Preliminary results for the Bering Sea and Pacific Sector of the Arctic Ocean

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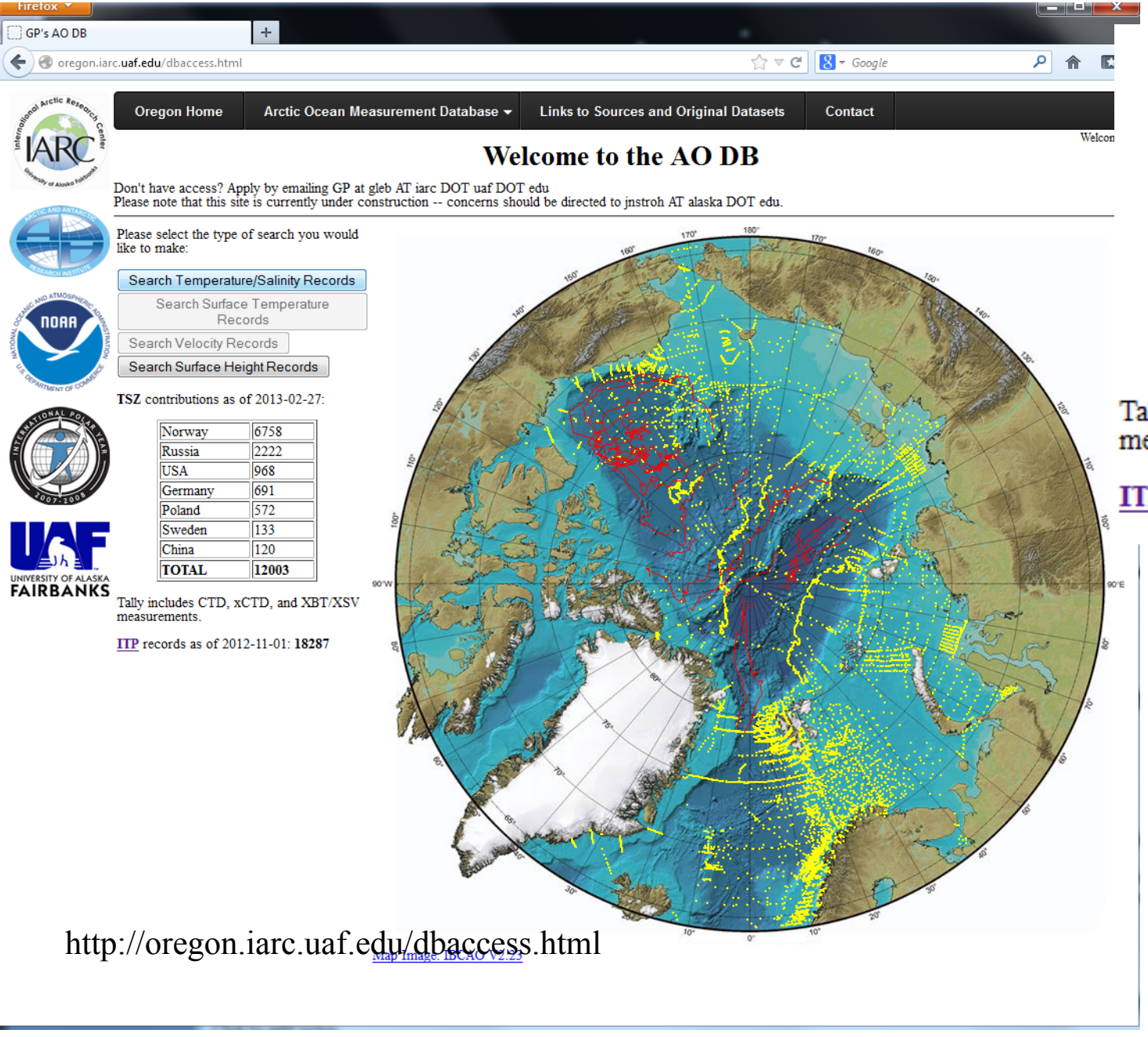
Since October 2012…

Krakow, April 17, 2013

Outline:

1. IPY Database
2. Estimates of the transports in the northern Bering Sea: 2007,2008,…
3. Anomalous circulation regimes in the Pacific Sector of the Arctic Ocean during 2008
4. Toward operational hindcast of the circulation in the Chukchi Sea: optimized location of the HFR.
5. Conclusions
6. Future plans

IPY database



Norway	6758
Russia	2222
USA	968
Germany	691
Poland	572
Sweden	133
China	120
TOTAL	**12003**

Tally includes CTD, xCTD, and XBT/X measurements.

