

Autonomous profiler reveals Arctic zooplankton dynamics during transition to polar night

Ways forward in monitoring ecosystems in inaccessible regions

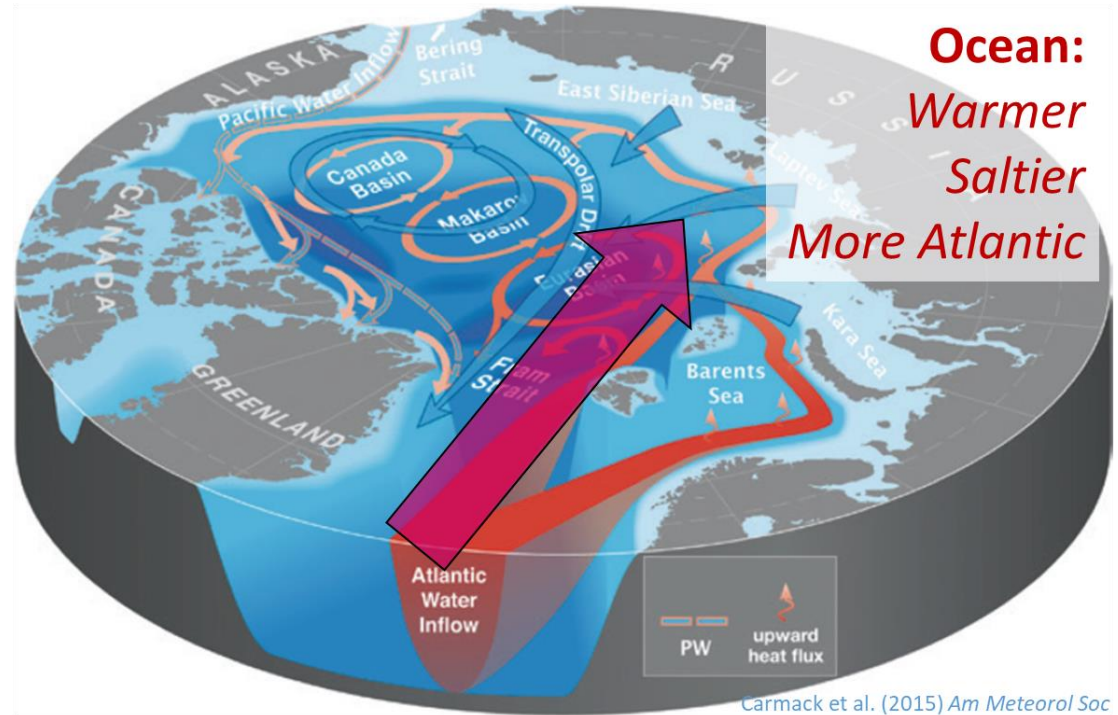
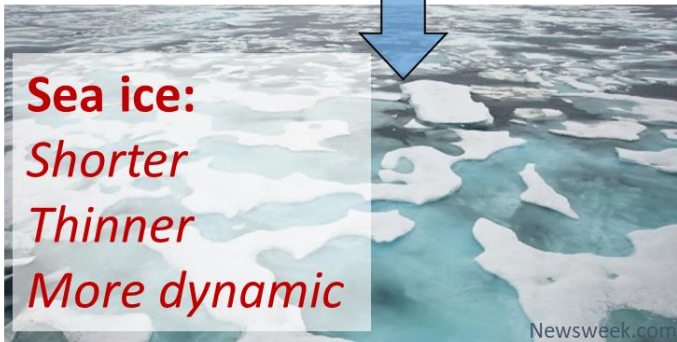
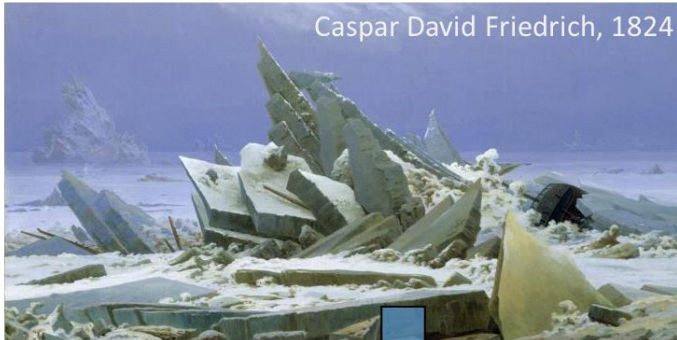
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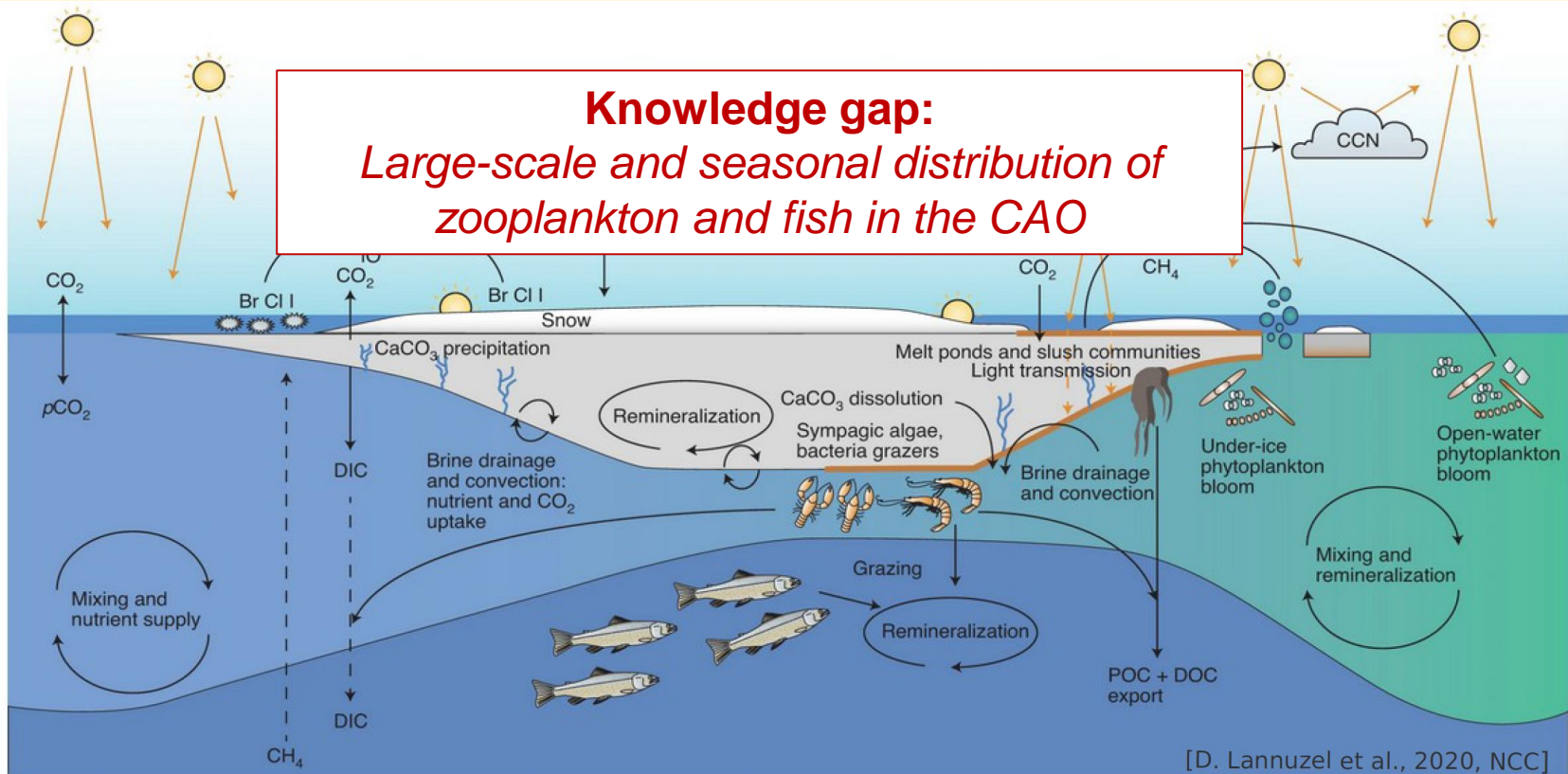


