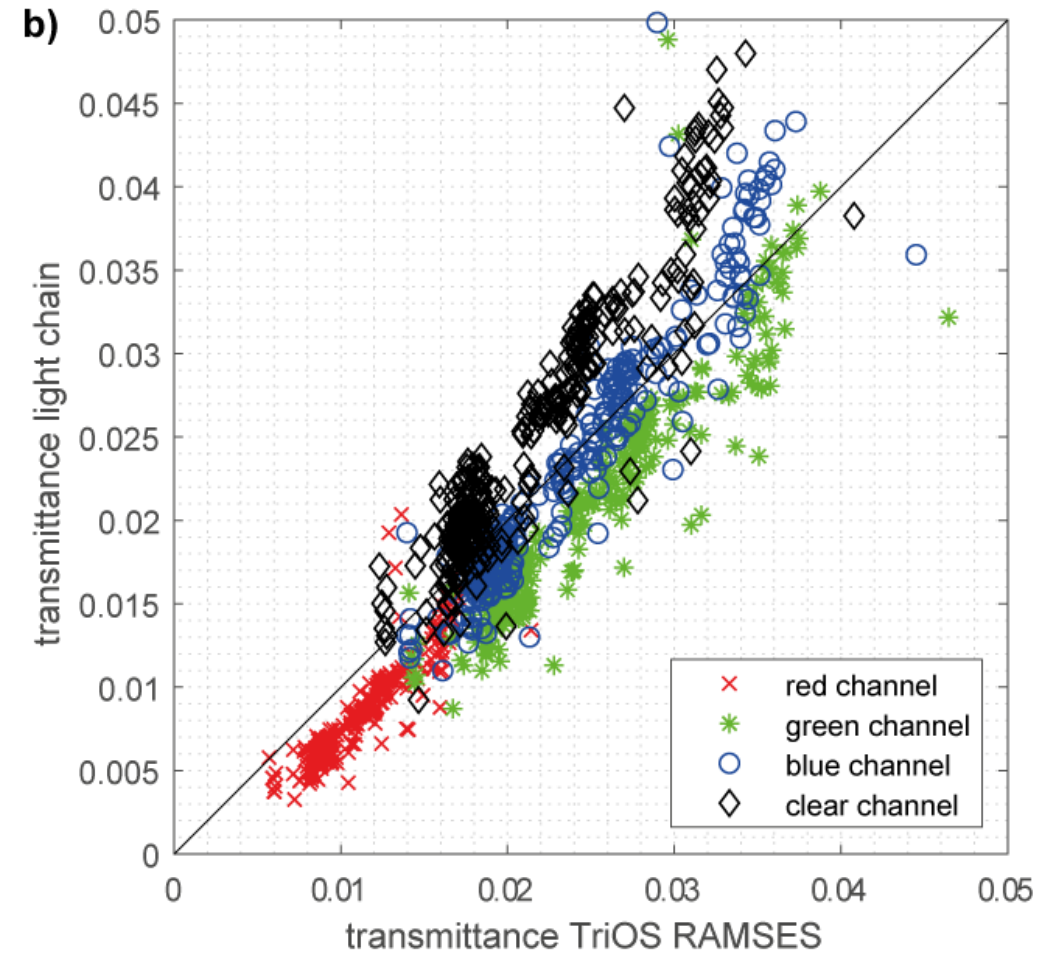
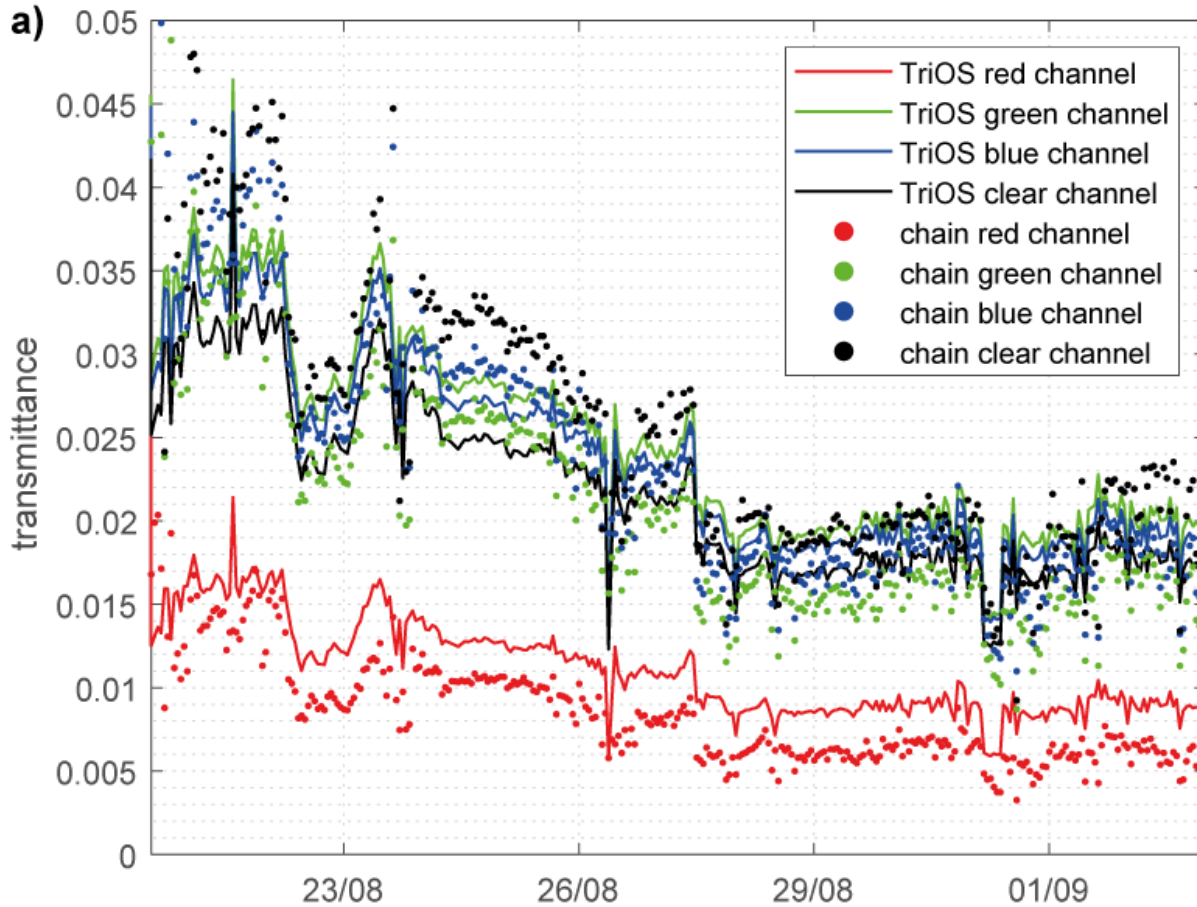