ITP records as of 2012-11-01: **18287**

http://oregon.iarc.uaf.edu/dbaccess.html

IPY database

Firefox

GP's AO DB

oregon.iarc.uaf.edu/dbaccess.html

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Oregon Home | Arctic Ocean Measurement Database | Links to Sources and Original Datasets | Contact

Welcome!

Welcome to the AO DB

Don't have access? Apply by emailing GP at gleb AT iarc DOT uaf DOT edu
Please note that this site is currently under construction -- concerns should be directed to jnstroh AT alaska DOT edu.

Please select the type of search you would like to make:

- Search Temperature/Salinity Records
- Search Surface Temperature Records
- Search Velocity Records
- Search Surface Height Records

TSZ contributions as of 2013-02-27:

Norway	6758
Russia	2222
USA	968
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TOTAL	**12003**

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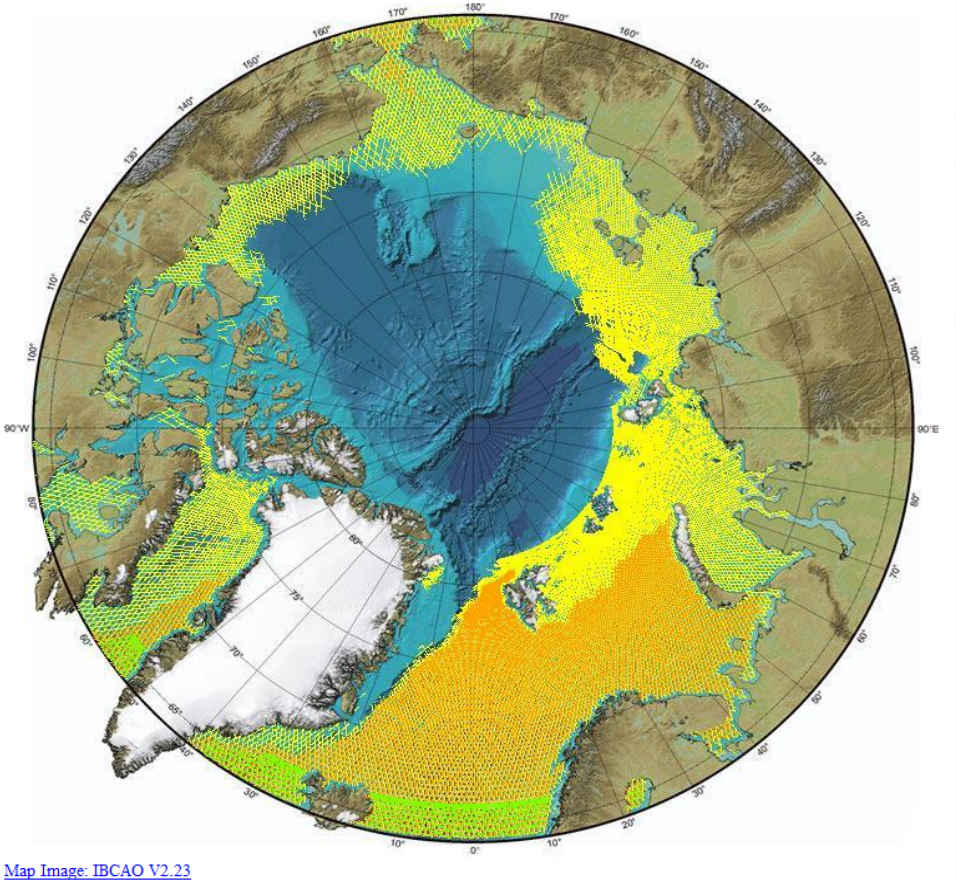
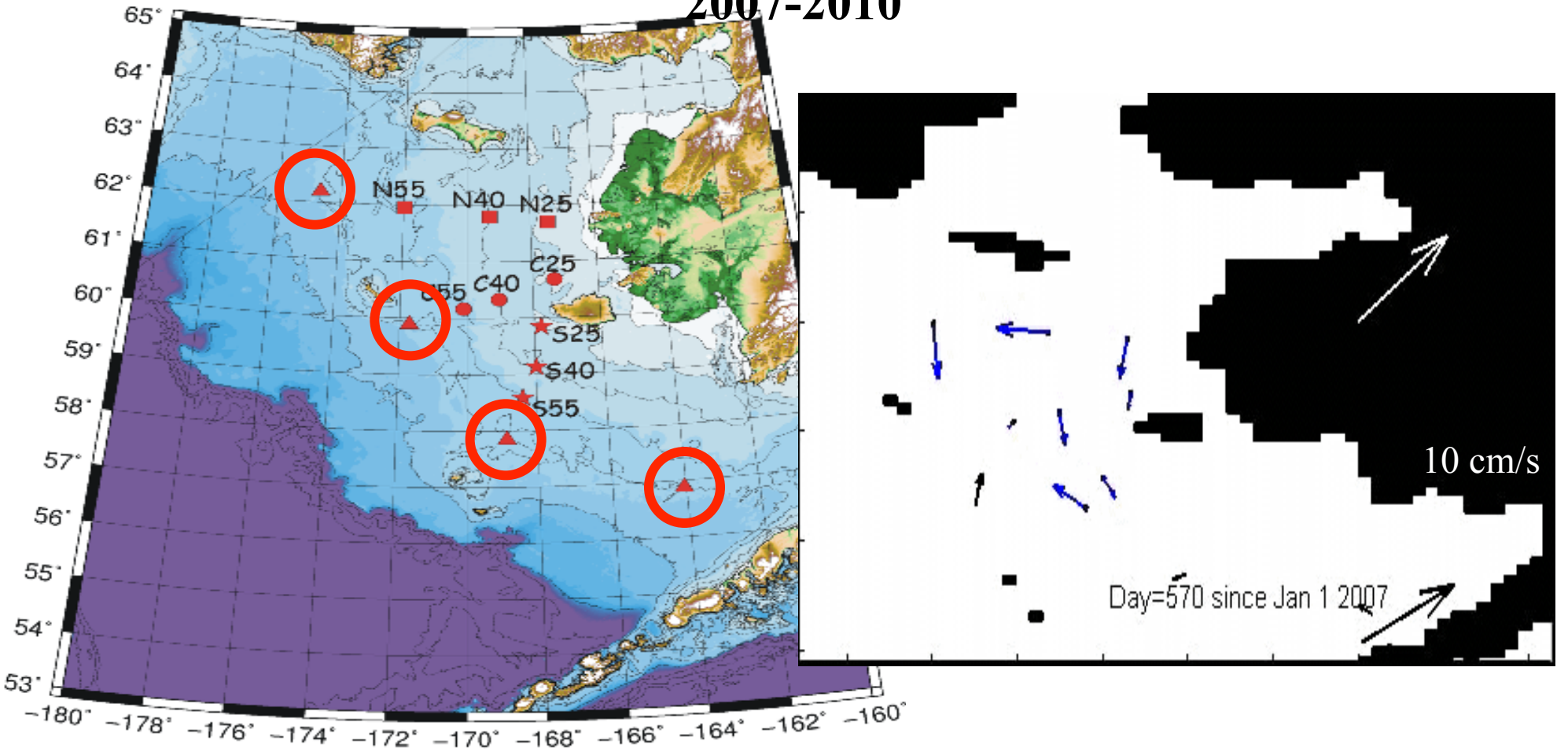
ITP records as of 2012-11-01: **18287**