The Changing Arctic Ocean



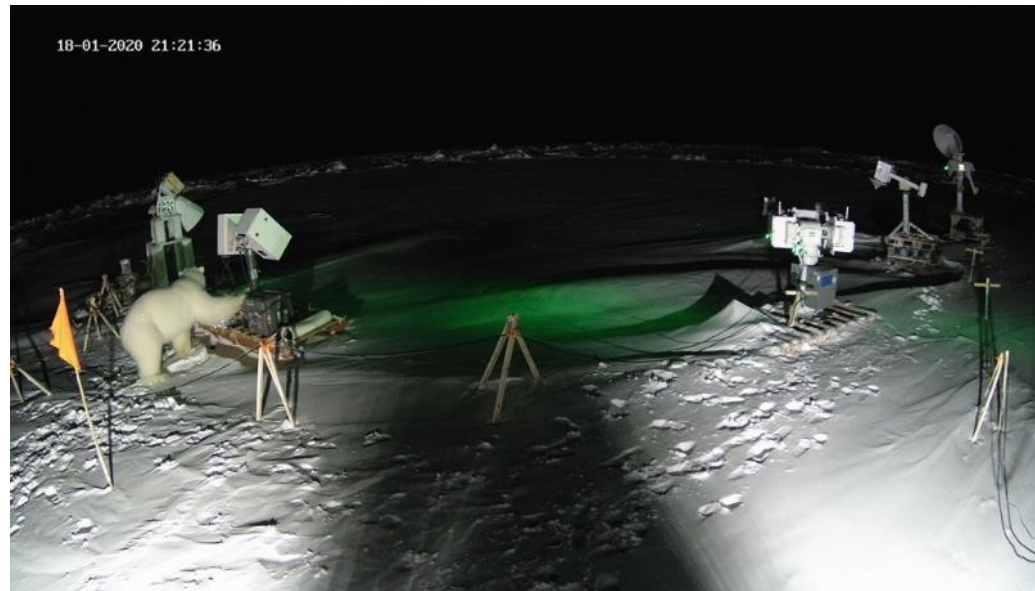
The Changing Arctic Ocean

Changes in sea ice lead to **changes in habitat, food type and availability, and species distribution**, thus affecting ecosystem dynamics and biogeochemical cycling



Objectives of EcoLight

- Investigate the effect of the changing under-ice light field on the abundance and vertical distribution of zooplankton
- Analyze interaction of zooplankton distribution with hydrography and food availability
- Evaluate autonomous AZFP for future studies in the CAO

