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Acoustic communication and navigation in the Arctic Ocean

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Acoustic communication and navigation in the Arctic usually implies surface interaction because of the upward refracting profile. While open water leeds and polyna exist, sensors must also be deployed beneath the ice. Nominal roughness of several meters plus ubiquitous ice keels all lead to complicated multipath propagation typically of durations from .1 to 10 seconds. Pack ice drifts at scales of .1-.2 nm/s leading to doppler shifts/spreads of 2 - 8 Hz at 10-20 kHz carriers. These lead to highly spread channels with lots of ISI. Wise signal and code designs coupled with equalizers are critical to successful performance of acomms system even at low rates. Navigation such as by long base line systems encounter the same multipath. Path detectors and trackers are easily confused in determining interactions with the underside of the ice cover. Often, first arrivals are weak and do not trigger detectors. This leads to "lane" skipping by tracking algorthms and sychonization errors for acomms.. This implies clever "track association" algorithms to identify the arrival patterns and then transform them to locations which move with ice drift. This presentation outlines acoustic problems which communicaton and navigation systems must overcome using data take from several Arctic experiments.