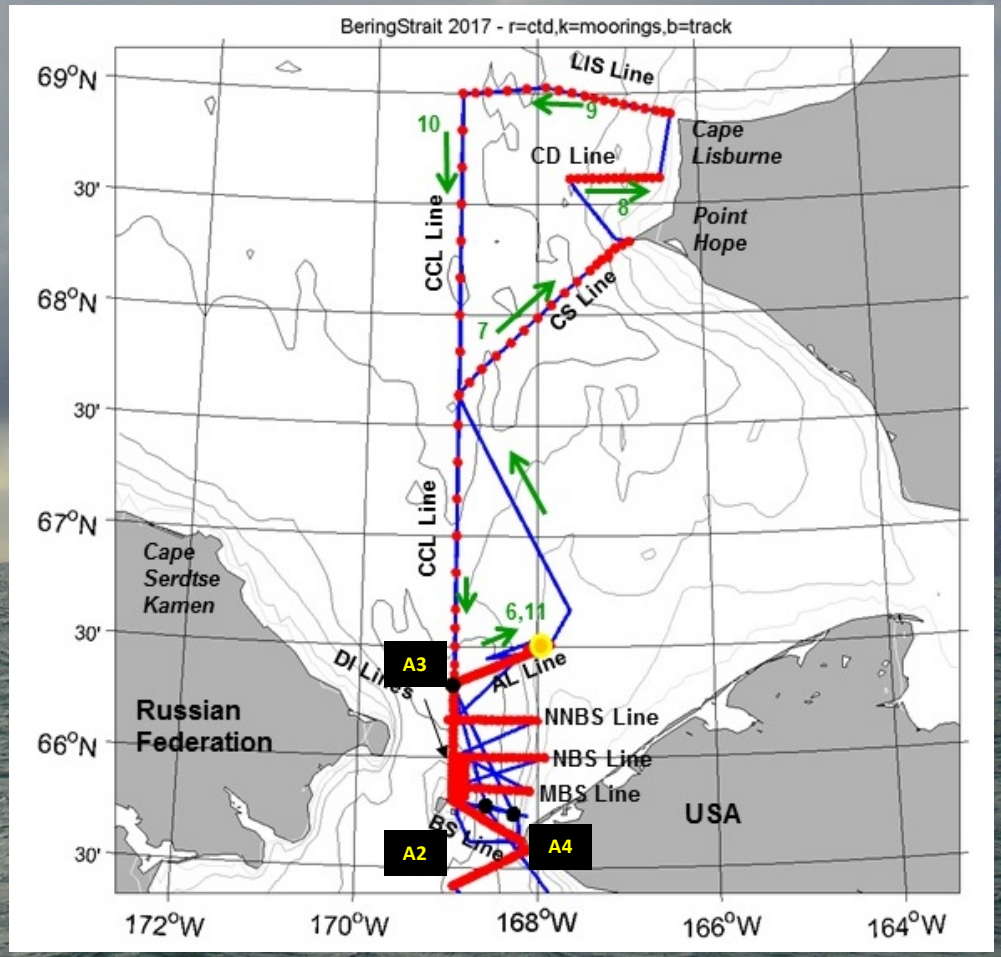
Bering Strait Mooring Program – 2017 Updates

Rebecca Woodgate *University of Washington, Seattle, USA*

Funded by NSF-AON

Our July 2017 Norseman 2 cruise recovered & redeployed the 3 Bering Strait moorings, and took CTD sections, finding the Chukchi remarkably warm



Black dot = moorings
Red dot = CTD
Blue line = underway
Yellow dot = Glider deployment