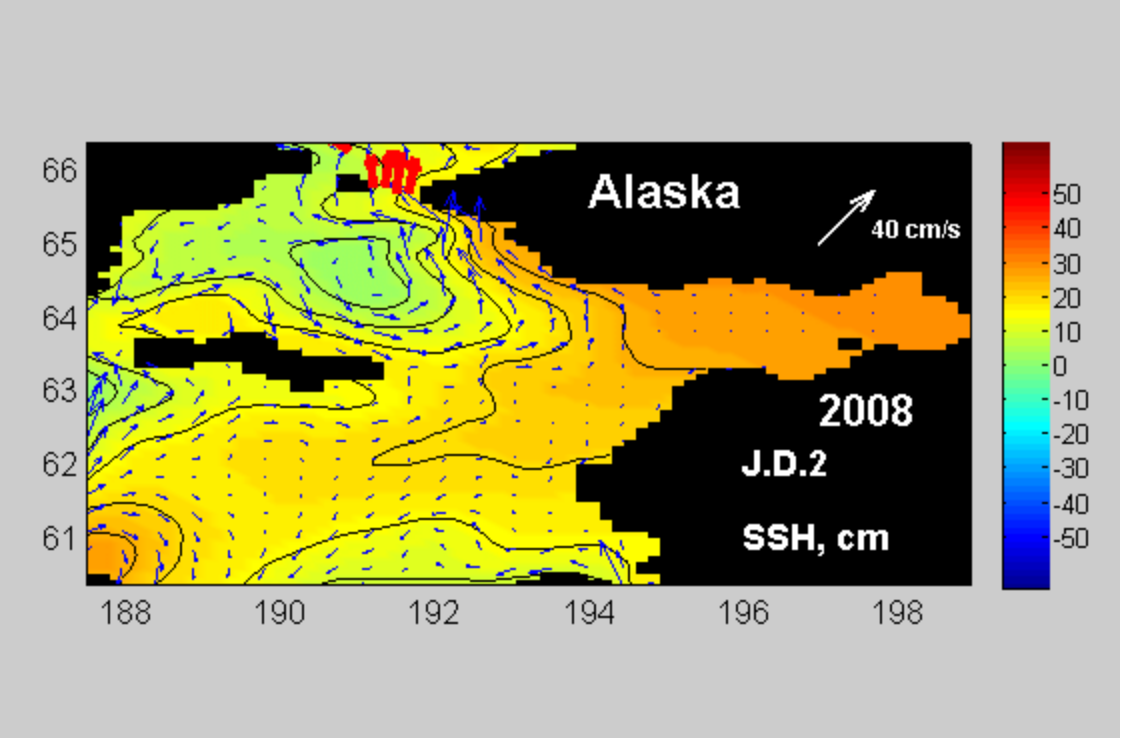


Map Image: IBCAO V2.23

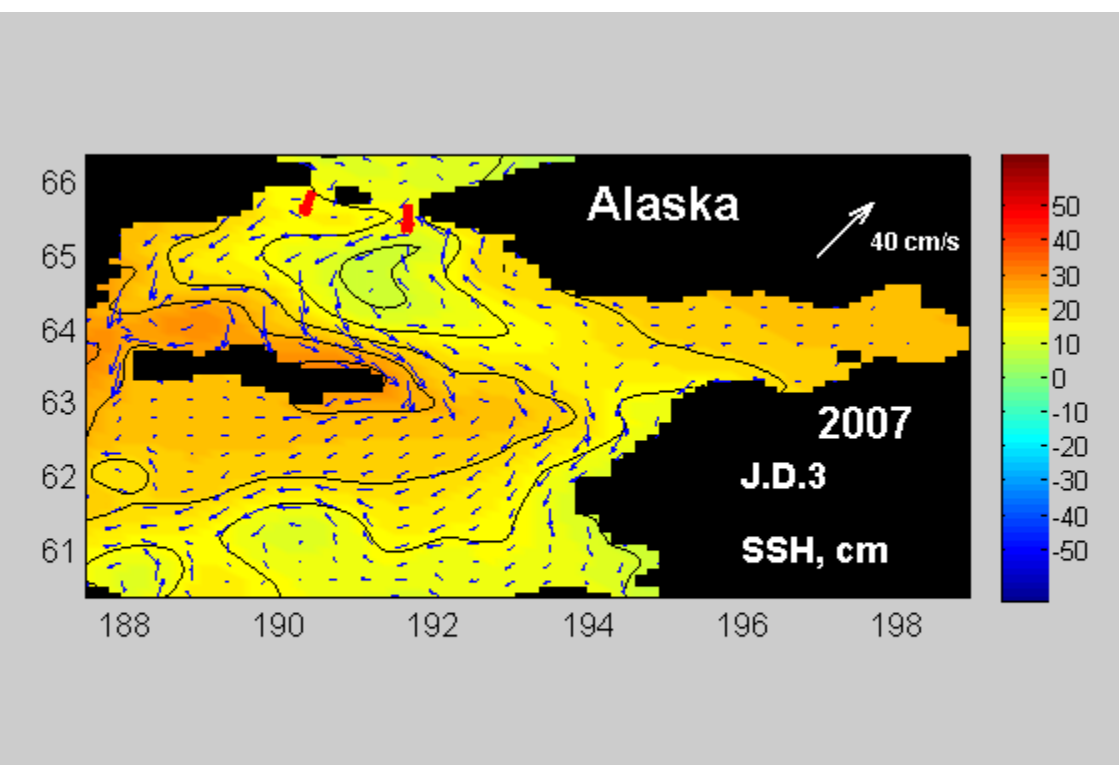
Data: velocity observations in the Bering Sea during the 2007-2010



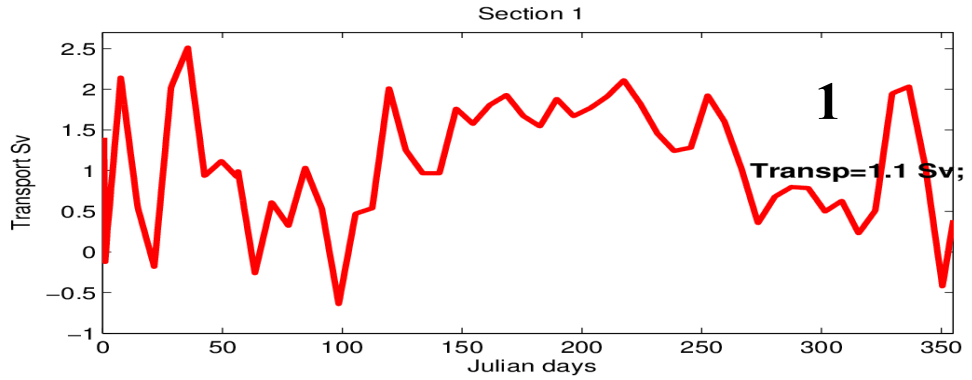
1. N55, N40, N25, C55, c40, c25, S55, S40, S25 moorings (T.Weingartner and K. Aagard)
2. Bering Strait moorings (R. Woodgate)
3. Surface drifters (P.Stabeno, NOAA) 35m
4. ARGO drifters (1000m)