# Profiles: 20 Aug - 3 Sep

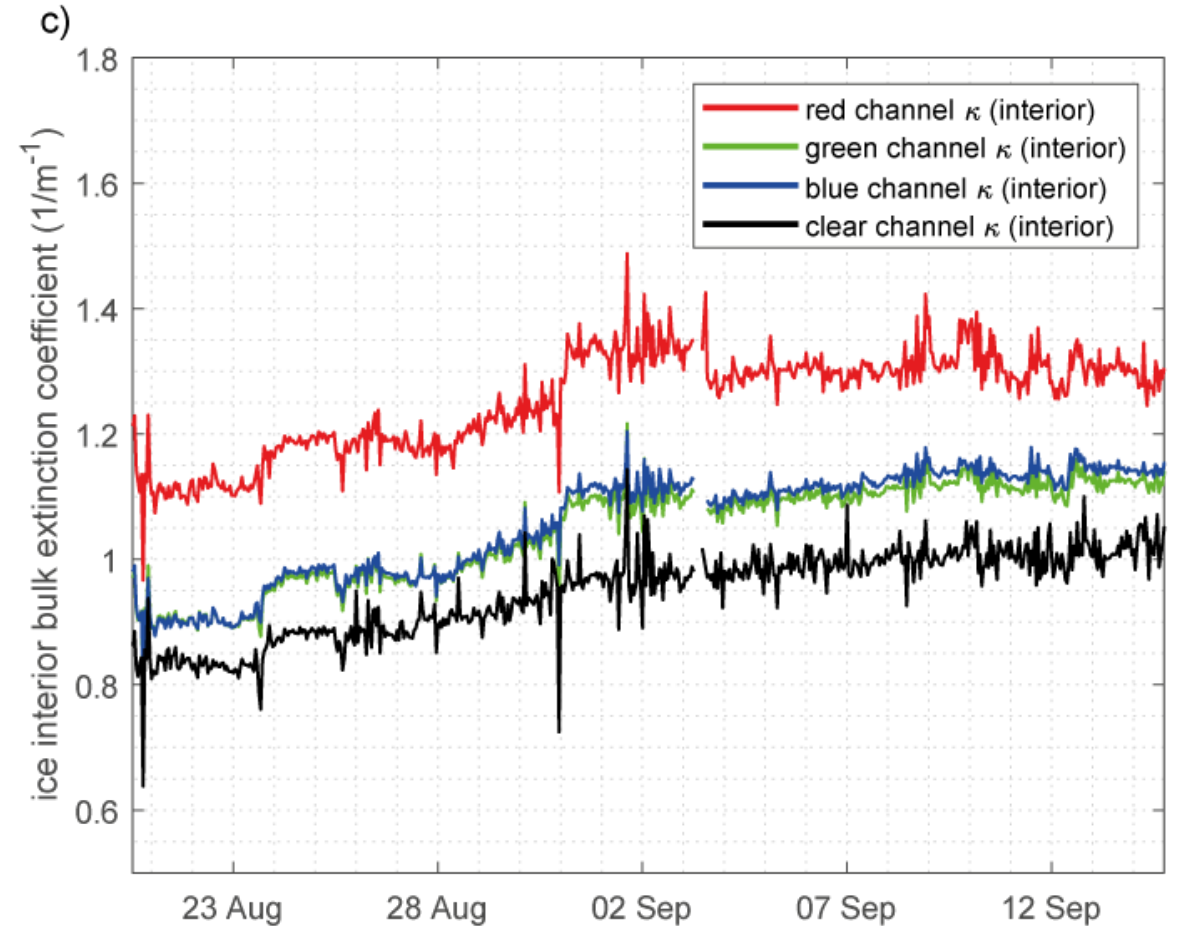