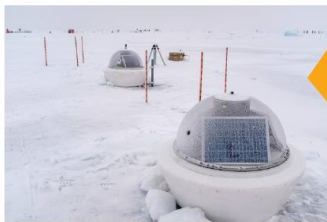


Autonomous buoy array

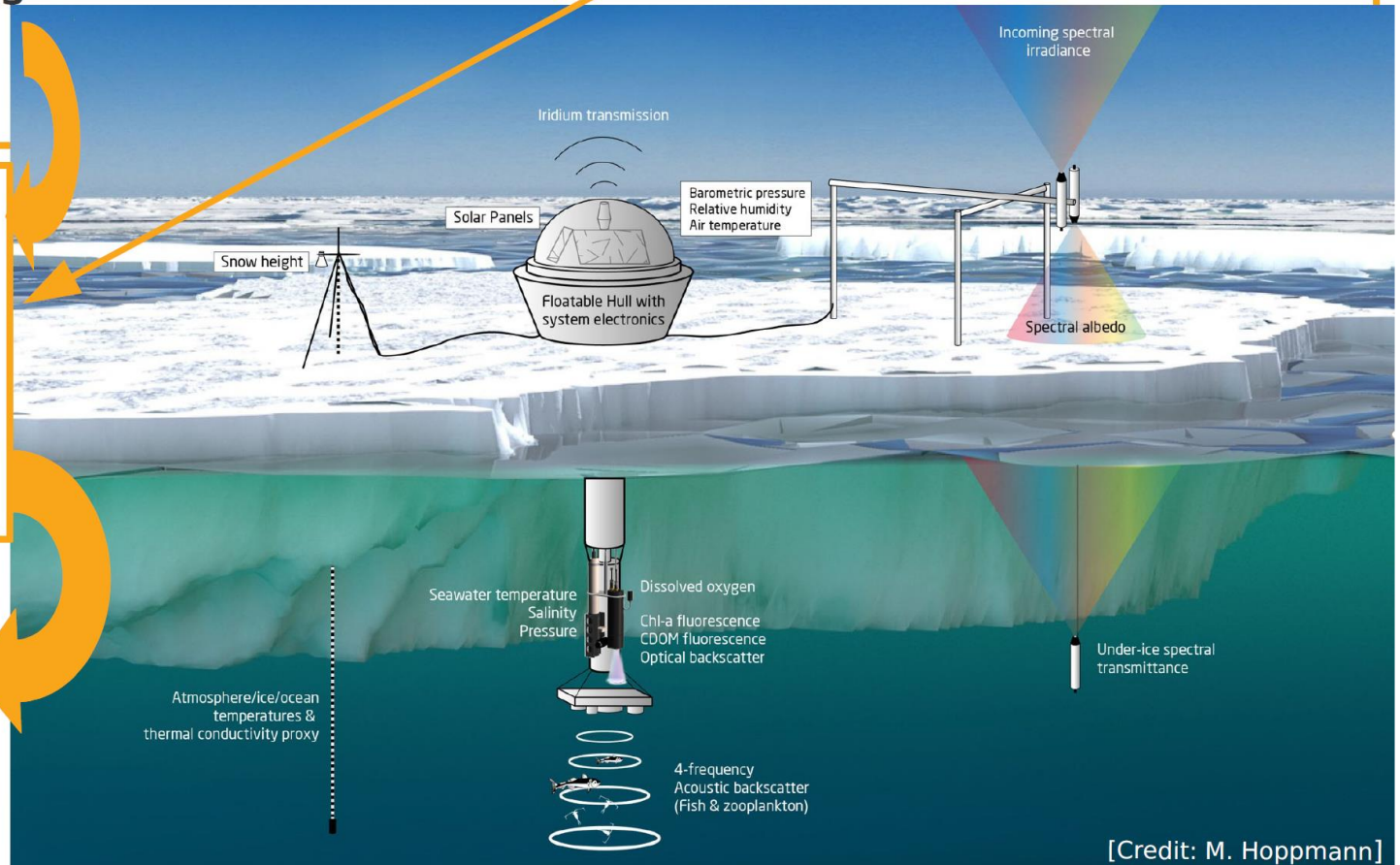
Future Arctic research needs a **holistic coupled physical-biological approach** and **continuous year-round observations**

