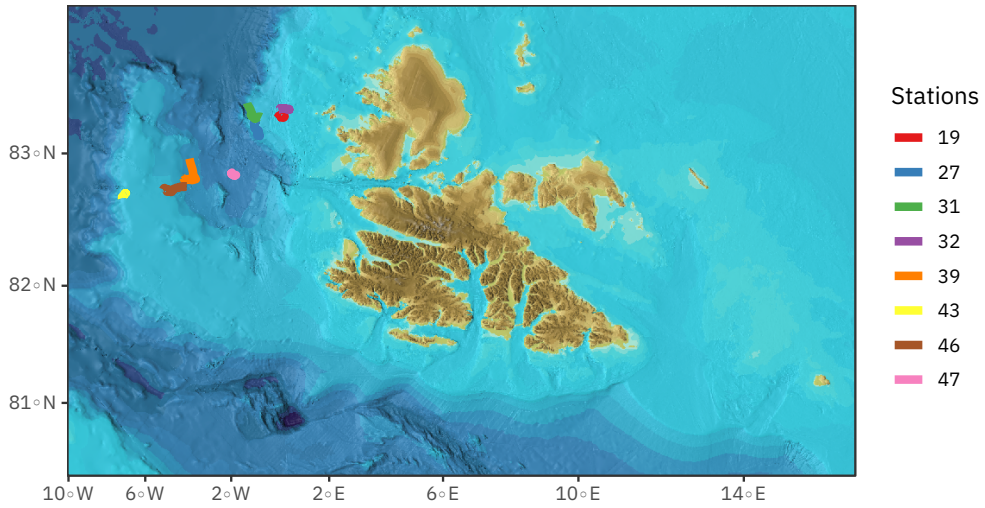
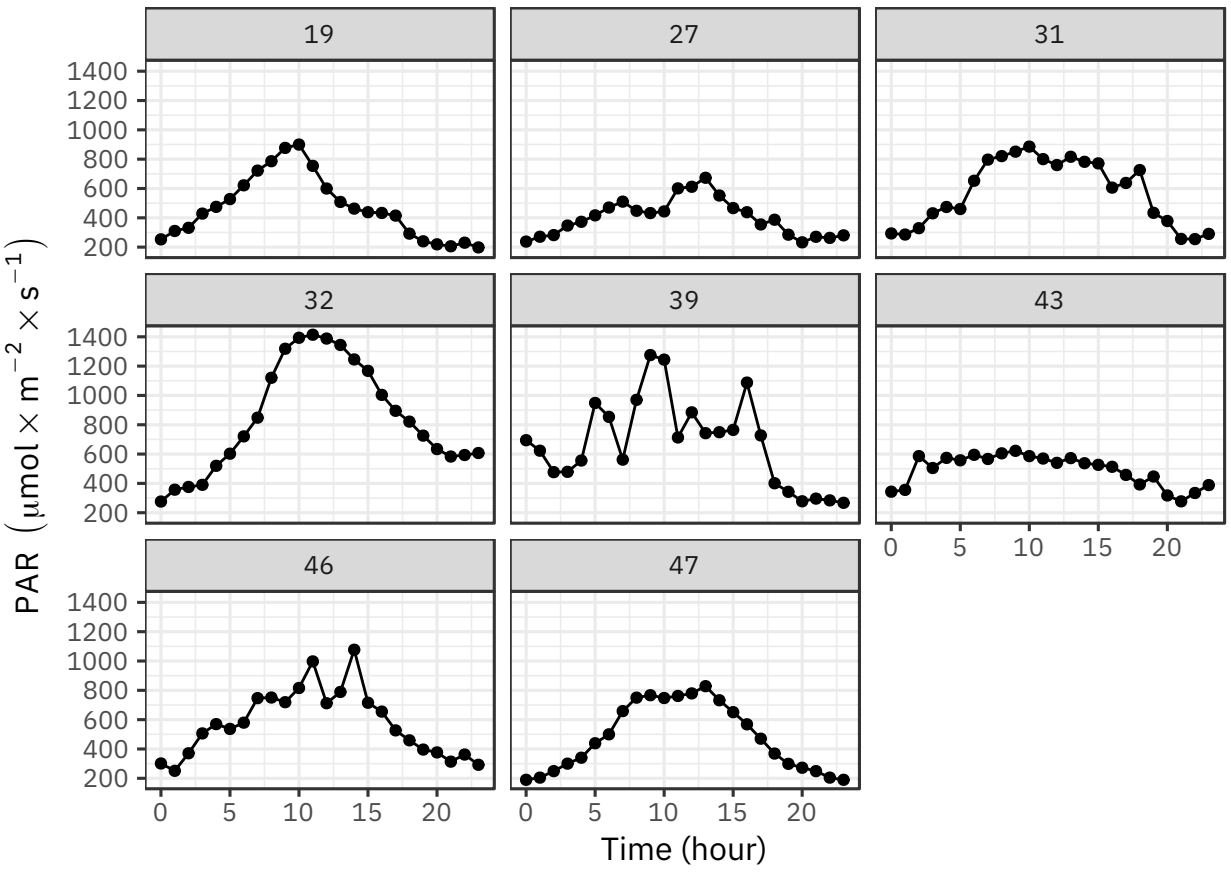
Appendix