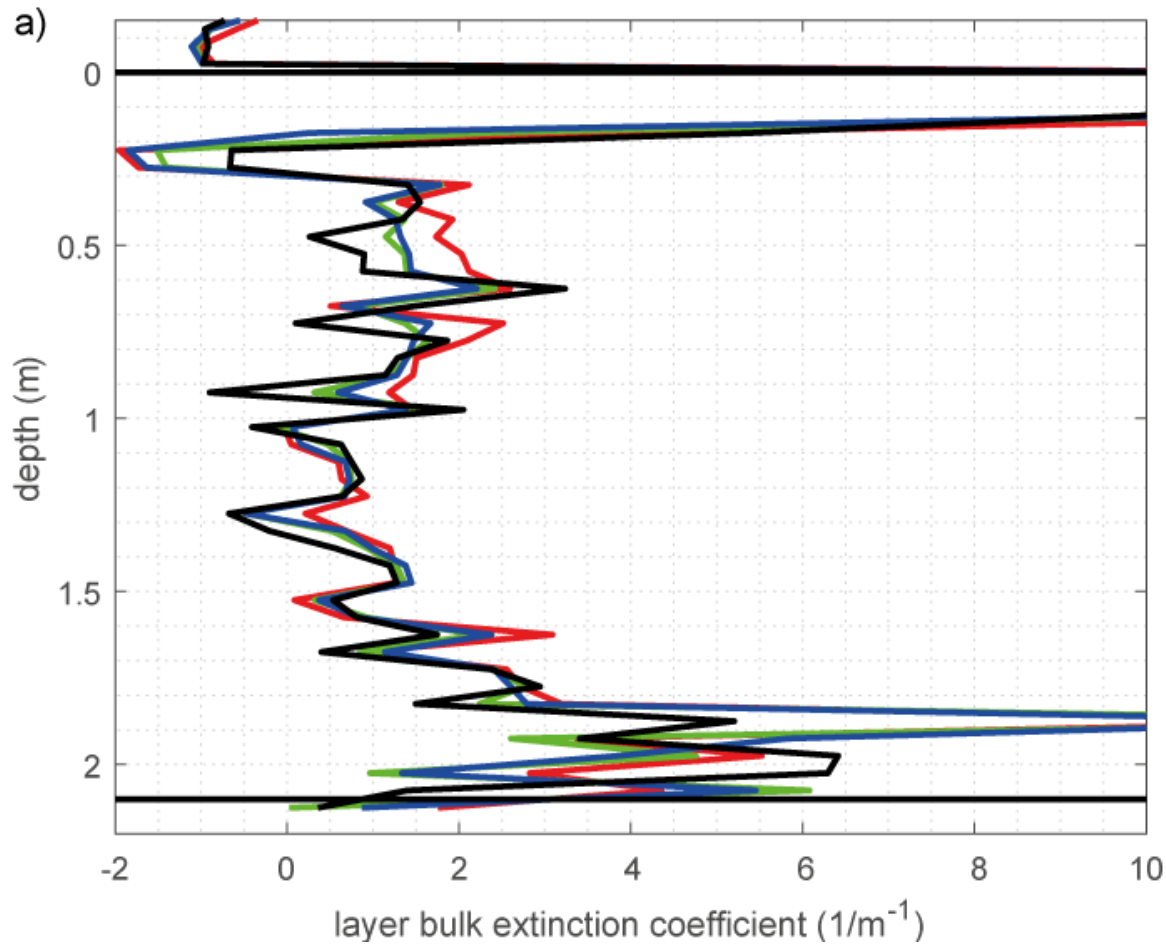