From Woodgate et al., 2017 Norseman2 Cruise Report

Find data, reports and papers at:
psc.apl.washington.edu/Bstrait.html

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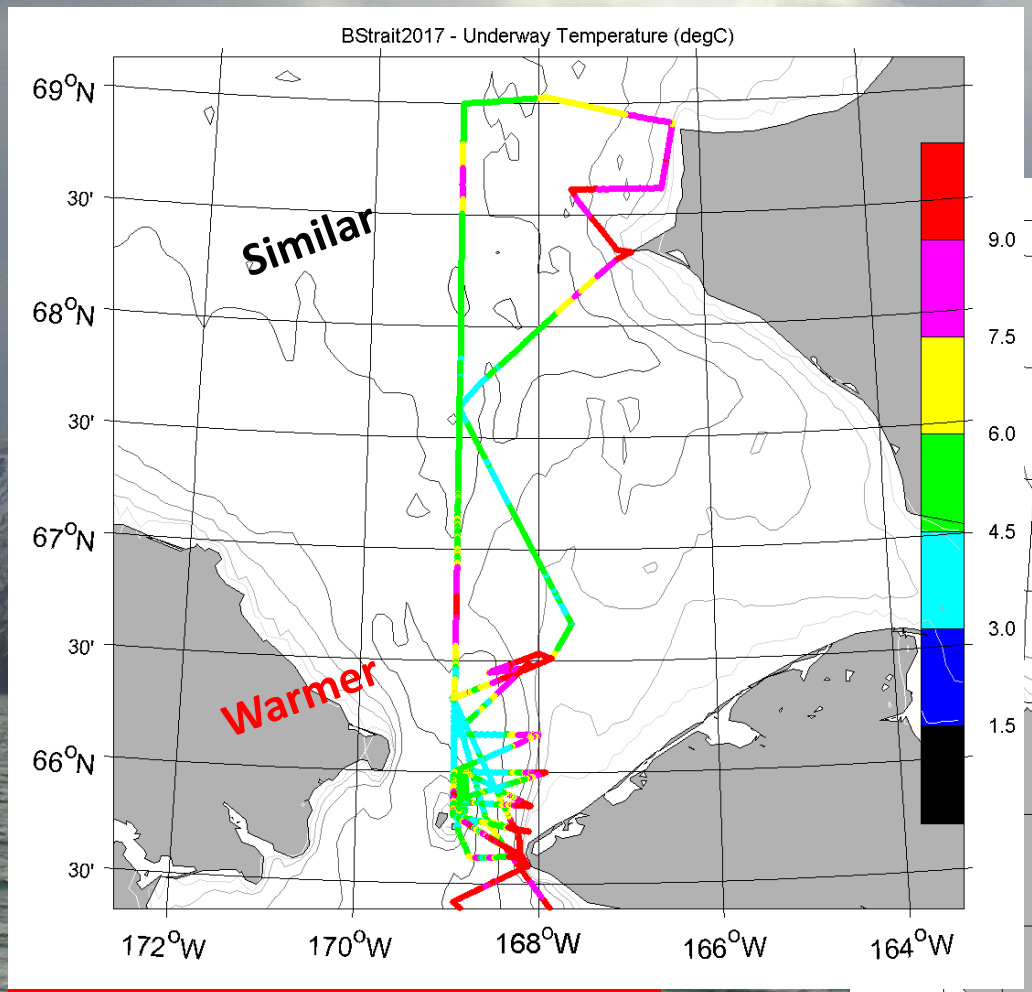
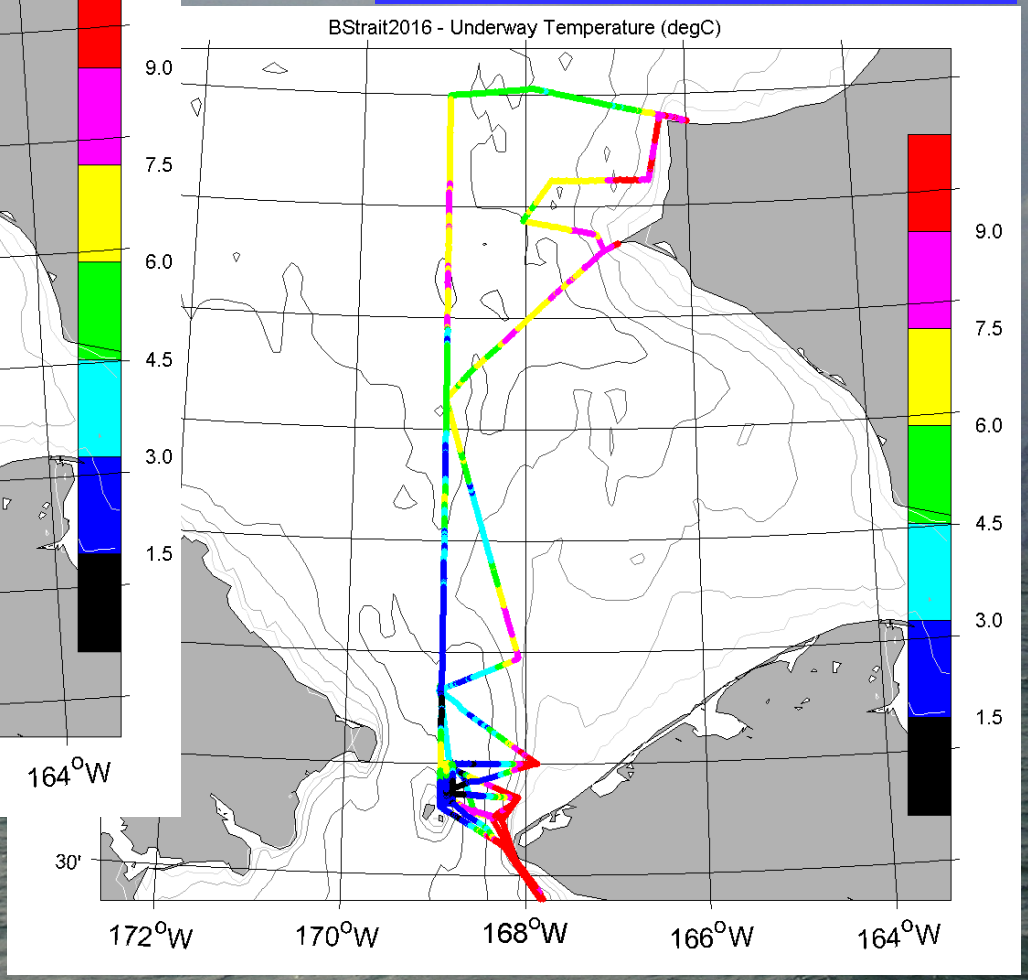


