Relationships among the Beaufort Sea High, sea ice melt back and Pacific-origin and melt water masses in Barrow Canyon

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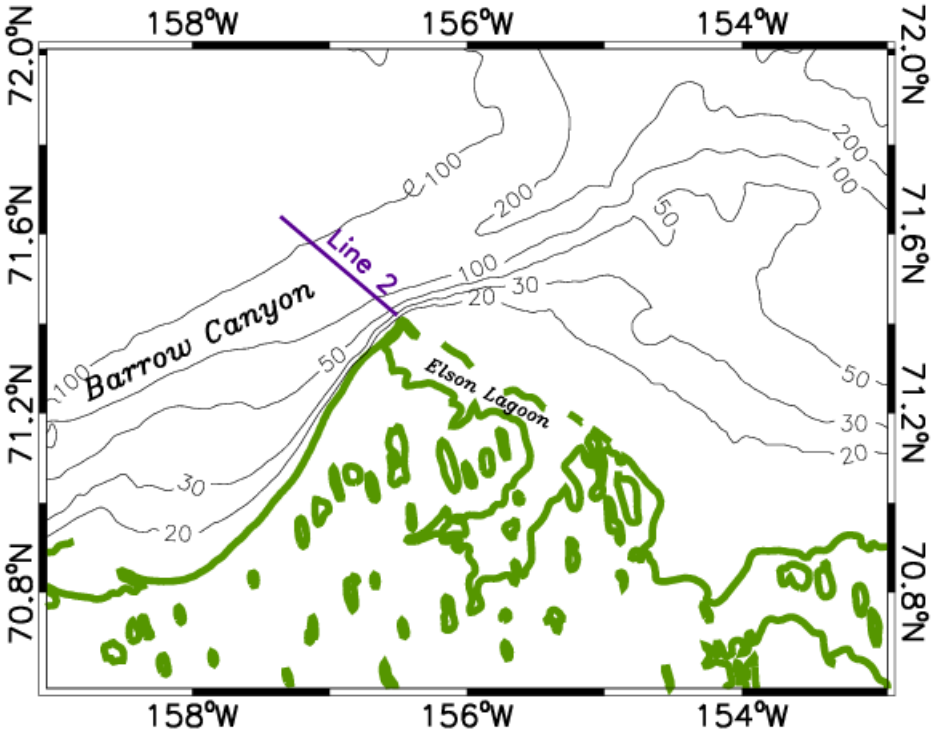
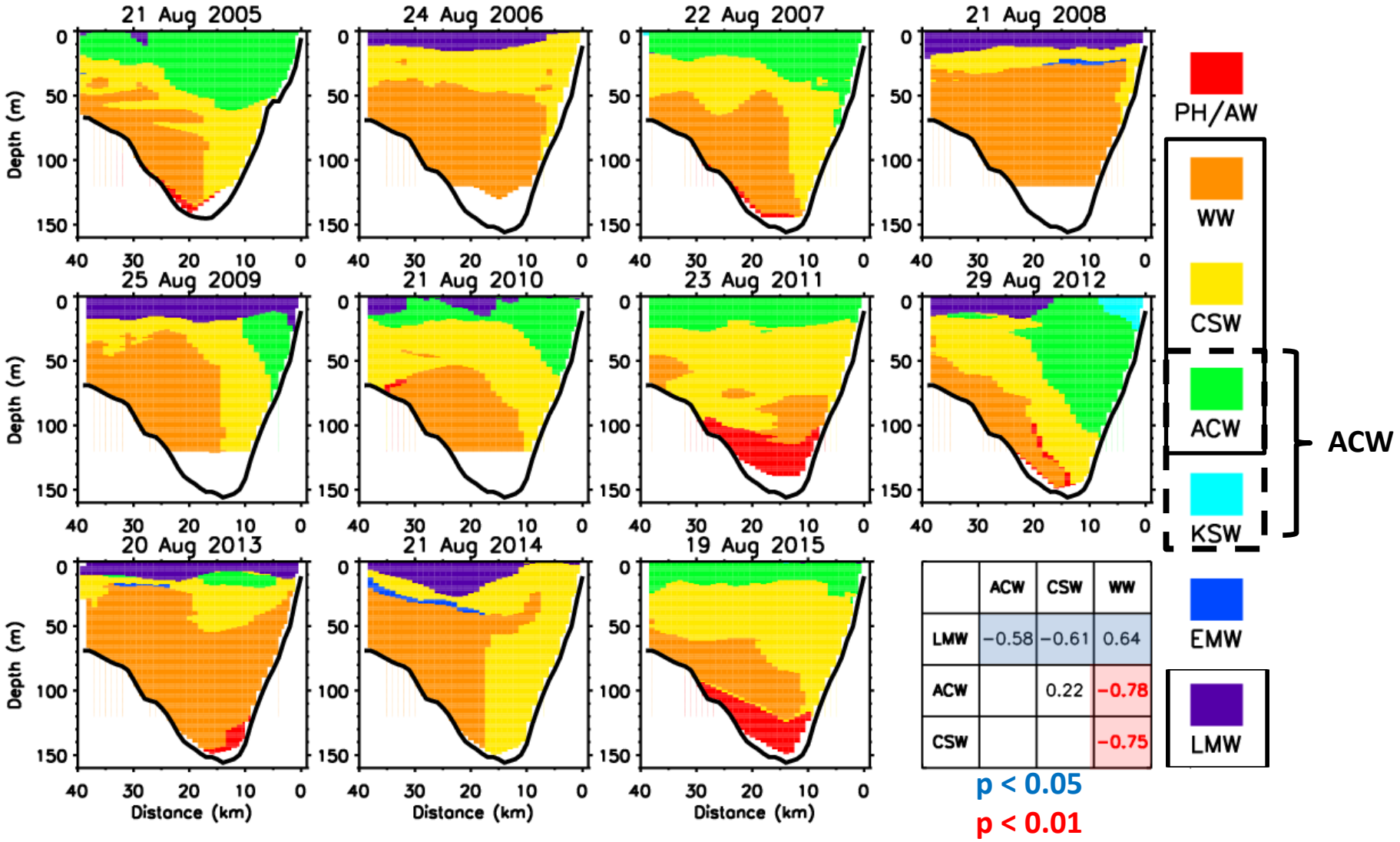