Sampling locations



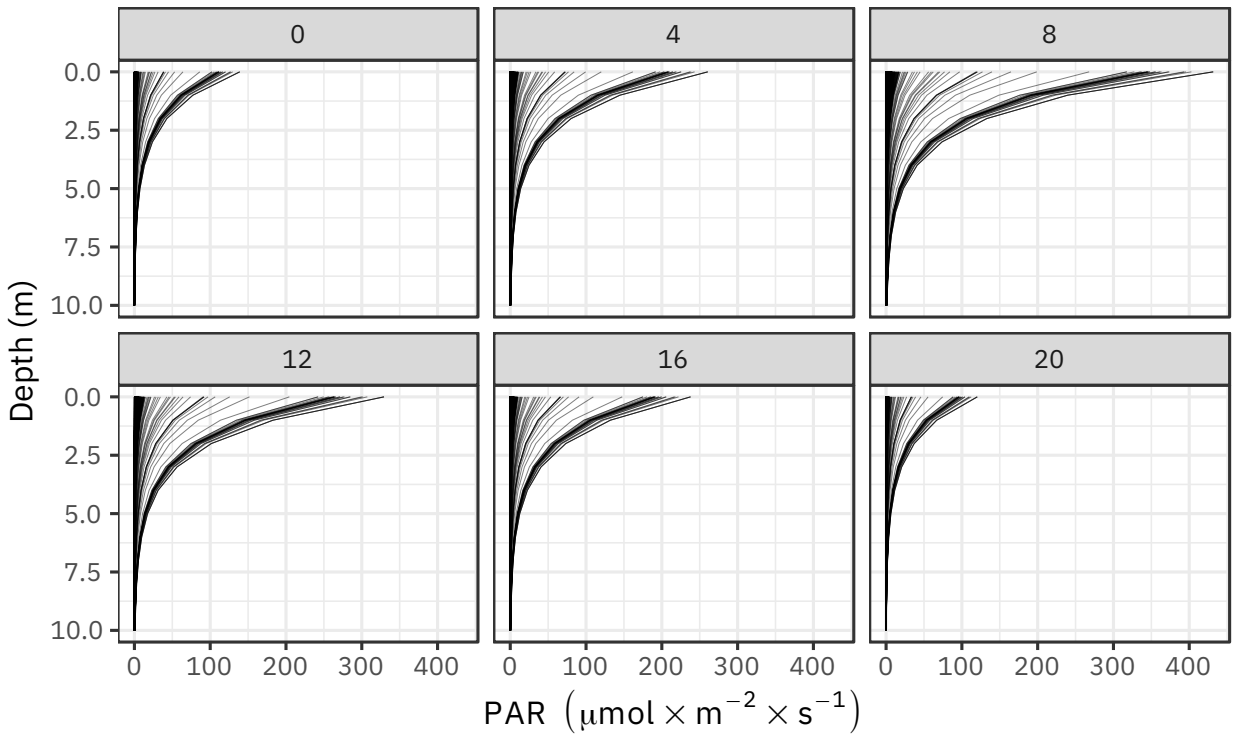
Supplementary Fig. 1: Locations of the ice stations sampled during the Transsiz expedition. Bathymetry data from the International Bathymetric Chart of the Arctic Ocean (IBCAO, v3.0).

Incident light



Supplementary Fig. 2: Hourly photosynthetic active radiation (PAR) measured at each station with a pyranometer installed onboard the ship. Numbers on top of the gray boxes identify the stations.

Propagating light in the water column



Supplementary Fig. 3: Propagated photosynthetic active radiation (PAR) in the water column at station 19 using ROV transmittance data. At this station, a total of 1561 transmittance values were measured by the ROV. Numbers on top of the gray boxes identify selected hours of the day. For visualization, data is plotted only between 0 and 10 meters.