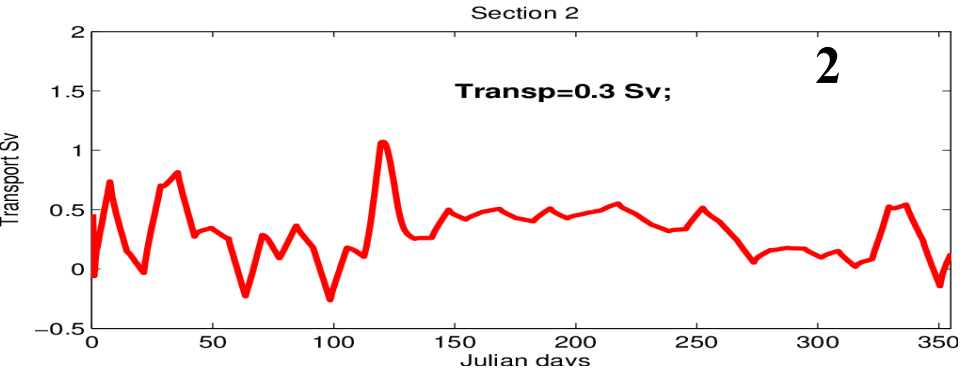


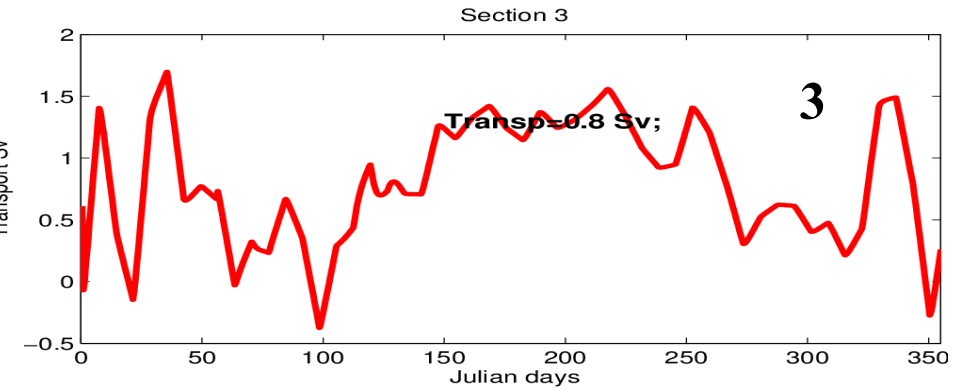
Preliminary results of the 2007,2008 Velocity, SSH