Bering Strait 7th-15th July **2017**

Bering Strait 7th-15th July **2016**



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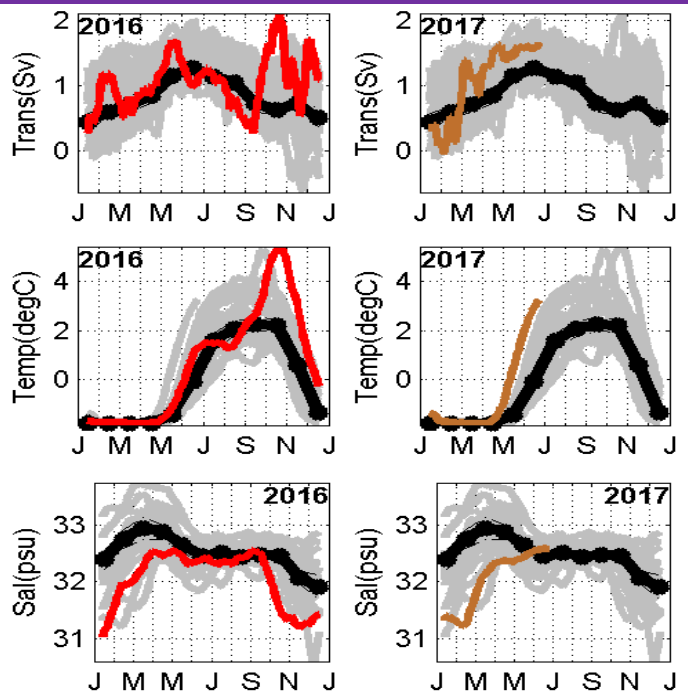
2016/2017
Remarkably warm & fresh



