Remote Operated Vehicles under sea ice – Experiences and results from five years of polar operations

ROV Method

Operating ROVs under sea ice changes various paradigms of ROV operations as compared to bluewater operations. Heavy tether and vehicle trim as well as specialized navigation solutions are necessary for a smooth scientific investigation of the bottom side of sea ice. In spite of the challenges, ROVs provide a great tool for interdisciplinary sea ice science.

Influences of ice thickness and surface properties

The first ROV data showed, that recent changes in the physical properties of the Arctic ice pack lead to a significant increase in light transmission.

Anisotropic scattering coefficient

ROV data and laboratory experiments proved together with numerical modeling, that the light scattering coefficient in sea-ice is anisotropic.

Increasing Light transmittance

The seasonal parameterization was derived from the ROV data. It was used to upscale energy fluxes to the entire Arctic and reveals the spring-melt transition as the key factor influencing the energy budget.

Conclusions

Operations under sea ice require adjusted procedures (vehicle/tether trim, contingency plans, navigation solutions)

- Algal Aggregates

Spatial distribution and biomass of under-ice algal aggregates were analyzed from upward-looking imagery. Aggregate distribution was found to be tightly linked to sea topography and rapid aggregate sinking was found to be a provider of strong cryo-benthic coupling.

- Primary Productivity

The seasonal parameterization was combined with biological measurements of photosynthetic parameters for an Arctic-wide estimation of primary productivity. The algorithm performed well compared to productivity retrievals from satellite observations.

- Spectral transmittance measurements were used to derive in-ice chlorophyll a content

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