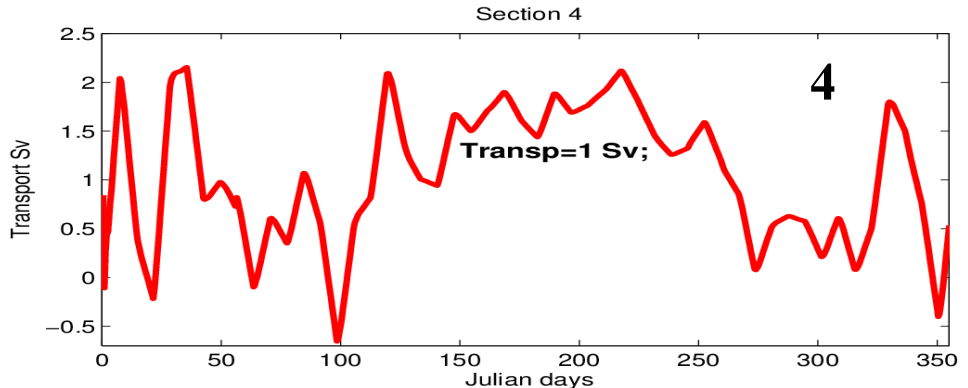


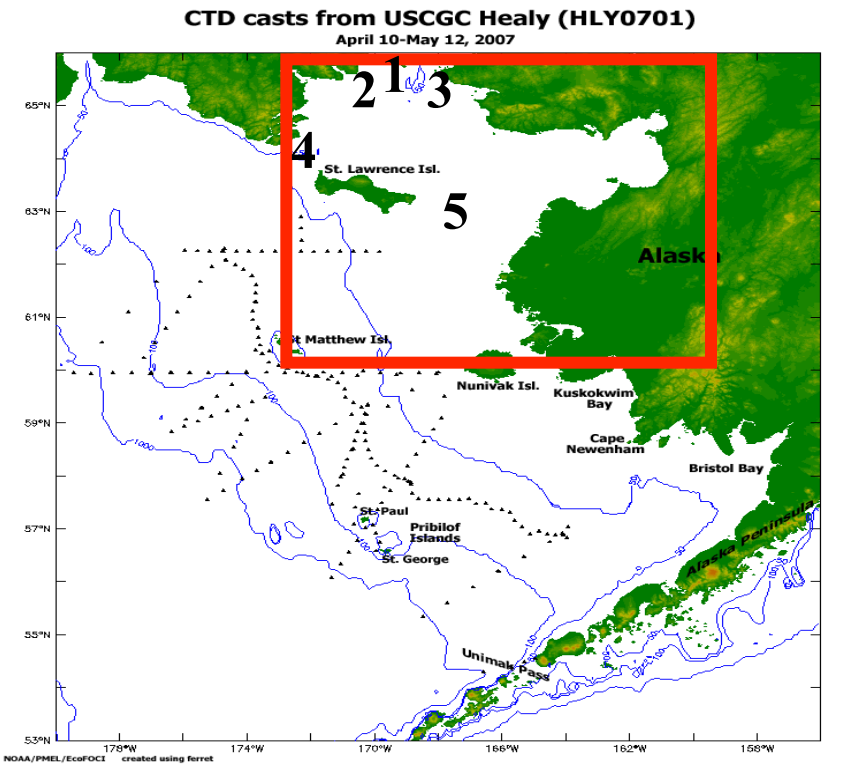
Preliminary results of the 2007 Transports

