An Elecromagnetic Under Ice Positioning System and An Underwater Drone for Under Ice

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Research under the ice in polar region are an important issue to understand mechanisms of ice melting. Autonomousunderwater vehicles (AUVs) or underwater drones are a promising platform which carries sensors. Observation data must include the observed position. But it is not easy to deploy an underwater localization system from the ice surface. In open seaan acoustical super short baseline (SSBL) system installed on a vessel or a boat is widely utilized. In ice-covered sea a localization system have to deploy from the ice surface because the ice prevents the entry of vessels. We need much effort and cost to dig a hole on the ice if we deploy SSBL systems since acoustic waves does not propagate in the ice. We propose an underwater localization system for AUVs or underwater drones. It consists of two major units: a short range positioning (SRP) unit using electromagnetic (EM) waves and a DVL (Doppler velocity log) - INS (inertial navigation system) hybrid unit. The SRP unit uses low frequency EM waves which can propagate in both of the ice and sea water. It is set on the ice, receiving GPS signal to fix self-location. It will transmit EM waves into the sea water through the ice up to several tens meters deep. A DVL-INS hybrid unit can measure relative position from a reference point within error of a few meters per km if the DVL receives valid reflection wave from the ice bottom. If the SRP unit covers the range of over 30 meters from the ice bottom, it will be placed in every 10 km on the ice. We have been studying which localization method is suitable for the proposed system. An underwater dorone (about 200 kg in weight) has also developed since 2017. We describe the drone system as well as the localization system in the conference.
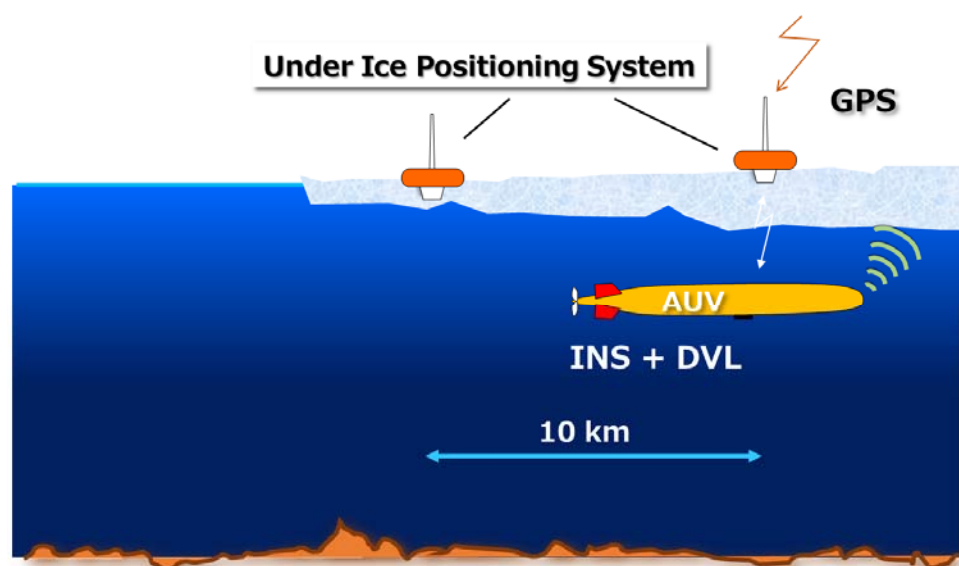

Figure 1.   Concept image of the under Ice Positioning System.