# Comparison to RAMSES station

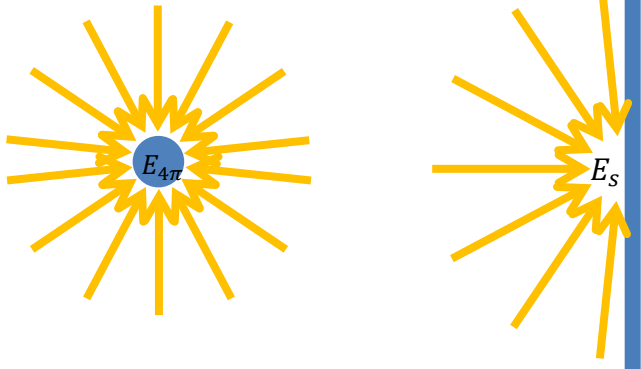


# Extinction coefficients

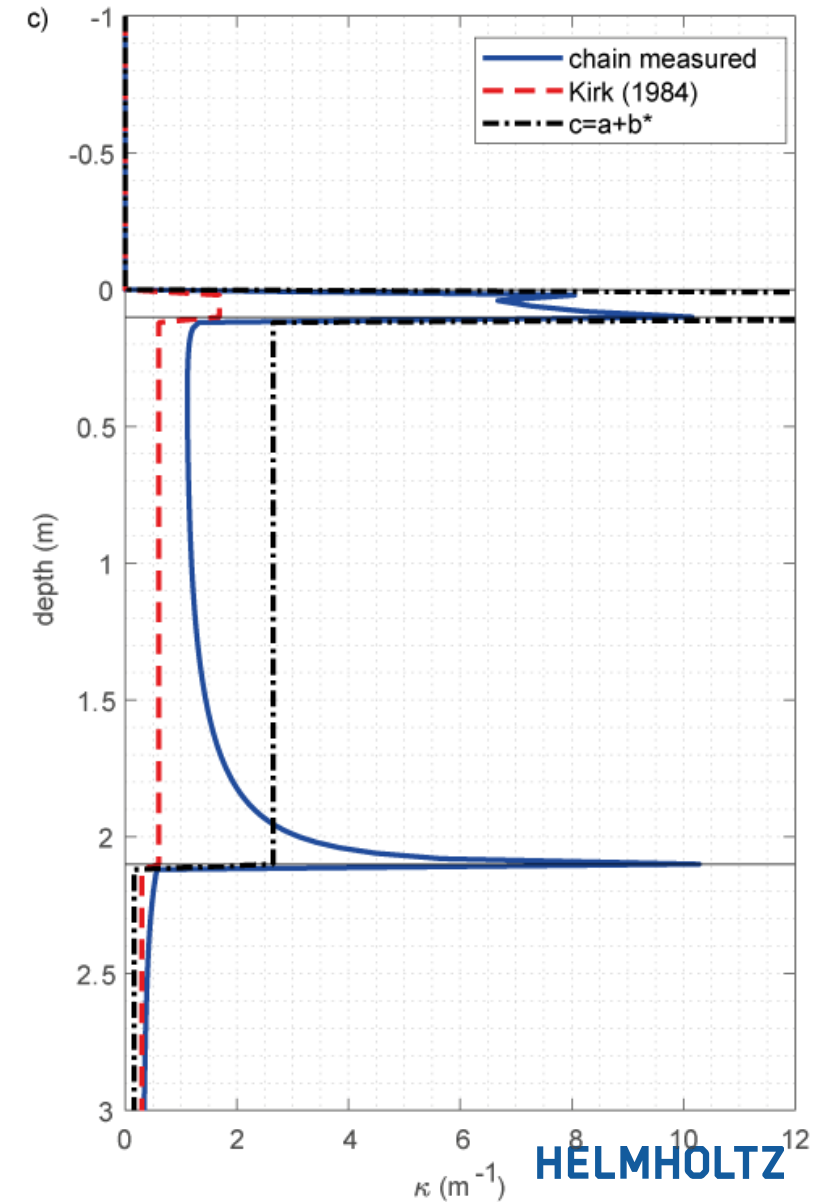
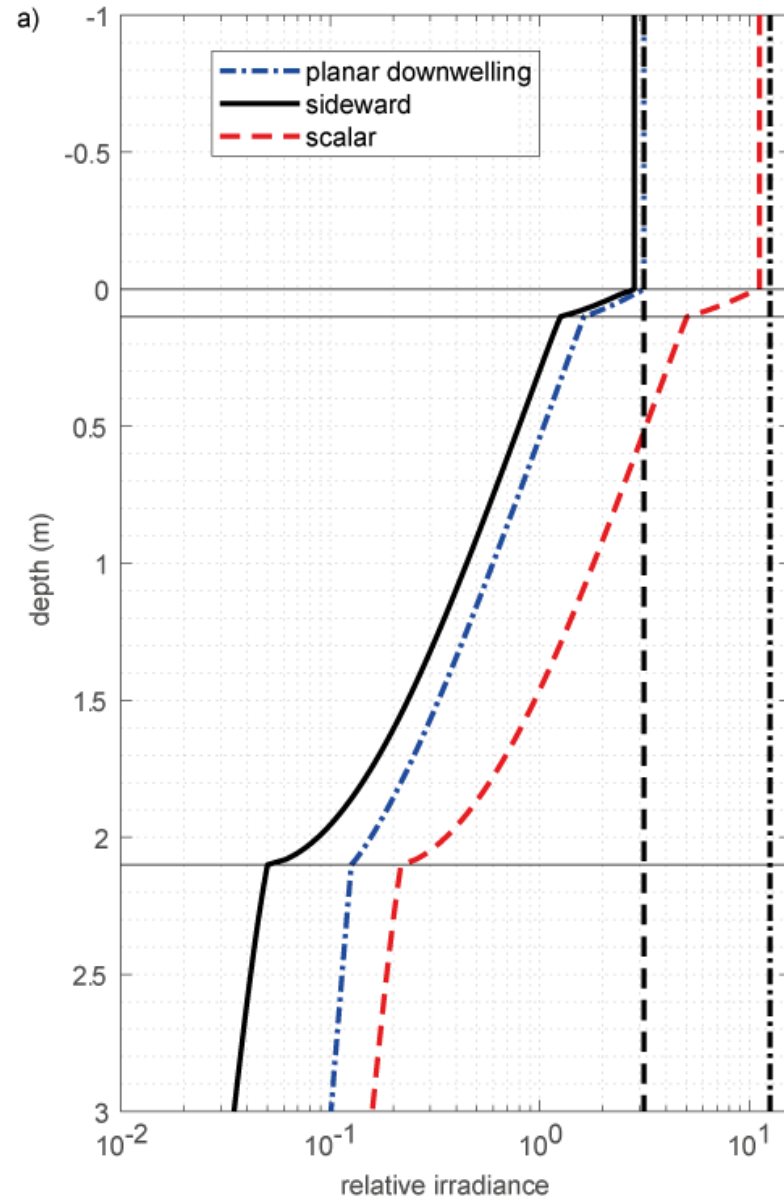