Line 2 sampled each year, 2005 – 2015, during the third week in August

Water mass volumes vary interannually



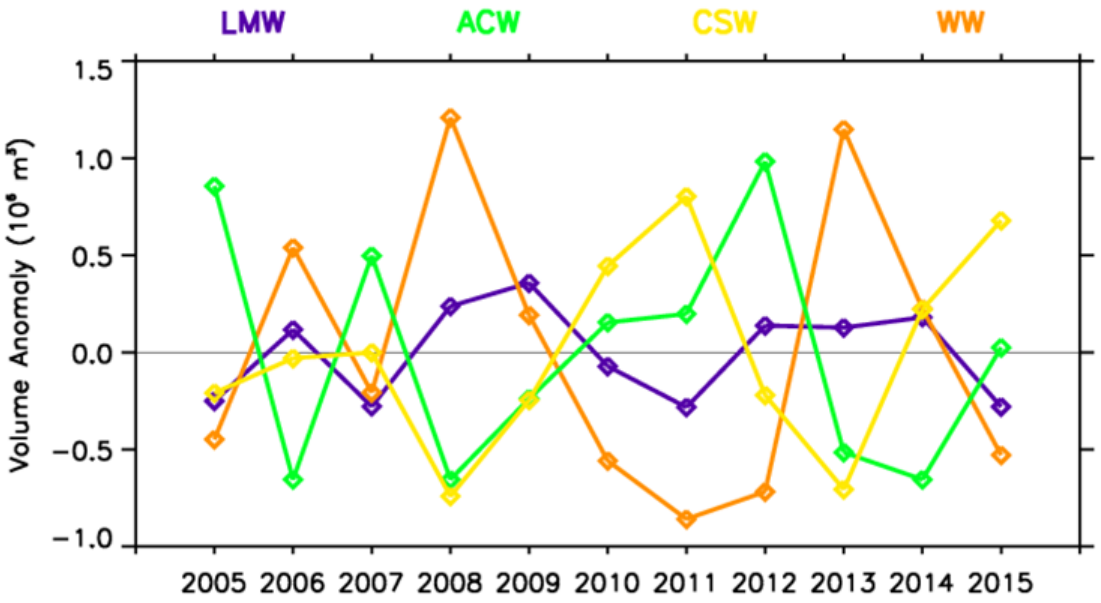
	ACW	CSW	WW
LMW	−0.58	−0.61	0.64
ACW		0.22	−0.78
CSW			−0.75

