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Field observations of sea spray icing on lighthouses located on the west coast of Hokkaido, Japan

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Heavy sea spray icing on lighthouses severely affects their maintenance in the northern harbours that face the Sea of Japan. Small lighthouses on breakwater were initially not equipped with countermeasures for spray icing. We investigated the growth rate of sea spray icing by interval recording telephotographs.
The field observation was conducted at the Hamamasu harbor located on the west coast of Hokkaido. Two dummy lighthouses were set up on the north breakwater that has been made as intersect perpendicularly to primary wind direction of a seasonal wind in winter. The height of both the dummy lighthouses was approximately 4 m. During the winter of 2007?2008, 2008?2009 and 2009?2010, ice accretion on the dummy lighthouses was recorded by using a monitoring system constructed on a conventional lighthouse. The distance between the dummy lighthouses and the camera was 170 m.
Weather conditions and marine conditions during sea spray icing on the lighthouse were considered. To address the icing on the breakwater, sea spray generation, spray delivery and heat transfer for ice accretion are important. The parameter $(T_f-T_{avg})U$ was used for comparing with growth rate of spray ice in this preliminary analysis. The growth rate of icing was defined as an increase of projected ice area per unit time. U is average wind speed and $T_{avg}$is average air temperature. T_f= -1.9 ℃ was used because the salinity of seawater was approximately 3 % during the observational period. The wind velocity might be related to sea spray generation and spray delivery as well as conductive heat transfer. The growth rate of icing monotonically increased with the parameter $(T_f-T_{avg})U$, i.e. the heat losses by convective heat flux.

Keywords: ice accretion, sea spray, offshore structure, marine icing