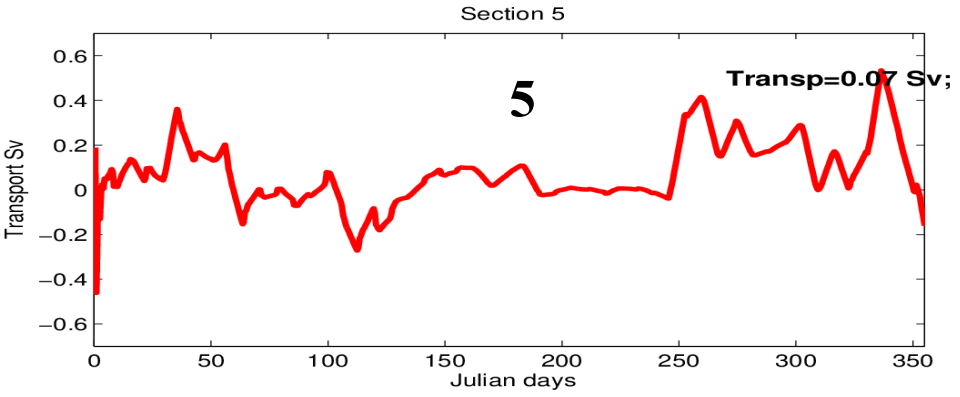




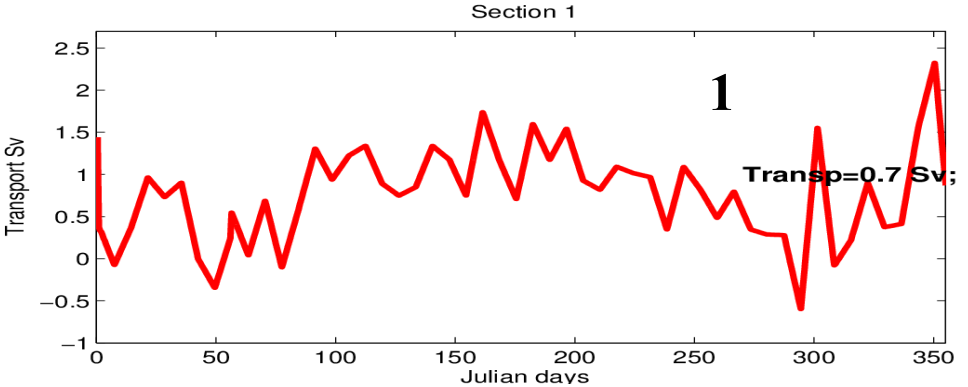


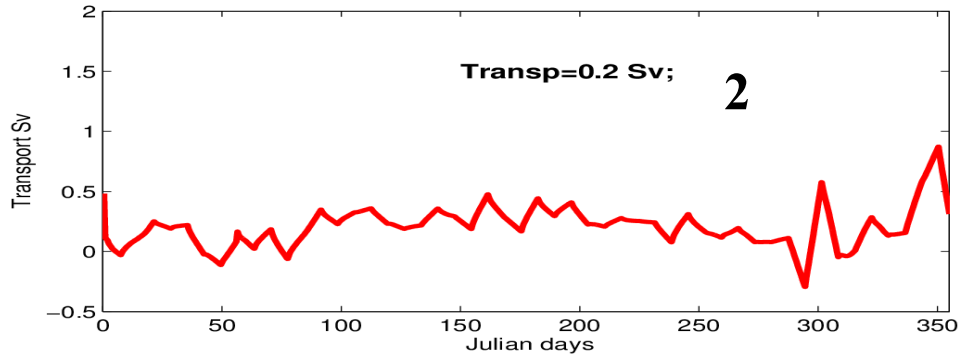


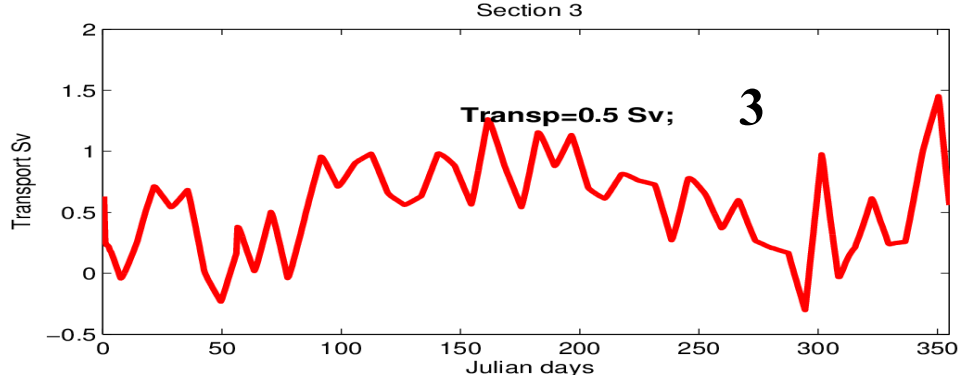


