Year-round observations of sea-ice drift and near-inertial internal waves in the Northwind Abyssal Plain, Arctic Ocean

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In this study, intra-annual variation of near-inertial internal wave (NIW) in the Arctic Ocean is examined using year-round mooring in the Northwind Abyssal Plain. Our emphasis is on dynamical responses of NIW to local sea-ice variables such as concentration, draft, and drift. We obtained those using a coupling system of ice profiling sonar (IPS) and an acoustic Doppler current profiler (ADCP) deployed at the top of the mooring. According to the wavelet spectrum, the inertial oscillation of ice drift becomes considerably strong during periods of ice formation and decay. Results show that the NIW amplitude in the upper part of the water column responds more sensitively to the sea-ice inertial oscillation than to the mean component of ice drift heading to the northwest. We also conducted an experiment with a mixed-layer slab model using the IPS-ADCP measured ice speed to examine the NIW generation responding to the ice-to-ocean stress. Experiment results suggest that the mixed-layer inertial oscillation is amplified in the early time of ice formation, through the ice-water resonance process. It is then concluded that the mixed-layer inertial current driven by ice drift is the primary driver of the enhanced NIW generation.

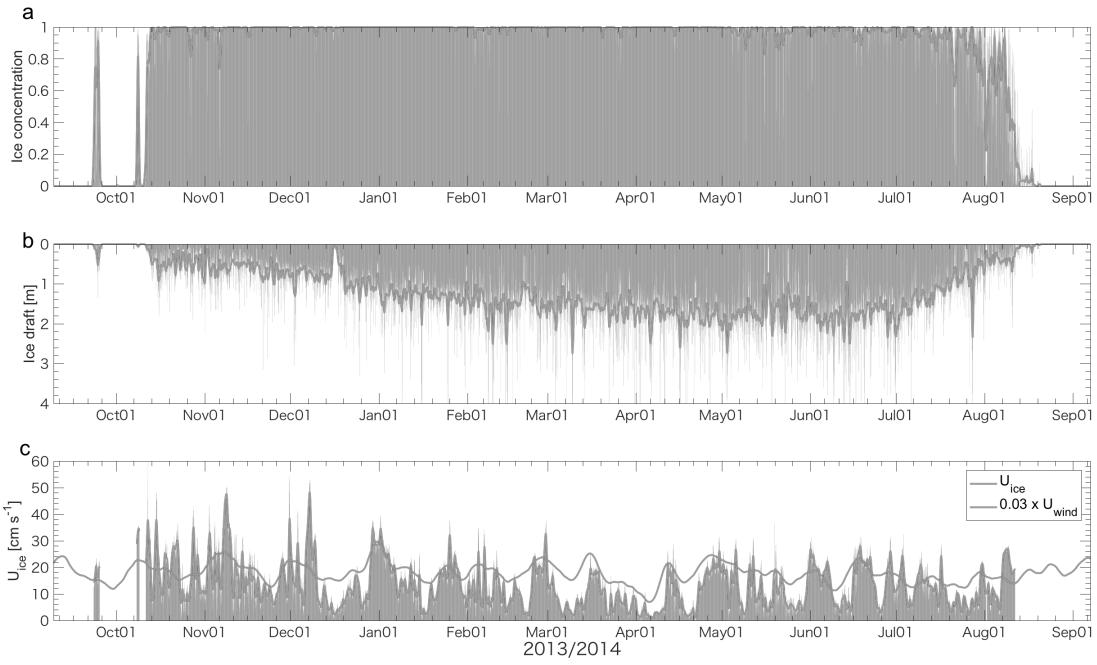

Figure: Time series of IPS-ADCP sea-ice variables: (a) sea-ice concentration (fraction: 0–1); (b) ice draft (m); (c) ice drift magnitude (cm s^{-1}). In each plot, the raw values are 24-h running averaged.

References

Kawaguchi, Y. et al., Year-round observations of sea-ice drift and near-inertial internal waves in the Northwind Abyssal Plain, Arctic Ocean, Polar Science, https://doi.org/10.1016/j.polar.2019.01.004, 2019.