Color=2016 or 2017 30day smoothed data.
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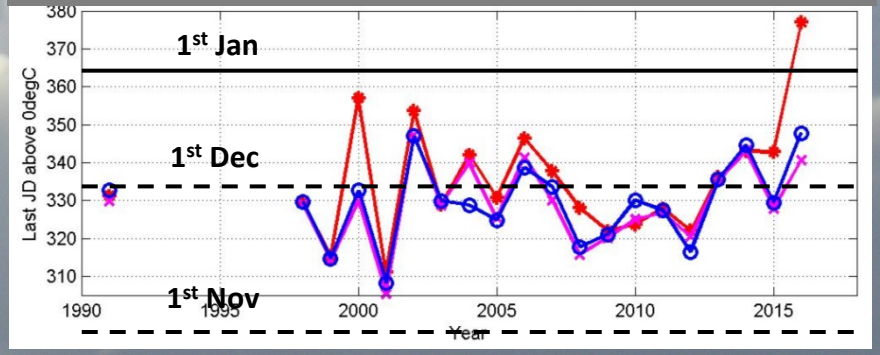
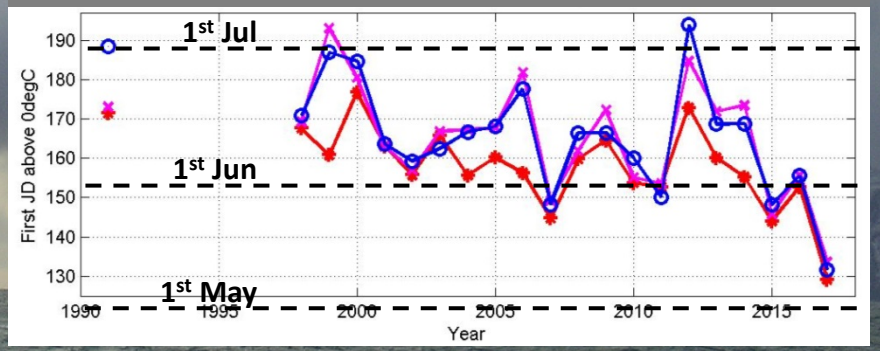
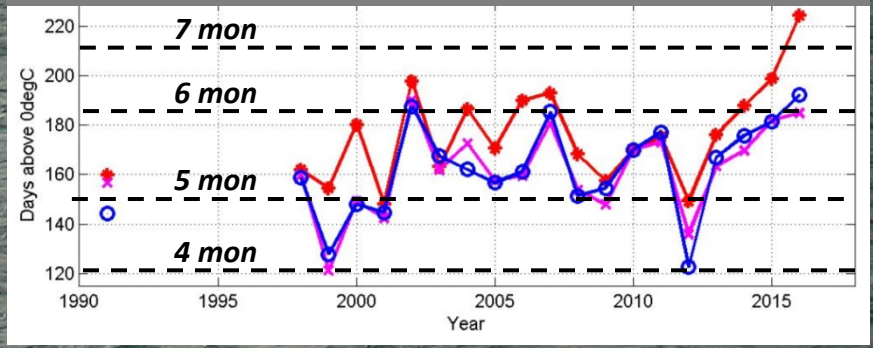
LAST Day above 0°C



FIRST Day above 0°C



Number of Days in year above 0°C



- ***Oct 2016 & June 2017 both 3°C warmer than climatology***
- ***~20 day late cooling in 2016***
- ***~15 day early warming in 2017***
- ***Salinities 0.5-1psu fresher than climatology***

A3 DATA
Red=hourly
Mag=7day smoothed
Blue=30 day smoothed

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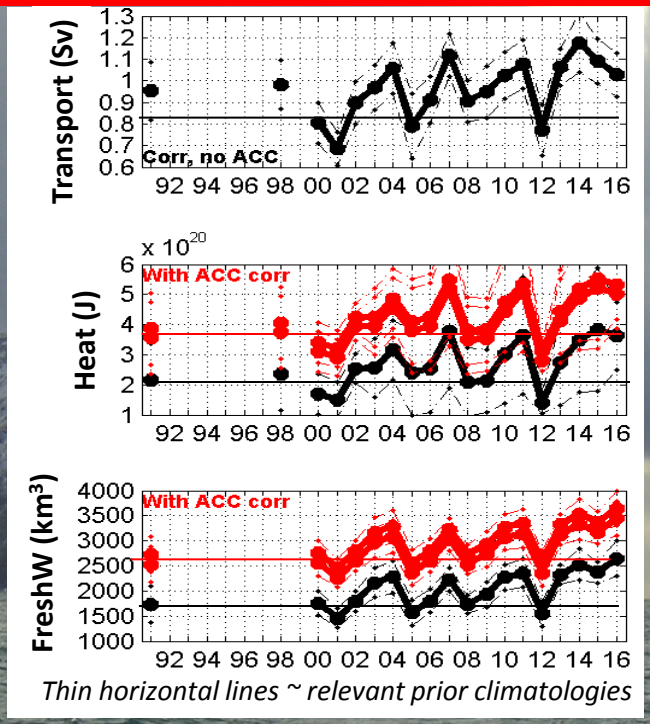
** For 2000s, annual average ~ 1.0Sv (not 0.8Sv of 1990-2004 climatology)*