# Sideward geometry: DISORT modeling

total scalar irradiance = sideward planar irradiance



$$E_{4\pi} \approx 4 \cdot E_s$$

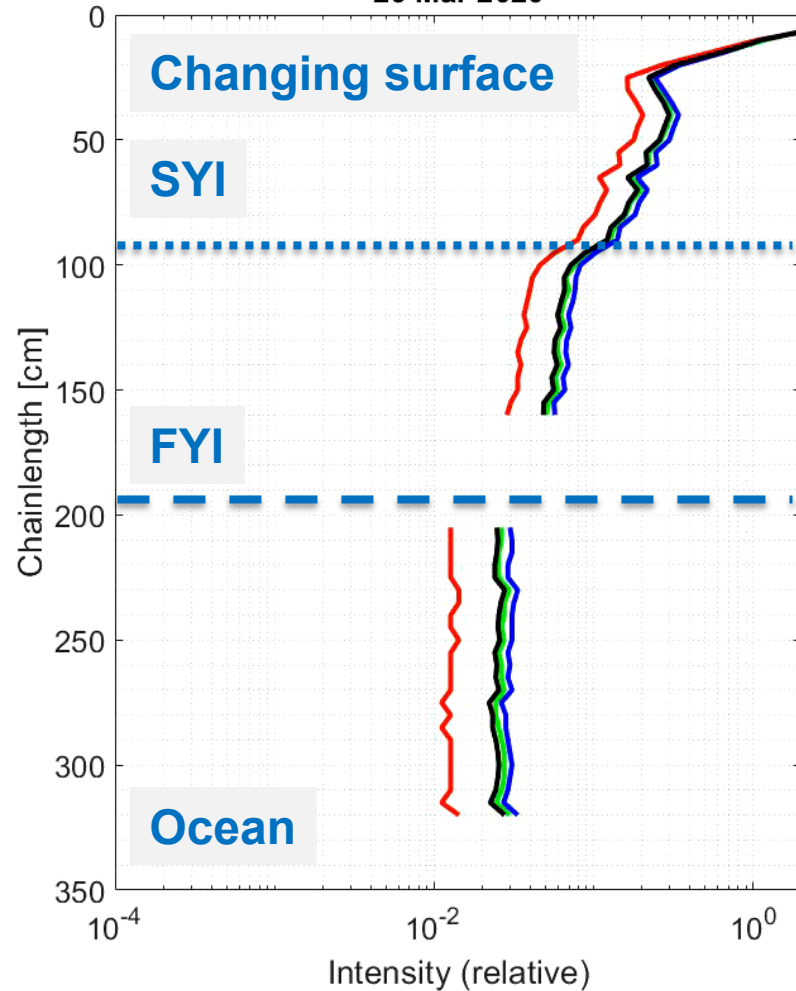