Buoys cluster

- ★ CTD
- ★ Ice mass balance
- ★ Snow
- ★ Zooplankton
- ★ Radiation



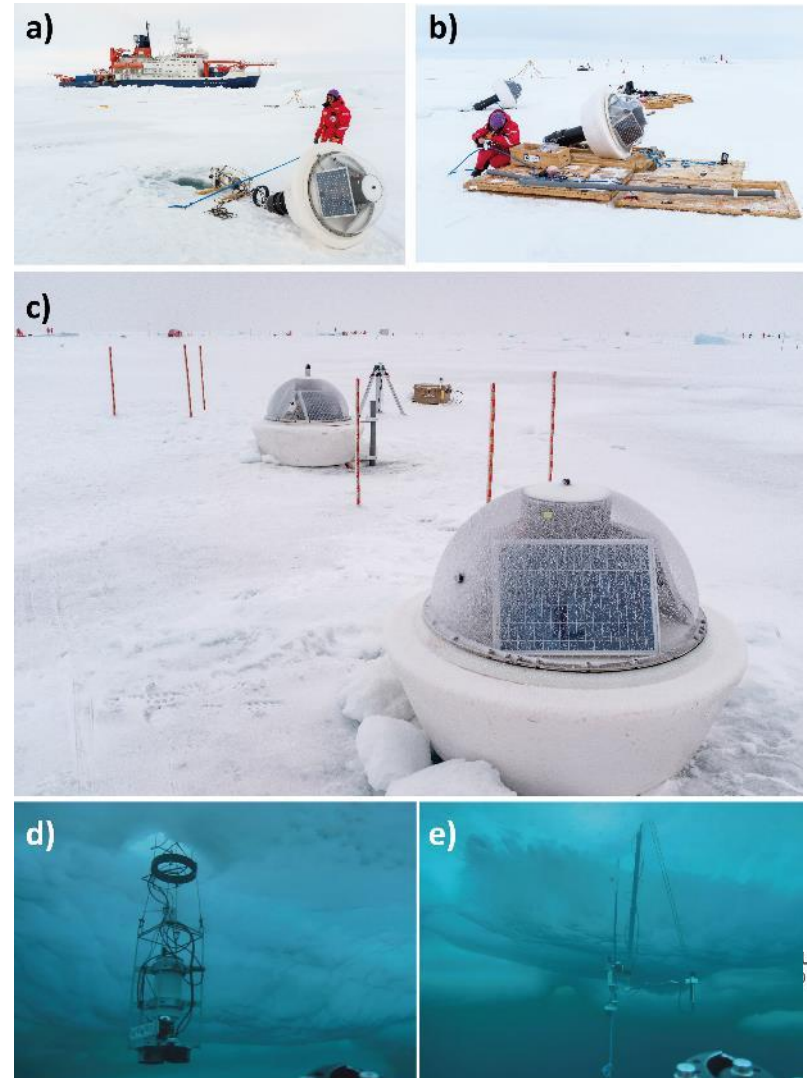
[M. Hoppmann]



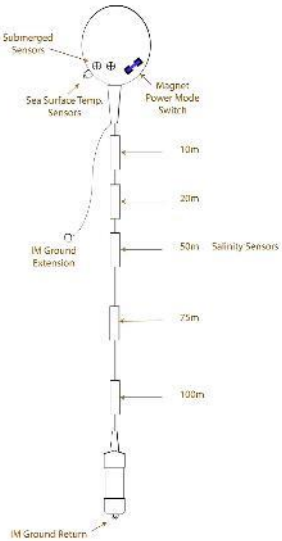
[Credit: M. Hoppmann]

AZFP buoy prototype

Parameter	Sensor Model
GPS position	Garmin 18x
Atmospheric pressure	Bosch B280
Air temperature	Honeywell
4 active acoustic channels (70, 125, 200, and 455 kHz)	ASL Acoustic Zooplankton Fish Profiler
Chl-a fluorescence	Turner Cyclops
Salinity (under ice)	Solometrix BKIN50
Incoming PAR	Apogee
Inner buoy temperature, humidity	Bruncin
Battery voltage/current, CPU load	Bruncin
Camera (air)	Bruncin
Camera (underwater)	Bruncin



Parallel: CTD chain buoy, irradiance buoy



- 5 Seabird SBE37IMP CTDs
- Conductivity, temperature, pressure
- Depths: 10, 20, 50, 75 and 100 m

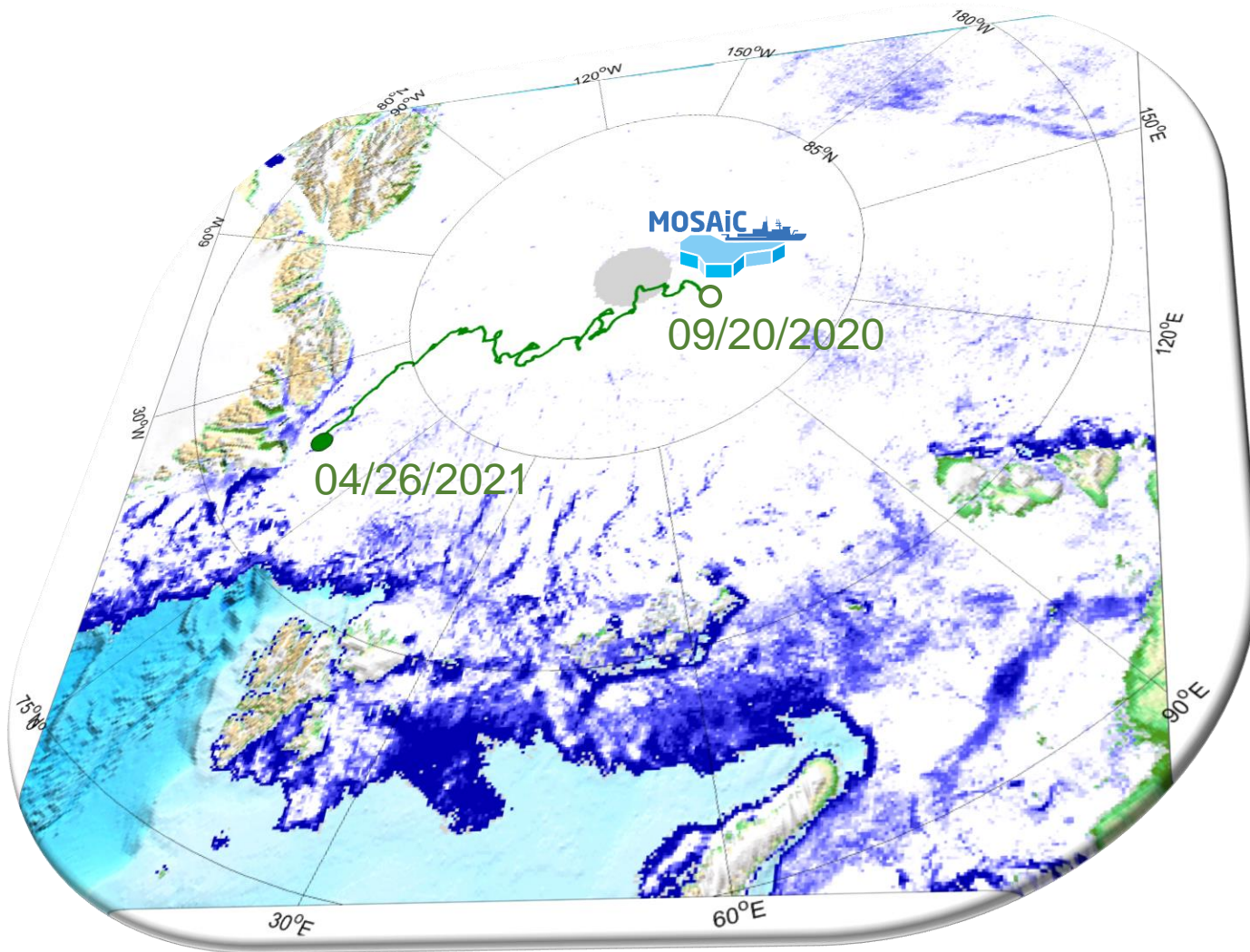
- 3 RAMSES ACC-VIS spectral radiometers
- Incoming, reflected, transmitted irradiance
- (also on the image: light chain, thermistor chain)