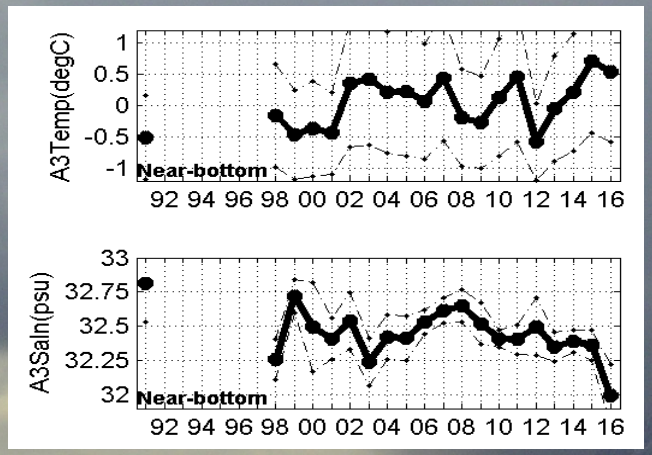
** Changes SEASONAL, greatest in summer (flow increase, early warming) + winter freshening*

Still Increasing annual mean fluxes



Thin horizontal lines ~ relevant prior climatologies

Trans ≥1Sv; FW~3500km³/yr *(cf 34.8psu)*
Heat ~5x10²⁰J/yr ~15TW *(cf -1.9°C)*



Significantly increasing annual mean fluxes
Mostly driven by volume flux increase

Due to far-field pressure head forcing (no trend in local wind)

Warming and Freshening

No trend in Alaskan Coastal Current

Woodgate, 2017, in review, PiO

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A New Monthly Climatology for the 2000s to include the Alaskan Coastal Current and Stratification (2003-2015)

Velocity (cm/s)

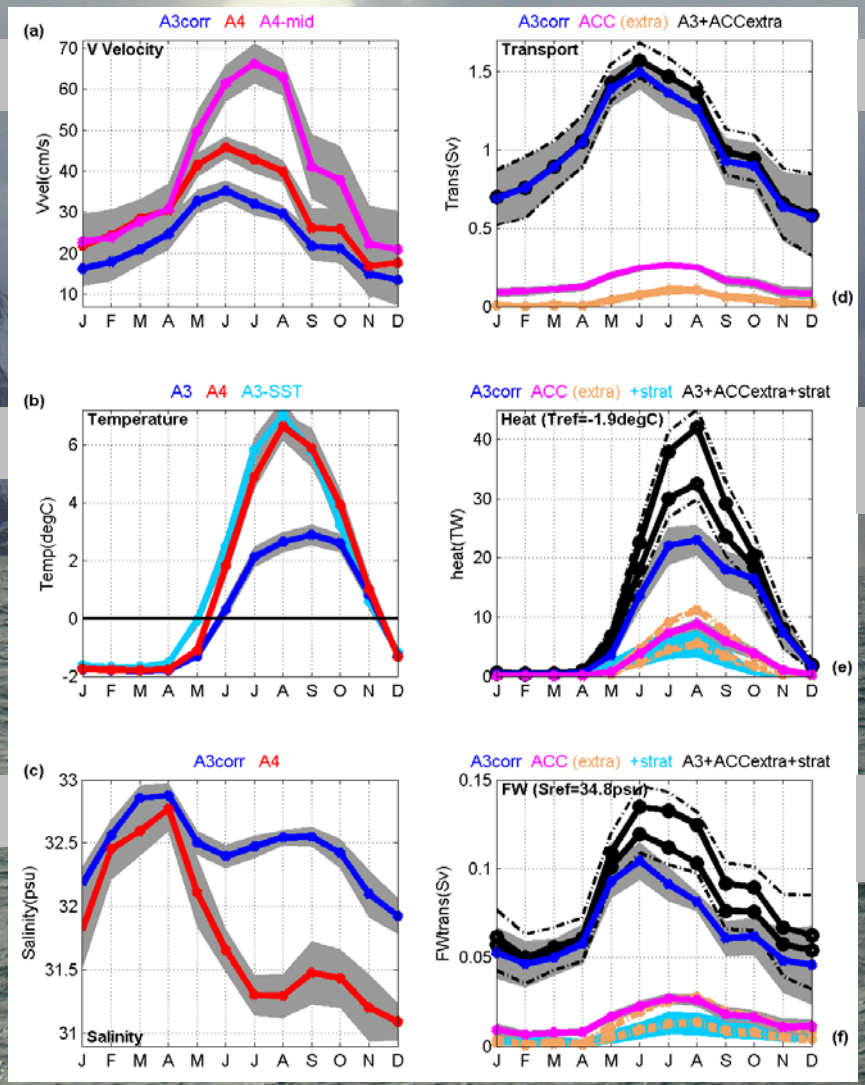
Transport (Sv)