# MOSAIC deployments



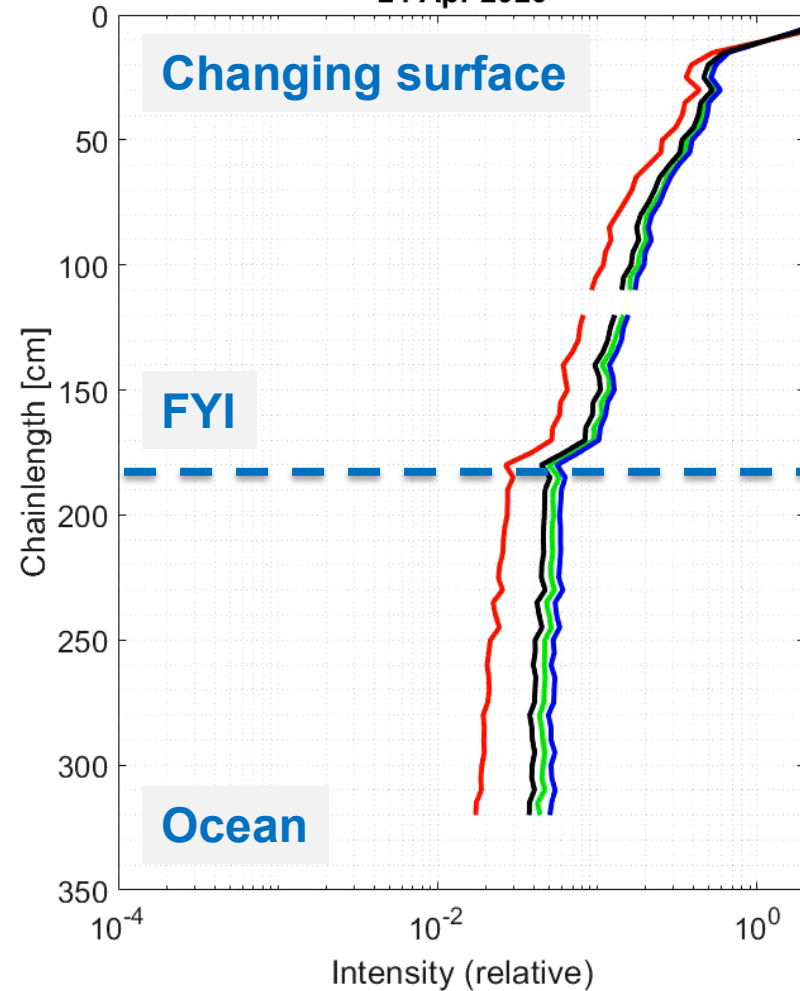
## MYI coring site

26 Mar 2020



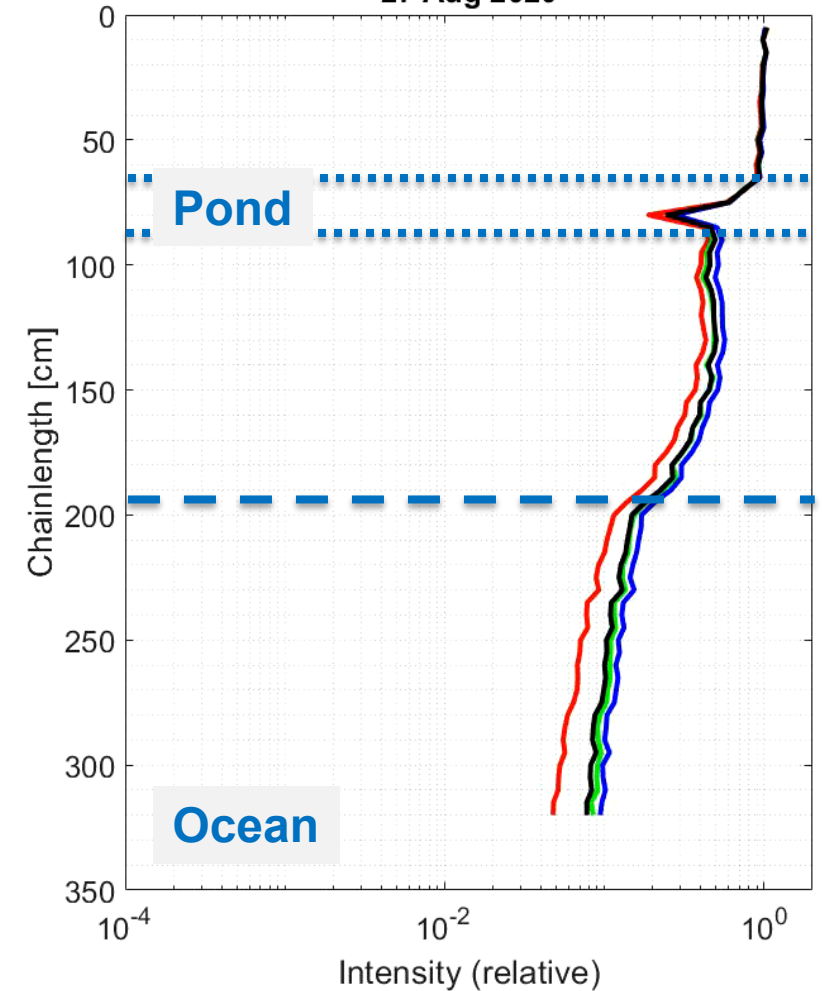
## L3 (FYI)

