The Aleutian Low – Beaufort Sea Anticyclone: A Climate Index for Predicting the Timing of Springtime Melt in the Pacific Arctic Cryosphere

C.J. Cox[1,2], R.S. Stone[3,4], D.C. Douglas[5], D.M. Stanitski[4], and M.R. Gallagher[1,2]

[1]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-4518, E-mail: christopher.j.cox@noaa.gov
[2]NOAA Earth System Research Laboratory, Physical Sciences Division (PSD), Boulder, CO 80305
[3]Science and Technology Corporation, Boulder, CO 80305
[4]NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305
[5]USGS Alaska Science Center, Juneau, AK 99801

Early and late extremes in the timing of snowmelt have recently been observed in the Pacific Arctic. Subseasonal-to-seasonal forecasts of this timing are important for industry, environmental management and Arctic communities. In northern Alaska, the timing is influenced by the advection of marine air from the north Pacific by the Aleutian Low, modulated by high pressure centered in the Beaufort Sea. A new climate index that integrates their interaction could advance melt predictions. We define this index based on 850 hPa geopotential height at four fixed locations referred to as the Aleutian Low – Beaufort Sea Anticyclone (ALBSA). During positive ALBSA in May, advection of +0.5–1.5 K/day is observed through the Bering Strait. ALBSA is correlated with both snowmelt in northern Alaska and the onset of sea ice melt over the adjacent seas. ALBSA, therefore, may be suitable for monitoring the relevant circulation patterns and for developing predictive tools.

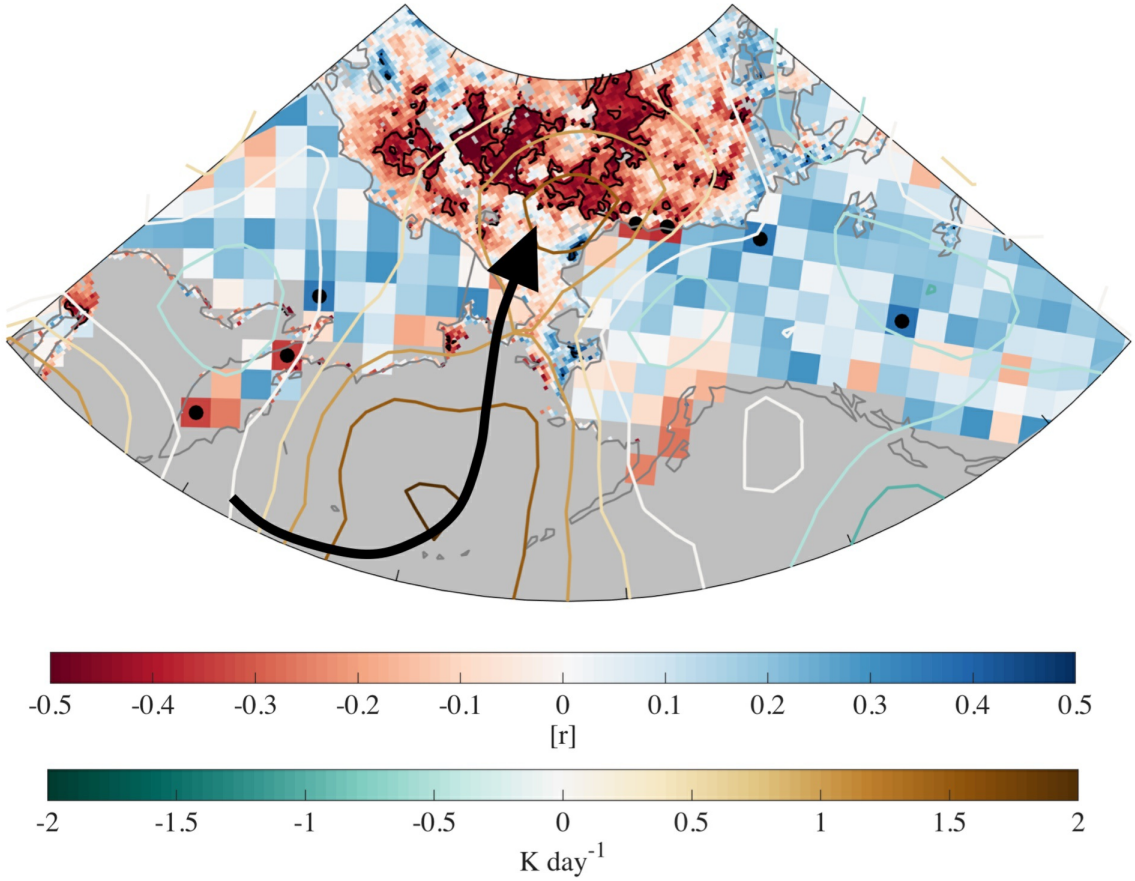

Figure 1. Correlation (r) between average May ALBSA and the timing of melt onset over sea ice (ocean pixels, 1979–2017) and the date of snowmelt over land (land pixels, 1979–2018). Dots over land and contours over ocean mark pixels with statistically significant correlations nominally for $p < 0.05$, but adjusted to a stricter threshold of ~0.04 to account for false discovery rates for tested pixels inside the domain. Black arrow is the approximate path of advection in early melt years. Advection (u + v) is shown for days with ALBSA > +1σ based on all days in May, 1979–2018.