Temperature (°C)

Heat Flux (TW)
Tref=-1.9°C

Salinity (psu)

Freshwater Flux (Sv)
Sref=34.8psu



Blue=A3 Data
Red=A4 Data
Mag=Alaskan Coastal Current
Cyan=SST/Stratification
Black=Totals including ACC & stratification

Woodgate, 2017, in review, PiO

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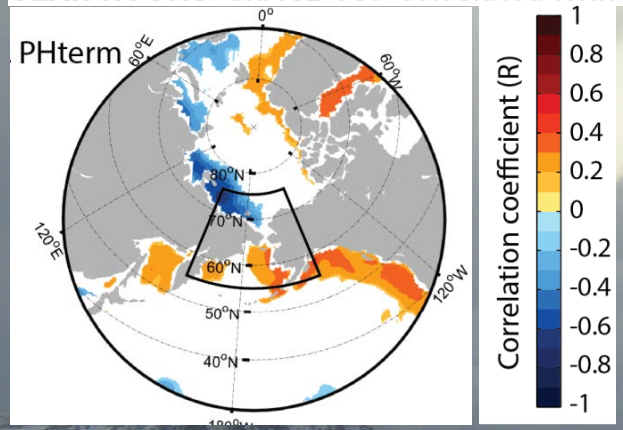
What drives Bering Strait Change?

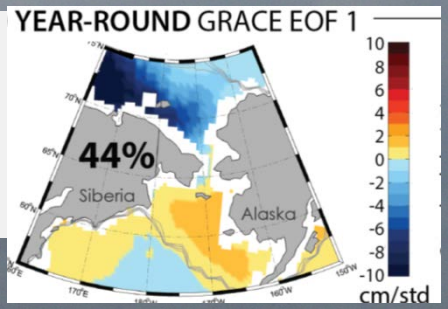
NOT local wind

YEAR-ROUND GRACE OBP correlated with:

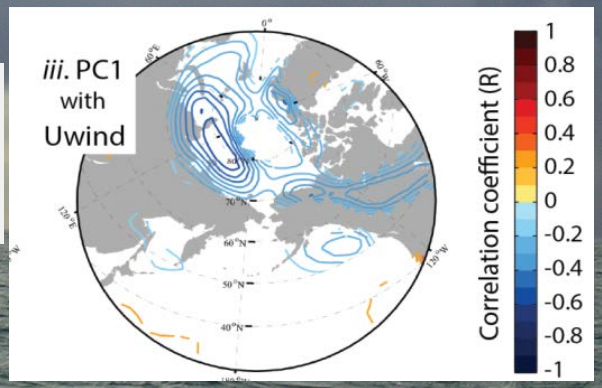


GRACE (Ocean Bottom Pressure) variability significantly correlated with strait's pressure head driven flow

First EOF of GRACE (r~0.59 with pressure-head flow) shows a **low East Siberian Sea (ESS) - high Bering Sea Shelf pattern**



* Strongly linked to **Arctic wind** patterns (westward wind along the Arctic coasts)



Westward wind over ESS
- Ekman flow off ESS
- low OBP in ESS
- increased northward BS flow

* **Year round** (35% of pressure-head variance) and in **summer** (71% of pressure head variance), link to **East Siberian Sea variations is dominant**
* **Winter**, **Bering Sea Shelf** more important