PvsE curves

Two different models based on the original definition proposed by (Platt et al., 1980) were used depending on the situation.

Model with photoinhibition

When apparent photo-inhibition was present, a model including two exponential was fitted (equation 1).

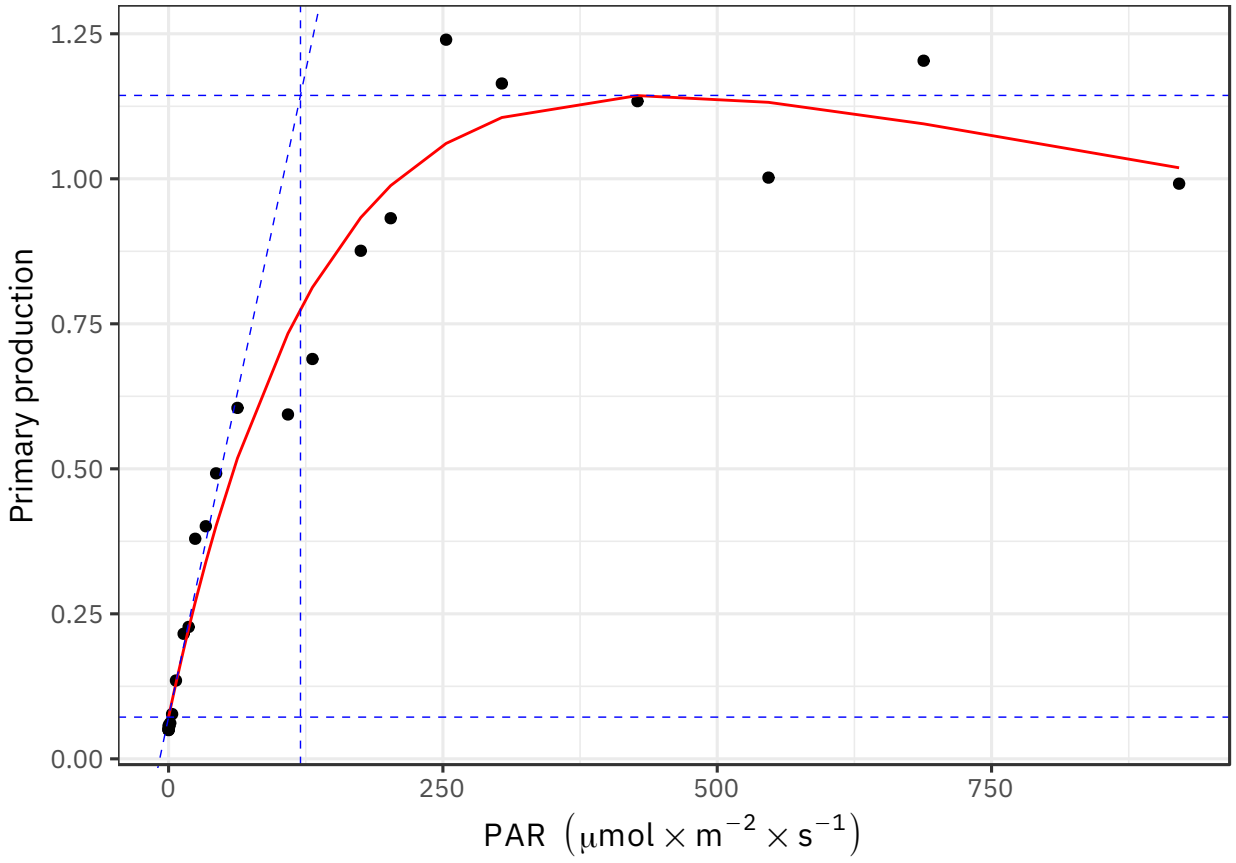
$$p = ps \times (1 - e^{-\alpha \times \frac{PAR}{ps}}) \times e^{-\beta \times \frac{PAR}{ps}} + p0 \quad (1)$$

Model without photoinhibition

When no apparent photo-inhibition was present, a model including only one exponential was fitted (equation 2).

$$p = ps \times (1 - e^{-\alpha \times \frac{PAR}{ps}}) + p0 \quad (2)$$

The non-linear fitting was done using the Levenberg-Marquardt algorithm implemented in the minpack.lm R package (Elzhov et al., 2013).