$p < 0.05$

$p < 0.01$

Melt Water and Winter Water were significantly positively correlated with each other and negatively correlated with Alaskan Coastal Water and Chukchi Summer Water

Water Mass Volume Anomalies



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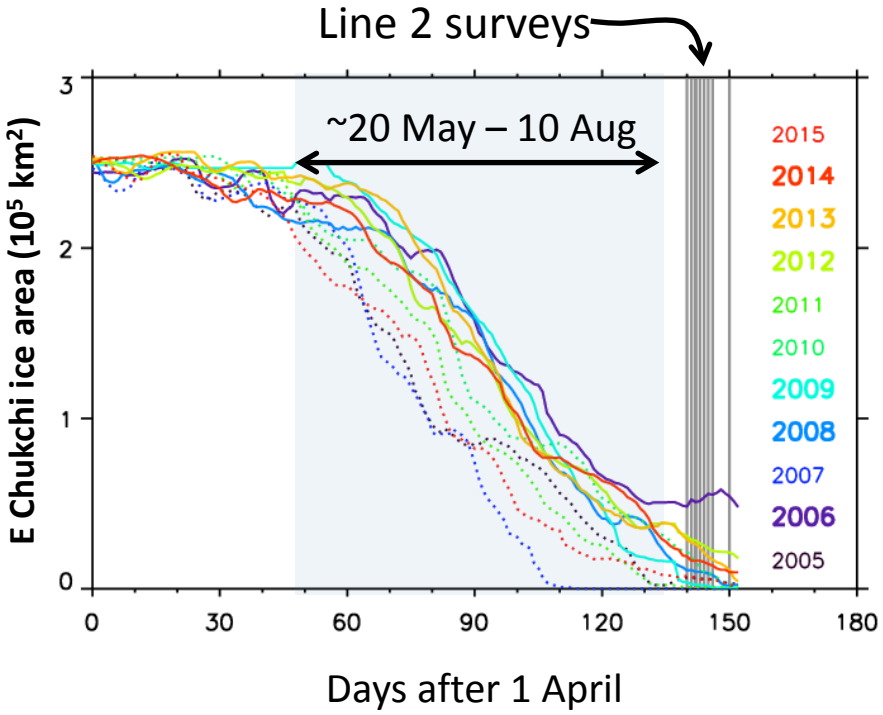
p < 0.05
p < 0.01

Volumes computed for 110 m ≤ Z ≤ 0 m. Results do not differ greatly if data for unsampled depths are extrapolated.

Eastern Chukchi Sea sea ice extent through melt season shows that low LMW anomalies occurred in early melt back years (and vice versa)