24 Apr 2020

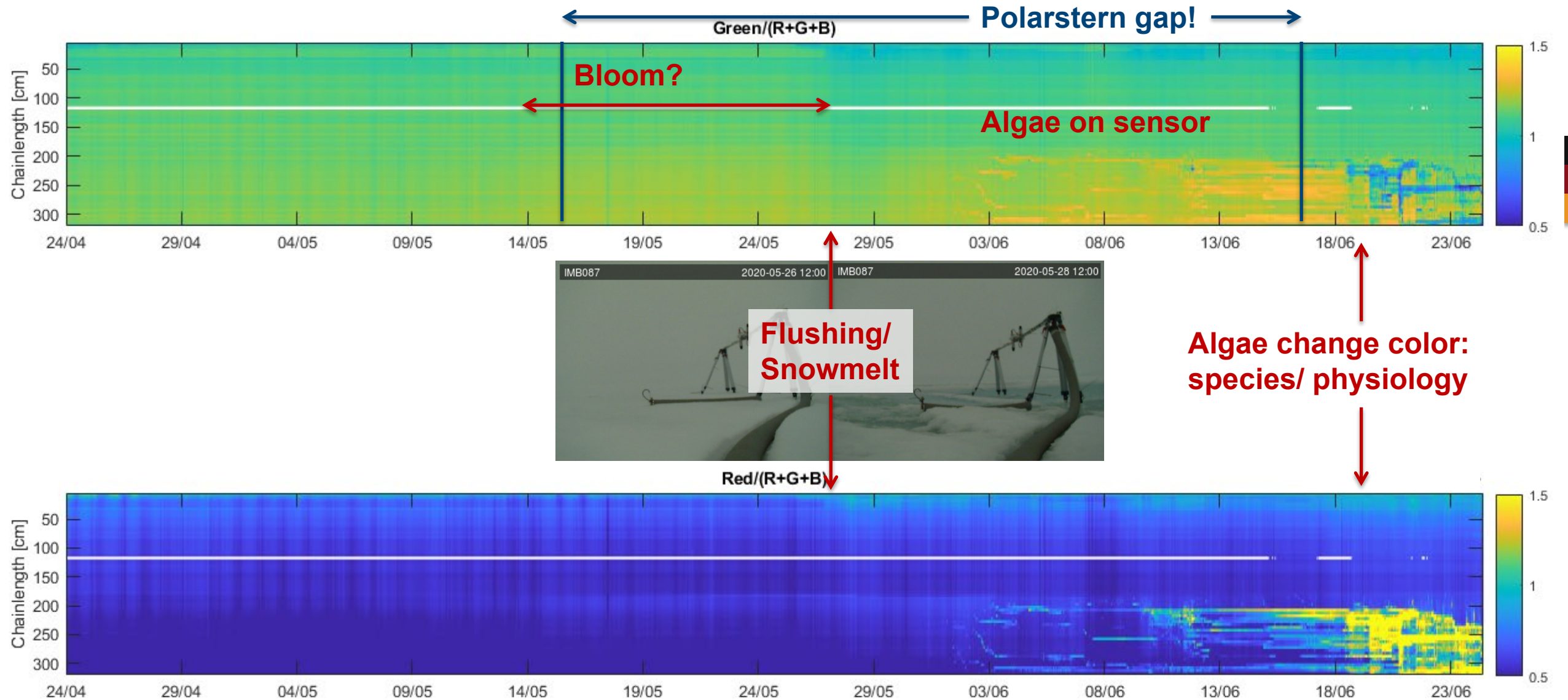


## 2<sup>nd</sup> Floe (Pond)

27 Aug 2020



# Spectral signals



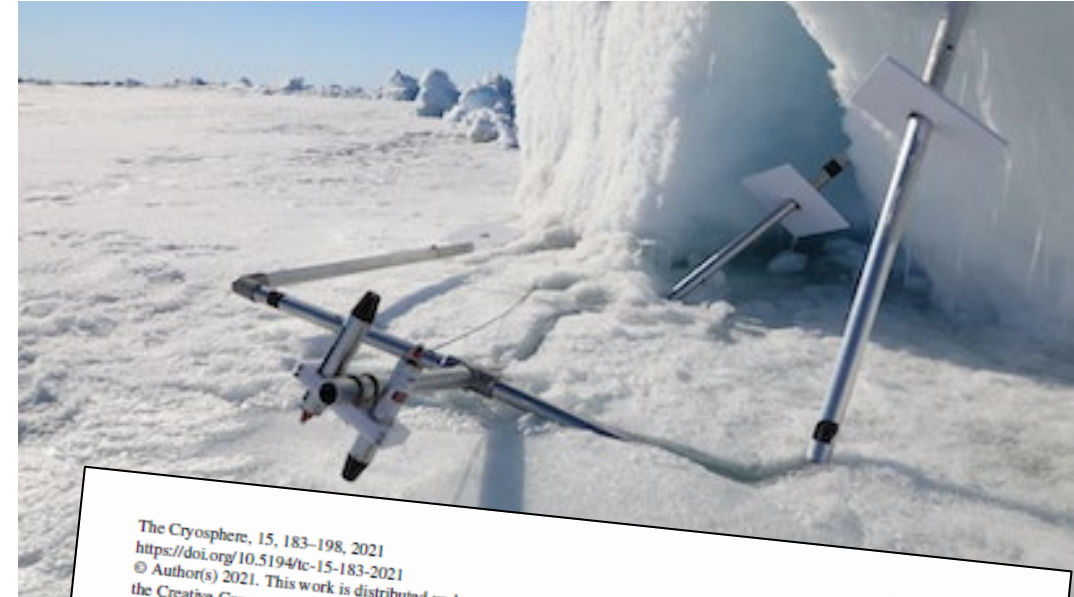
# Summary



Katlein, C., et al. (2020) New insights into radiative transfer in sea ice derived from autonomous ice internal measurements, *The Cryosphere*



- An easy to deploy low-cost tool for in-ice light measurements
- Results comparable to traditional setups
- In-ice measurements allow better IOP understanding
- Equivalency of sideward and scalar irradiance
- Spectral resolution allows ecosystem assessment



## Thank you for your interest!