Deployment

Deployments: MOSAiC September 2020, 89.05°N 107.10°E

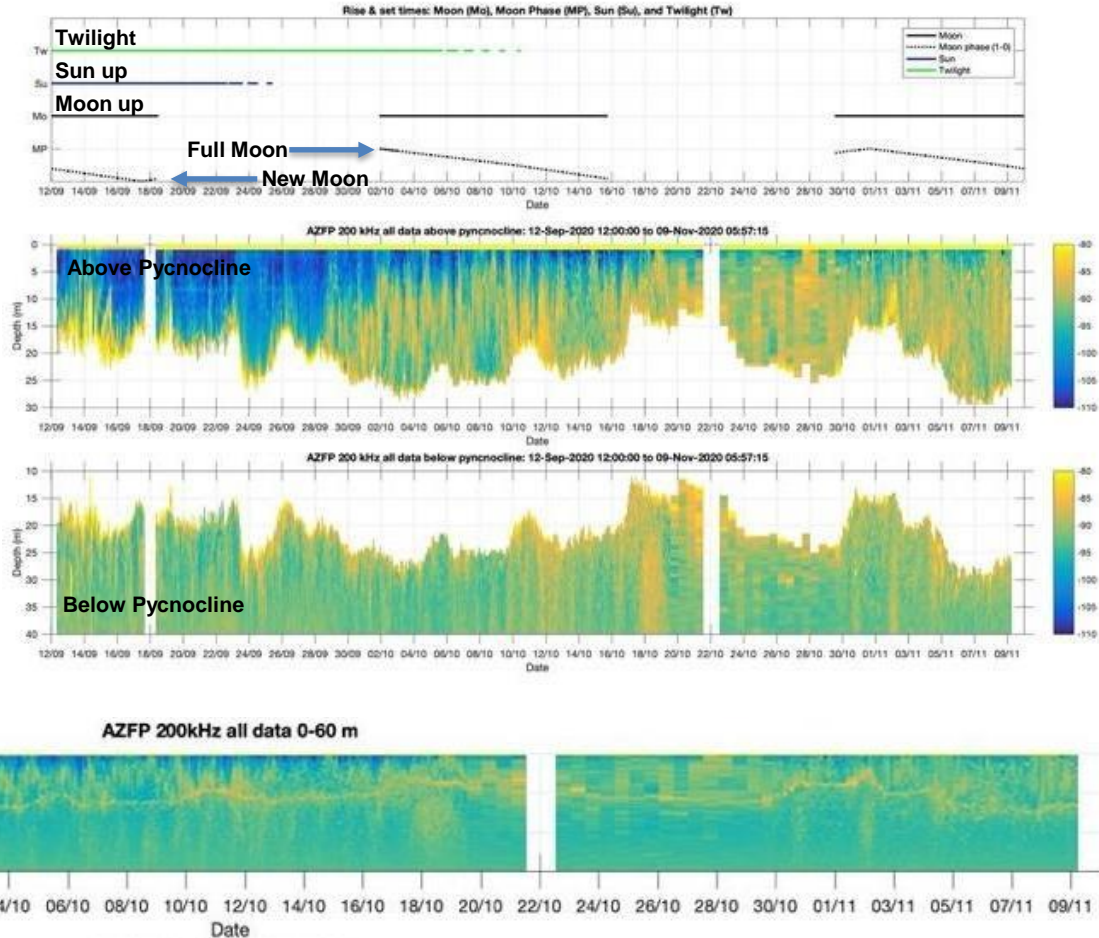


Drift 09/12/20 – 02/01/21