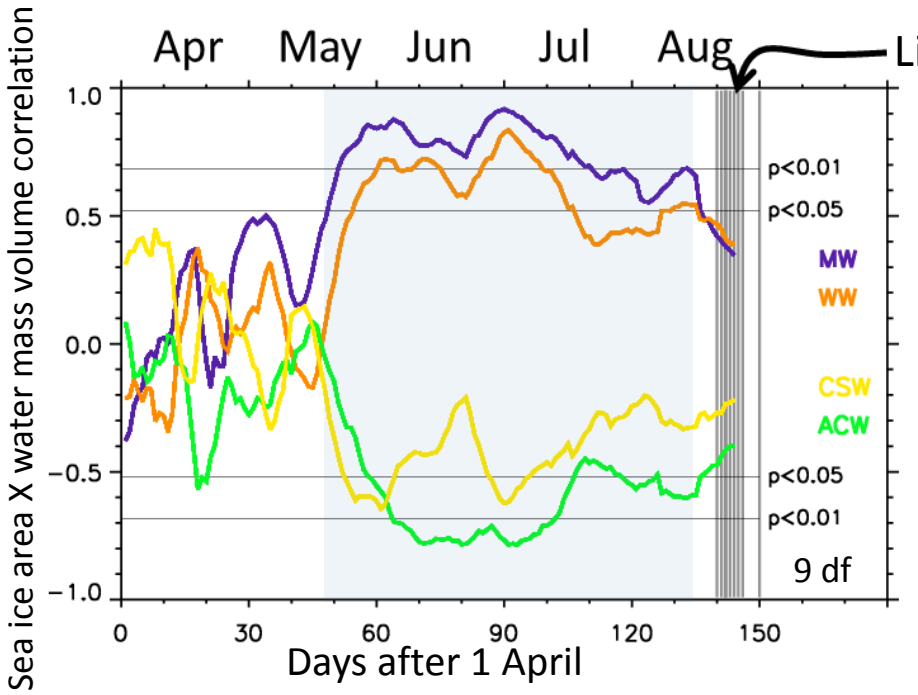
~Late May to early August corresponds to the Chukchi sea ice melt back period.

Solid lines, boldface years: LMW'>0, late melt back

Dotted lines, small font years: LMW'<0, early melt back

Daily Mean Sea Ice Concentration ¼° x ¼° ftp://ftp.cdc.noaa.gov/Datasets/noaa.oisst.v2.highres/icec.day.mean.yyyy.v2.nc

Eastern Chukchi ice area in ~June is a good predictor of late August relative water mass volumes in Barrow Canyon.



Late August water mass volumes in Barrow Canyon are significantly correlated with daily sea ice area in the eastern Chukchi for much of the period from late May to early August.

Strongest correlations among BC water masses and Chukchi shelf ice area (in a 10° window, z<150 m) are for 169°W-159°W

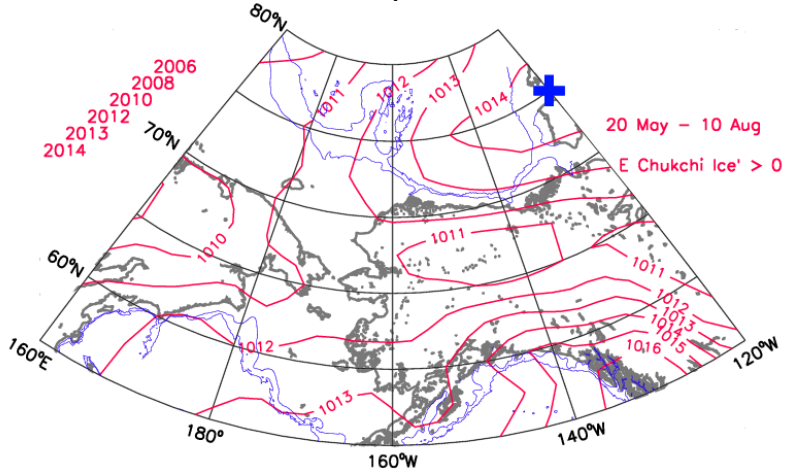
Late melt back: more LMW, WW less ACW, CSW
Early melt back: more ACW, CSW less LMW, WW

WHY?

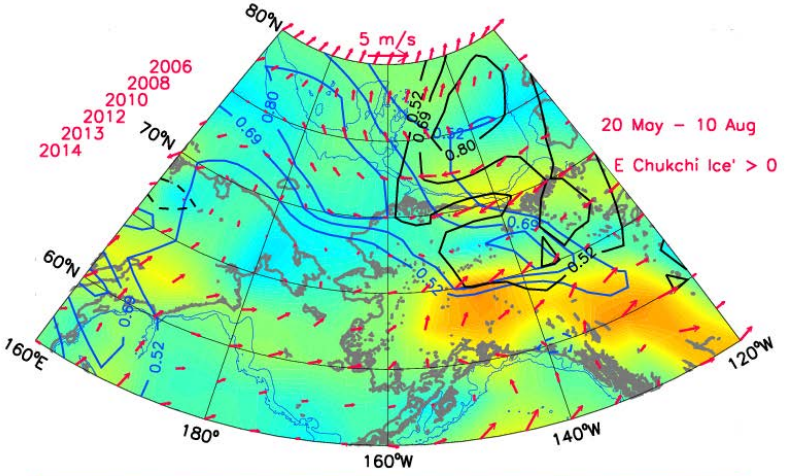
Rogers, 1978; Maslanik et al., 1999; Ogi et al., for example, 2008 show that summer SLP anomalies mediate late summer (Arctic) sea ice extent through wind-induced Ekman drift.

