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The Aleutian Low – Beaufort Sea Anticyclone: A New Climate Index for Seasonal Melt of the Pacific Arctic Cryosphere

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ABSTRACT

Recent springtime climate extremes have been observed along the northern coast of Alaska. The dates when snow melted at Utqiaġvik (formerly Barrow) in 2015 and 2016 were the 4th and 1st earliest recorded, respectively, since 1902. These early years were followed by the latest date of snowmelt since 1988 in 2017 and the latest date since 1947 in 2018. The range of these melt dates spans 41 days across the months of May and June, expressing large interannual variability in the arrival of spring in northern Alaska during recent years. Previous work implicates northward advection of warm air circulating around the Aleutian Low during years of early melt and blocking by the Beaufort High during years of later melt, and it is the juxtaposition of the two pressure centers that is influential for northern Alaska. However, the spatial and temporal variability of the melt timing is also sensitive to subtle variations in the way air circulates around these dominant pressure centers. For example, while the Beaufort High helped preserve snowpack at Utqiaġvik in 2017, circulation patterns also favored the transport of warmer air to points along the northern coast east of Utqiaġvik, which contributed to an earlier melt there. This suggests that the position of a high-pressure ridge to the east of the Aleutian Low is also important in modulating the timing of snowmelt regionally. We investigate these relationships using reanalysis, satellite retrievals, and surface-based data sets. We expand the analysis spatially beyond terrestrial snow cover to also analyze the spatial patterns in the timing of the onset of melt over sea ice in the Chukchi and Beaufort seas. We introduce a new 4-point climate index based on regional 850 hPa GPH called the Aleutian Low – Beaufort Sea Anticyclone (ALBSA). ALBSA tracks the synergy of the Aleutian Low and Beaufort High and is shown to explain some of the variance in the melt metrics over both the terrestrial and marine

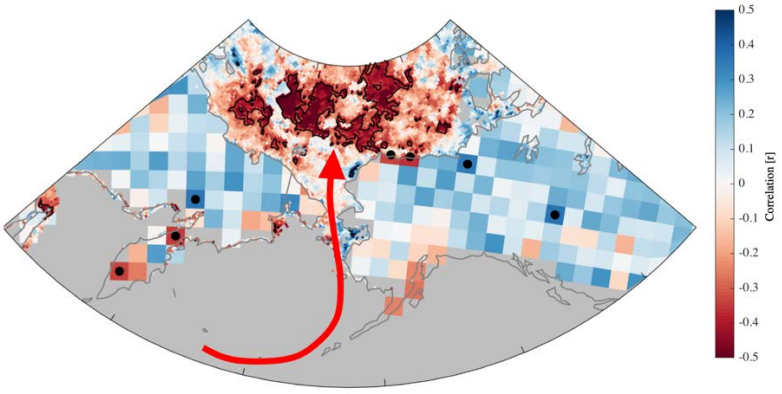

Fig. 1 Correlation (r) between ALBSA in May 1979-2017 and a combination of satellite observations; the date of snow melt derived from the Northern Hemisphere Snow Cover Extent (NH-SCE) (terrestrial regions) (Estilo *et al.* 2015) and the date of melt onset over sea ice derived from SSM/I passive microwave data (sea ice regions) (Markus *et al.* 2009). Dots (land) and solid contour (ocean) denote areas of statistically significant correlation ($p < 0.05$).

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regions. The index is therefore suitable for monitoring changes in regional circulation and may be useful for developing seasonal-scale predictive tools.

Reference

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