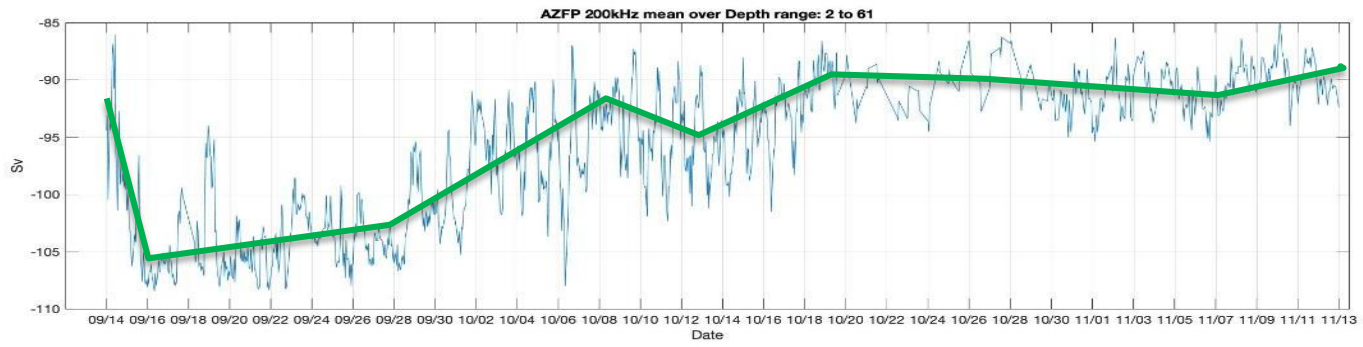
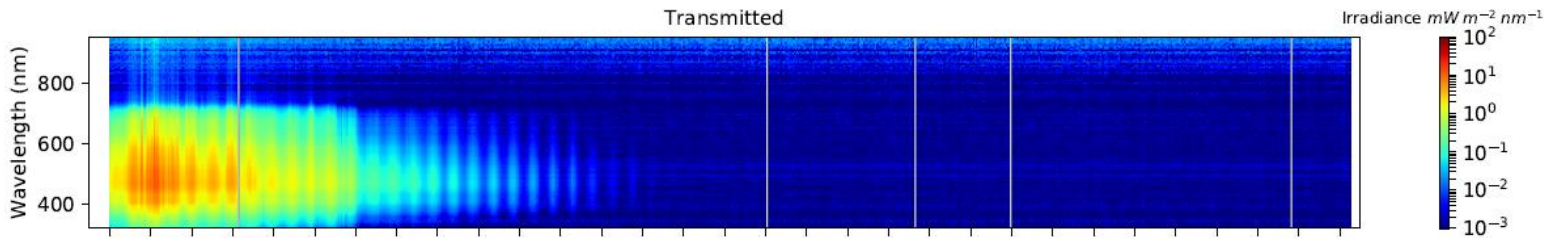
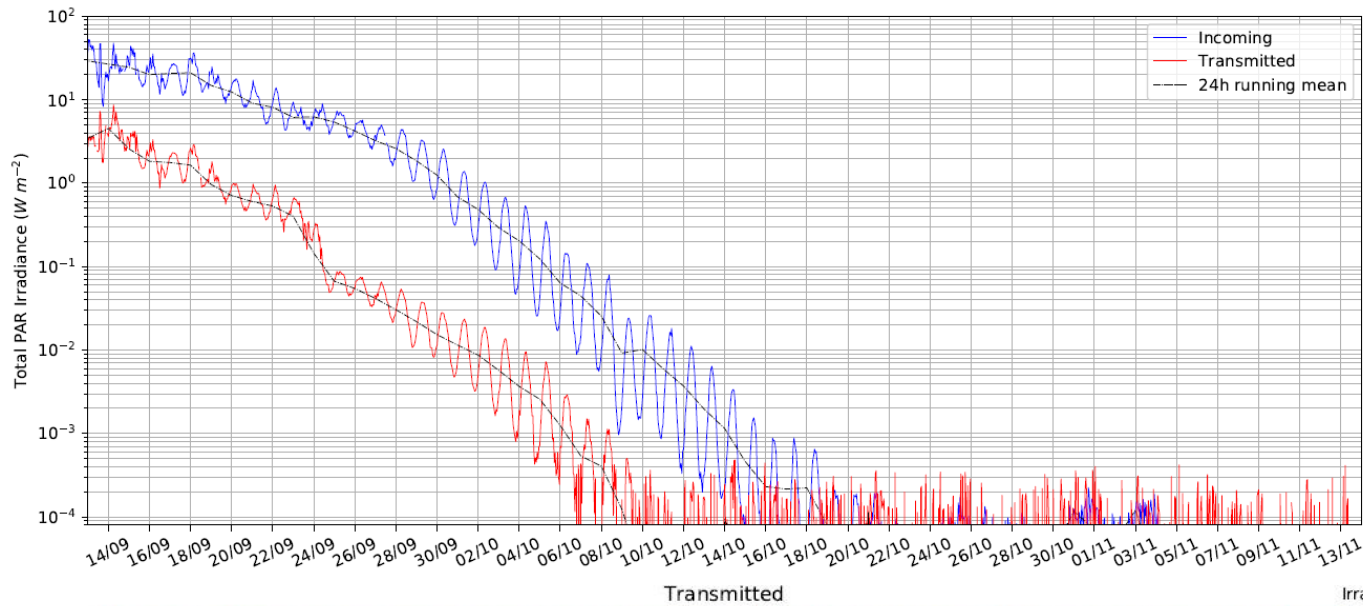