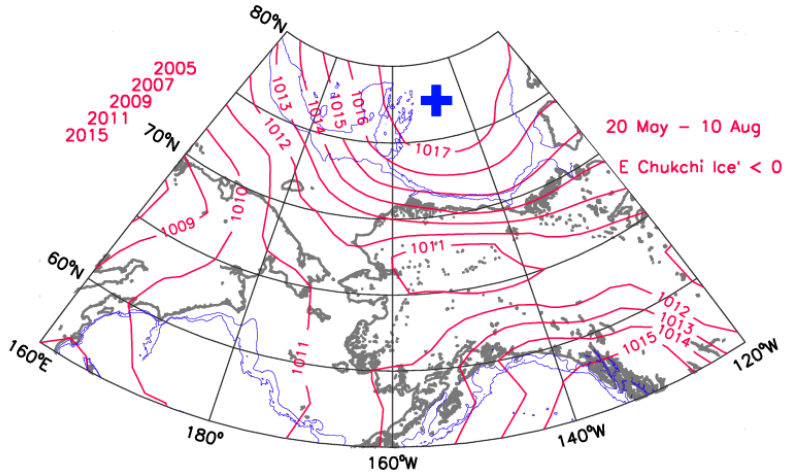
Daily sea ice (or open water) area reflects the time-integrated (average) response to wind forcing

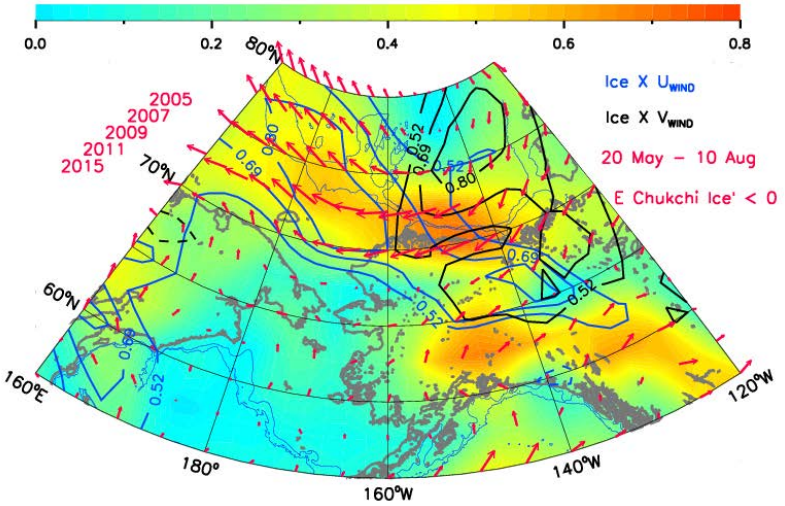
Late melt back
weak BSH, displaced to east



Late melt back
weak, variable easterlies
over N Chukchi







Early melt back
strong BSH, displaced to west;
deeper Siberian Low

Early melt back
strong, persistent easterlies over N Chukchi
(northward Ekman transport of ice)

(Daily NCEP 2.5° x 2.5°)

Summary

Late-August volumes of Pacific-origin and melt water masses in Barrow Canyon are significantly correlated with daily sea ice areas in the E Chukchi for much of the melt back season

- early melt back $\rightarrow$ more open water $\rightarrow$ solar warming of sfc waters $\rightarrow$ more ACW, CSW
- late melt back $\rightarrow$ more ice cover $\rightarrow$ less solar warming of sfc waters $\rightarrow$ more LMW, WW

The Pacific-Arctic pressure head responds to changes in wind forcing over the western Chukchi and eastern Siberian Sea (not shown).