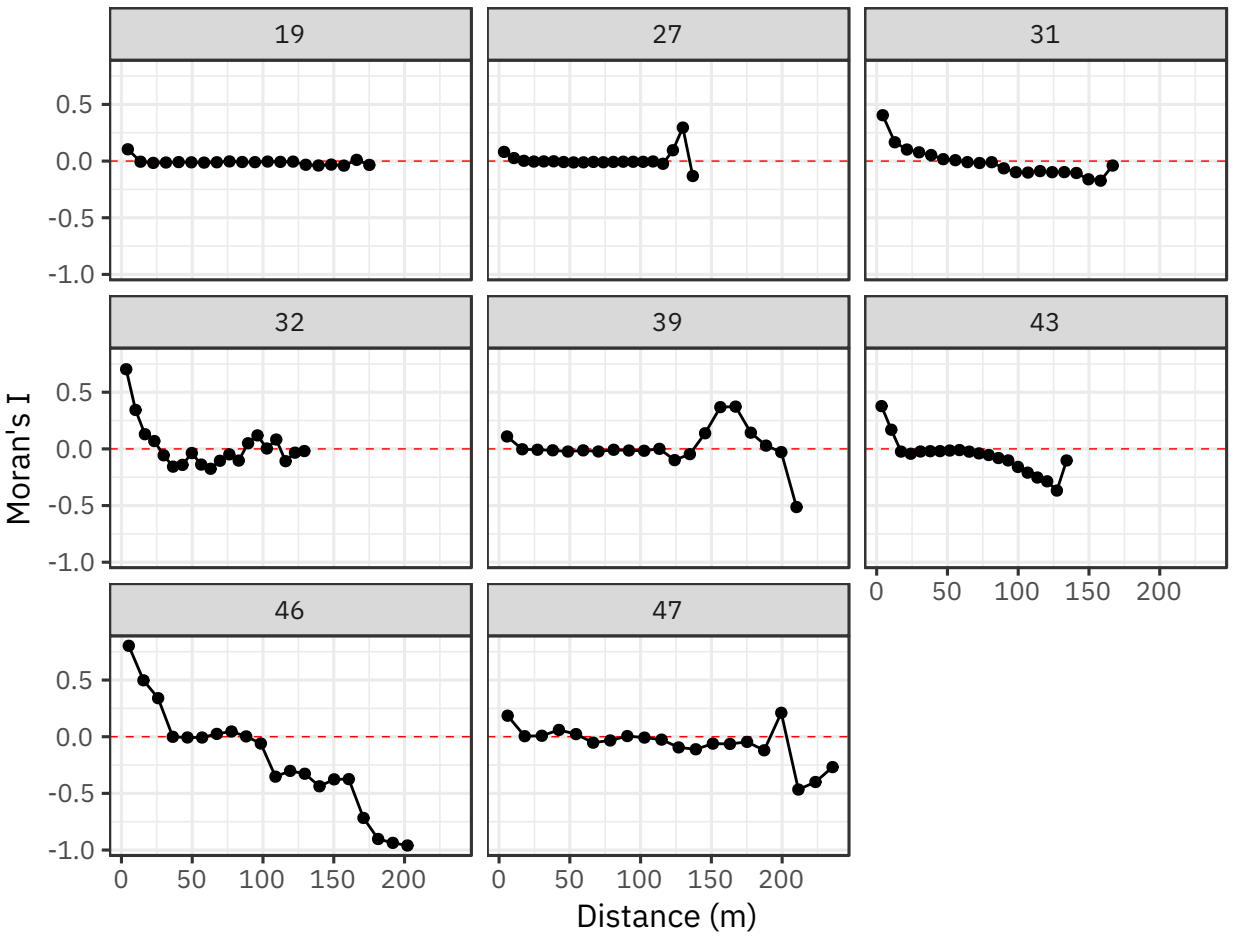


Supplementary Fig. 4: Example of fitted PvsE curve using equation 2.

Using photosynthetic parameters derived from PvsE curves, primary production was calculated as:

$$\text{Primary production} = ps \times (1 - e^{-\alpha \times \frac{PAR}{ps}}) \quad (3)$$

Spatial autocorrelation



Supplementary Fig. 5: Moran's I calculated from the SUIT transmittances (0^{-}).

References

Elzhov, T. V., K. M. Mullen, A.-N. Spiess, and B. Bolker (2013). *minpack.lm: R interface to the Levenberg-Marquardt nonlinear least-squares algorithm found in MINPACK, plus support for bounds*.