Suggests Bering Strait variability may be driven from the Arctic, + some Bering Sea effects

Peralta-Ferriz & Woodgate, 2017, in press, GRL

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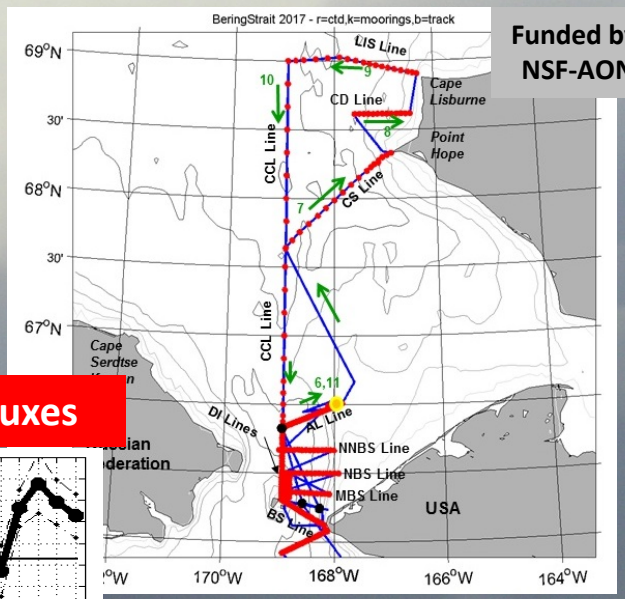
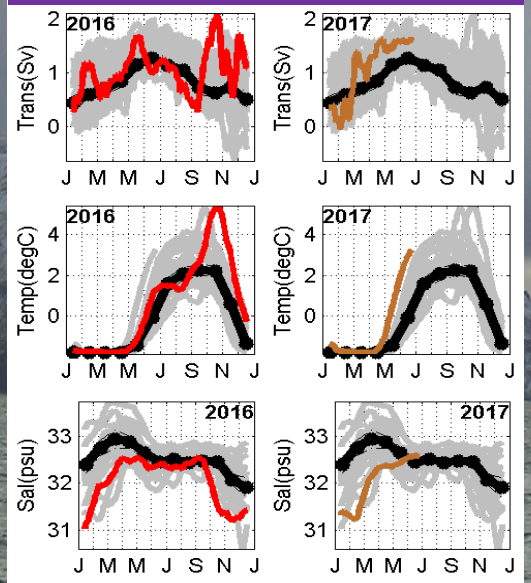


Recovered data show:

2016/2017 Remarkably warm & fresh



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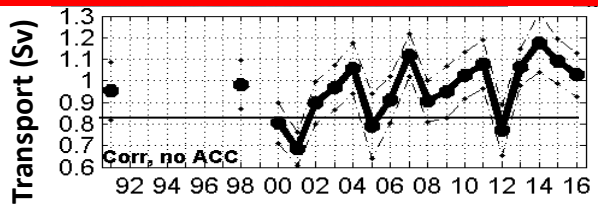

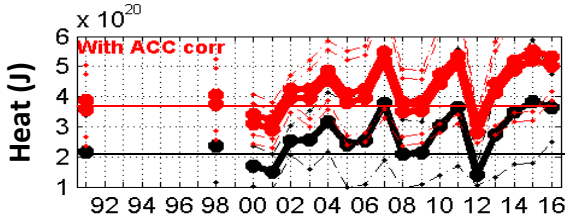

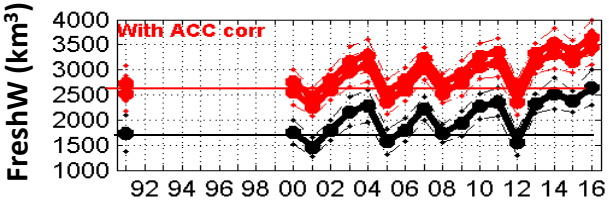

Thin horizontal lines ~ relevant prior climatologies

Recent papers document also:
*** trends in seasonal changes**
*** flow increase driven by pressure head, far field forcing;**
*** patterns of the pressure head forcing, finding flow dominantly driven from the Arctic**

