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A WIND-DRIVEN, HYBRID LATENT AND SENSIBLE HEAT COASTAL POLYNYA AT BARROW, ALASKA

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The nature of the Barrow Coastal Polynya (BCP) formed off the Alaska Coast in winter is examined using mooring data (temperature, salinity, and ocean current), atmospheric re-analysis data (ERA-Interim), and AMSR-E-derived sea-ice concentration and production data (Iwamoto et al., 2014). Previously, the BCP has been considered to be a latent heat polynya formed by predominantly offshore winds resulting in sea-ice divergence. Recently, it has been suggested that the sea-ice production rate in the BCP is suppressed by warm Pacific- or Atlantic-origin waters distributed beneath the BCP (e.g. Itoh et al., 2012). In this study, we focus on the oceanographic conditions such as water mass distribution and ocean current structure beneath the BCP, which have not been fully documented. A mooring was deployed off Barrow, Alaska in the northeast Chukchi Sea (71.23°N, 157.65°W, water depth 55 m) from August 2009 to July 2010. During the freeze-up period from December to May, five BCP events occurred in the same manner; 1) dominant wind parallel to Barrow Canyon, with an offshore component near Barrow, 2) high sea-ice production followed by sudden cessation of ice growth, 3) upwelling of warm (>2 K above freezing point) and saline (>34) Atlantic Water (AW) beneath the BCP, 4) strong up-canyon flow (>100cm/s) associated with density fluctuations. A baroclinic current structure, established after the upwelling, resulted in enhanced vertical shear, promoting vertical mixing. The mixing event and open water formation occurred simultaneously, once sea-ice production had stopped. Thus, mixing events accompanied by ocean heat flux from AW into the surface layer were likely to form/maintain the open water area that is a sensible heat polynya. The transition from a latent to a sensible heat polynya was well reproduced by a pan-Arctic ice-ocean model (COCO). We propose that the BCP is a hybrid latent and sensible heat polynya, with both processes driven by the same offshore wind.