First results: Light

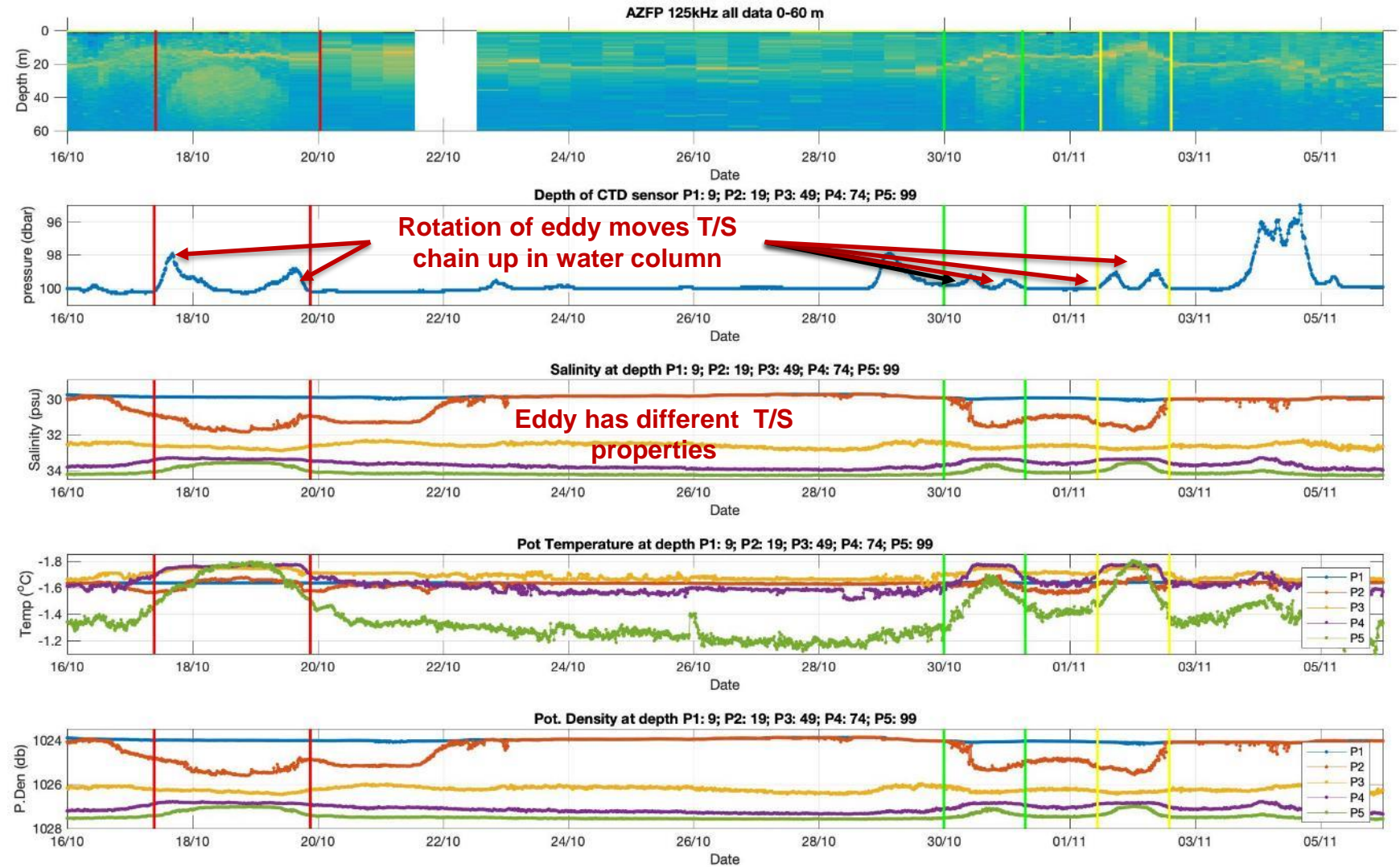
- Difference above and below pycnocline (PC)
- Increased backscatter above PC at „polar dusk“
- Periodic vertical shifts above PC during twilight
- „even“ distribution below PC