Woodgate 2017 in review PiO
Peralta-Ferriz & Woodgate 2017 GRL

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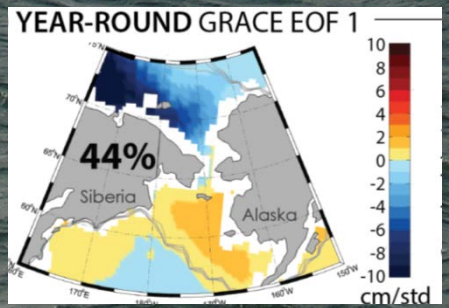

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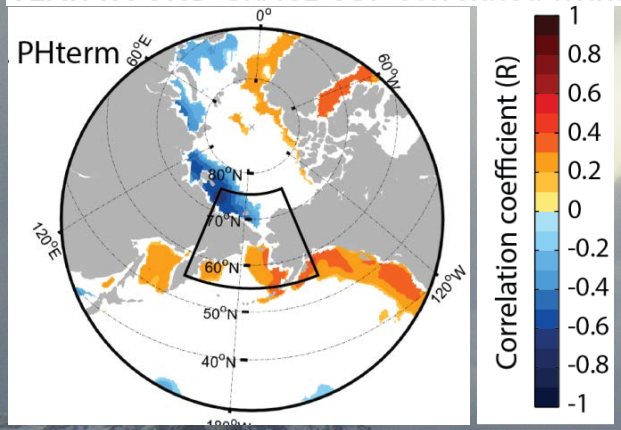
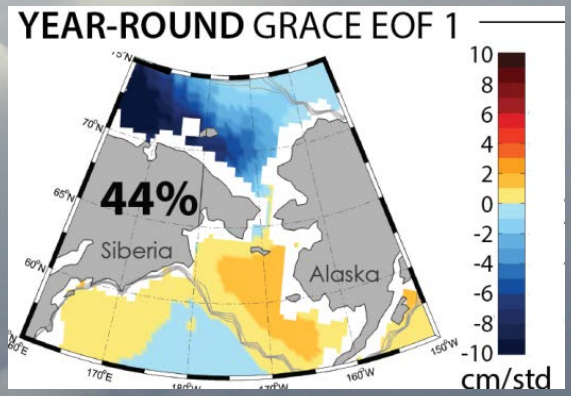
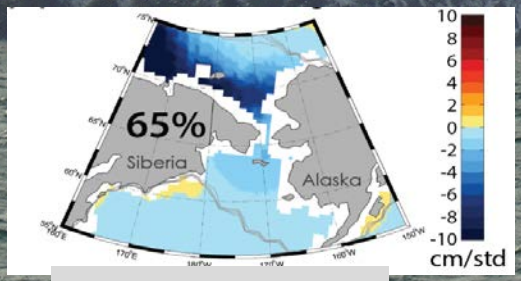


YEAR-ROUND GRACE EOF 1



SUMMER (June - August)

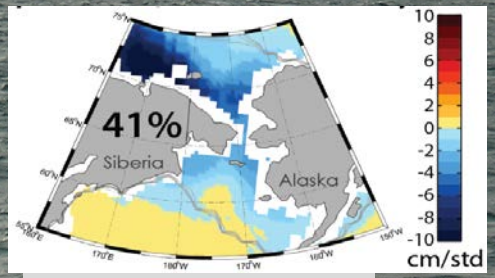
GRACE EOF 1



$R_{(PC1 \& vvel)} = 0.81$
$R_{(PC1 \& PHterm)} = 0.84$

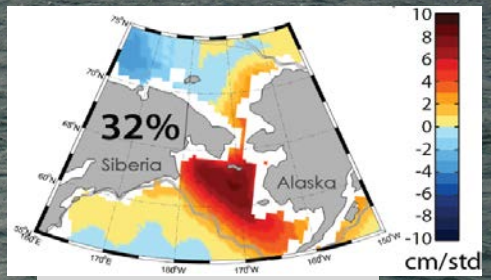
WINTER (December - February)

GRACE EOF 1



$R_{(PC1 \& vvel)} = 0.25$
$R_{(PC1 \& PHterm)} = 0.31$

GRACE EOF 2



$R_{(PC2 \& vvel)} = 0.57$
$R_{(PC2 \& PHterm)} = 0.50$

Peralta-Ferriz & Woodgate, 2017, in press, GRL