Measurements of lake ice thickness in the Saroma-ko Lagoon using the sledge-borne Electro-Magnetic induction device during 2013-2018

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Saroma-ko Lagoon located on the east coast of Hokkaido is 150km^2 in area, and 14.5 m in mean depth (Shirasawa et al., 1997). This lagoon has two inlets connected to the Sea of Okhotsk and is mainly supplied fresh water by two rivers. The lagoon water shows the salinity less than 32 ppt and freezes up every winter. Recent years, the lagoon had heavy snow fall and frozen over approximately 40-60% area. This study reports the results of investigation of snow, ice, and water in the Saroma-ko Lagoon since 2013.

We used an Electro-Magnetic induction device (EM) onboard a sled for the continuos measurement of total thickness (snow depth + ice thickness). Temprrature, conductivity and depth of lagoon water, in-situ snow depth and ice thickness are also measured on the stations. Figure 1 show the regression analysis of EM calibration during winters from 2013 to 2017. The difference between EM and drill-hole measurements were 7%, 15%, and 14% of total thickness in 2014 and 2016, in 2015, and in 2017, respectively. Large thickness difference appered in 2015 are considered to be caused by the bad snow/ice condition such as narrowness of freezing area and sparse data. In 2017, deep snow cover affected EM measurement. Effects of fresh water and water depth should be taken into account. Figure 2 shows an example of total thickness measured by EM and drill-hole in 2017. Total thicknesses in south eastern area is the thickest, because of influences of the Saromabetsu River inflow at south eastern and new ice tends to pile up by the north westerly wind during early winter.
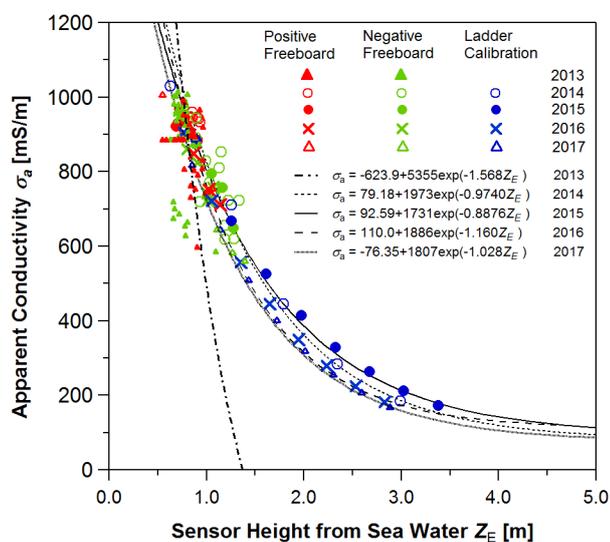

Figure 1.   The regression analysis of EM calibration in Saroma-ko Lagoon during the winter from 2013 to 2017
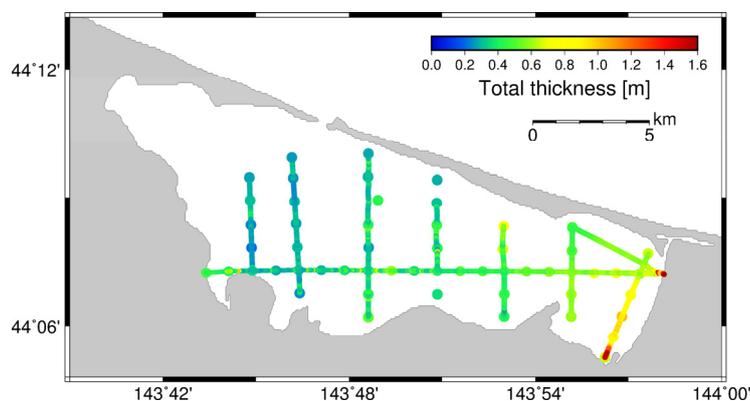

Figure 2. The distribution of total thickness using sled-borne EM and drilling in Saroma-ko Lagoon in 2017.

References

Shirasawa, K., M. Ikeda, M. Ishikawa, T. Takatsuka, M. Aota and Y. Fujiyoshi, Sea Ice Conditions and Meteorological Observations at Saroma- ko Lagoon, Hokkaido, December 1995 - November 1996, Low temperature science, Ser. A, 55, 47-77, 1997.