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Influence of ice thickness and surface properties on light transmission through Arctic sea ice.

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The observed changes in physical properties of sea ice such as decreased thickness and increased melt pond cover severely impact the energy balance of Arctic sea ice. Increased light transmission leads to increased deposition of solar energy and thus plays a crucial role for sea-ice-melt as well as for the amount and timing of under-ice primary production. Recent developments in underwater technology provide new opportunities to undertake challenging research at the largely inaccessible underside of sea ice.
We measured spectral under-ice radiance and irradiance onboard the new Nereid Under-Ice (Nereid-UI) underwater robotic vehicle, during a cruise of the R/V Polarstern to 83°N 6°W in the Arctic Ocean in July 2014. Nereid-UI is a next generation hybrid remotely operated vehicle (H-ROV) designed for both remotely-piloted and autonomous surveys underneath fixed and moving sea ice.
Here we present results from the first comprehensive scientific dive of Nereid-UI employing its interdisciplinary sensor suite. We combine under-ice optical measurements with three dimensional under-ice topography (multibeam sonar) and aerial images of the surface conditions. We investigate the influence of spatially varying ice-thickness and surface properties on the spatial variability of light transmittance on floe scale. Our results indicate that surface properties dominate the spatial distribution of the under-ice light field, while sea ice-thickness and snow-depth are most important for mean light levels.