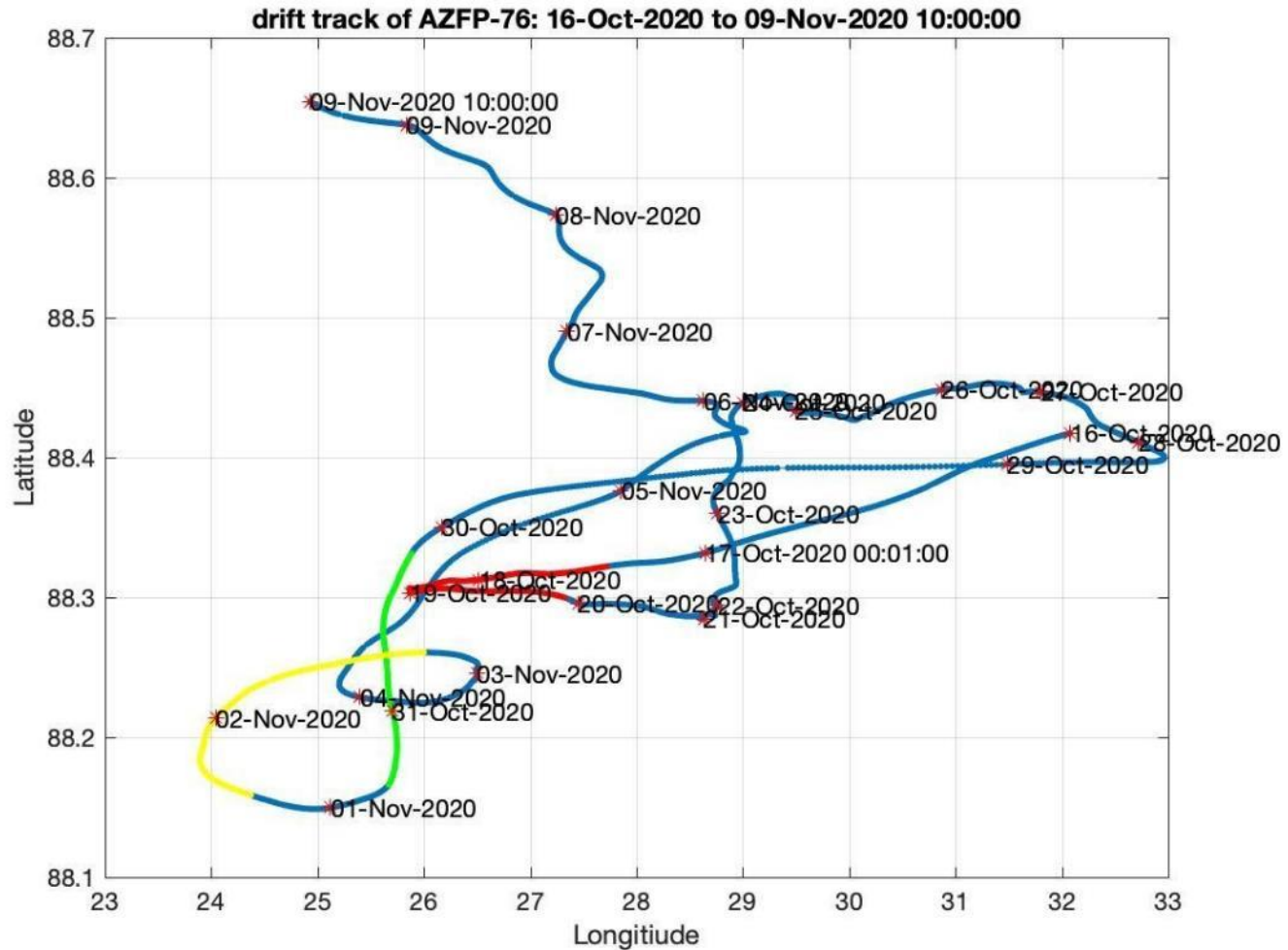
First results: Light

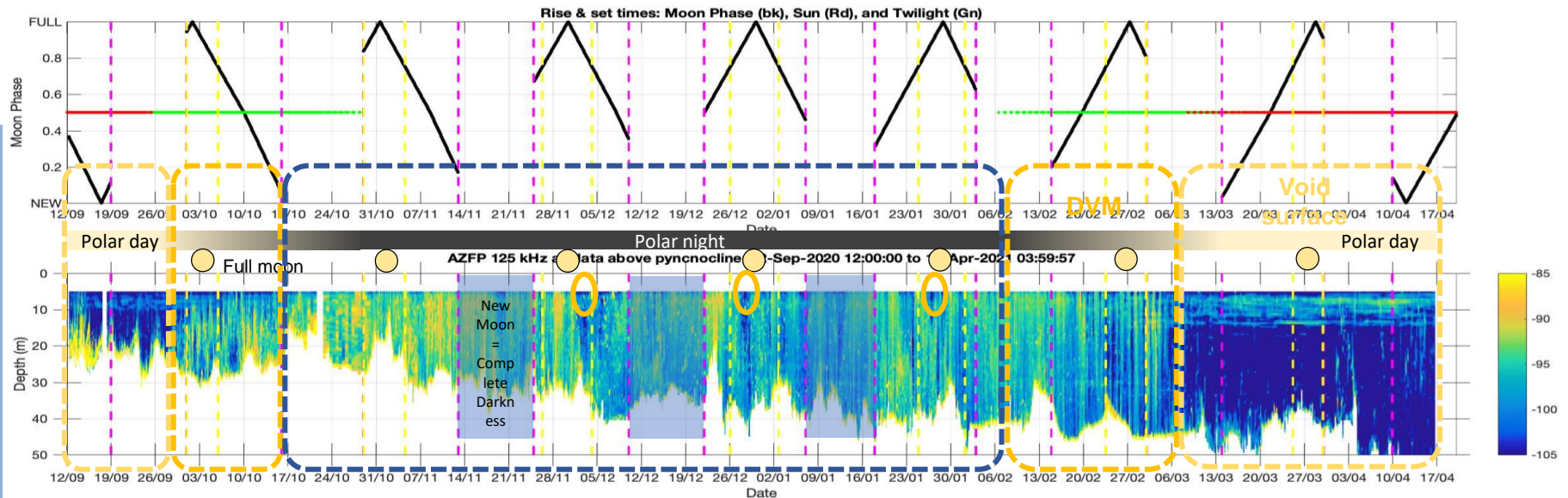


First results: Eddie



First results: Eddie





- First crossing of the Arctic Basin with a fully autonomous zooplankton profiler
- Time series of near-surface distribution in complete absence of artificial light during the entire Arctic winter
- Ability to investigate the influence of moonlight and under-ice features such as eddies on zooplankton distribution
- Multi-frequency analysis enables to investigate changes in community composition over space and time