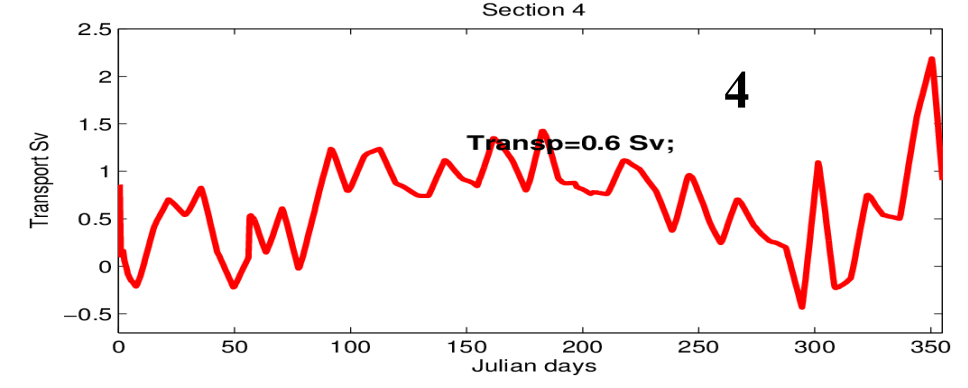


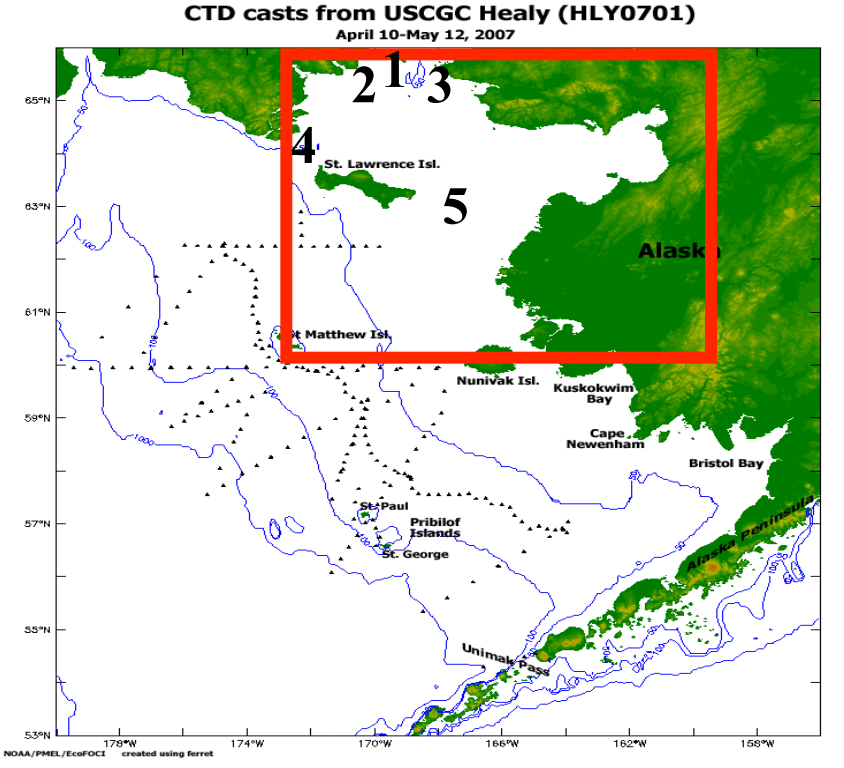
Preliminary results of the 2008 Transports

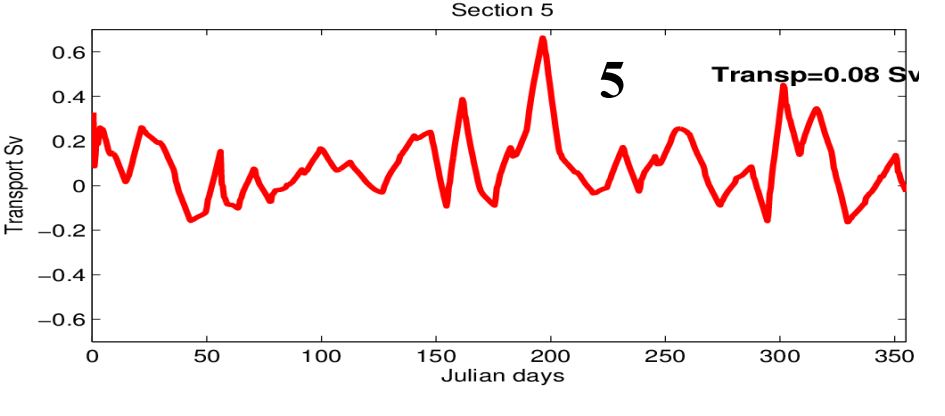






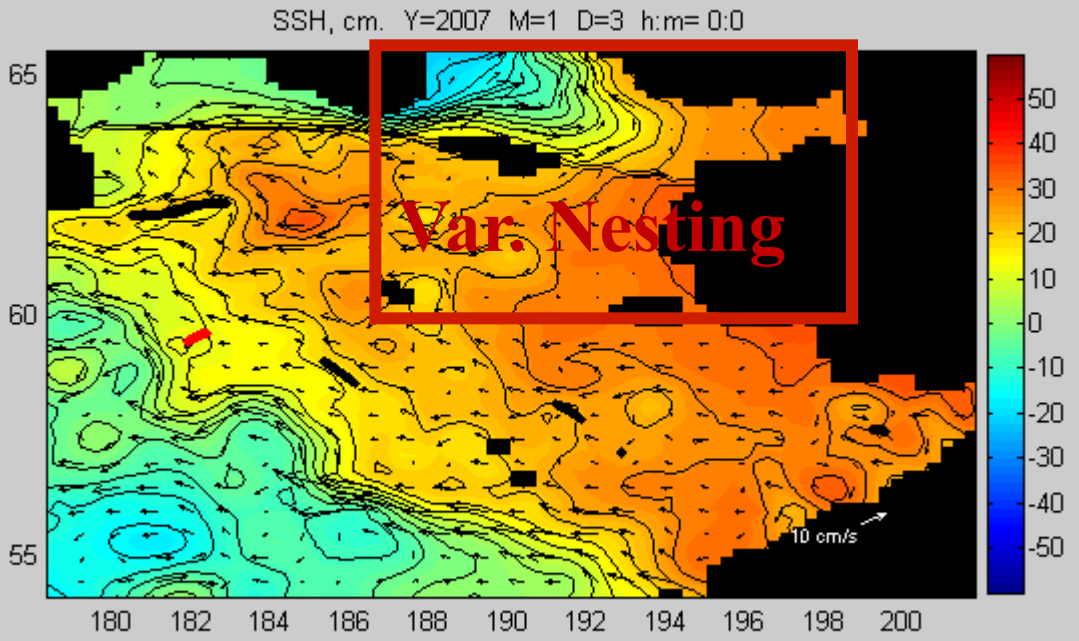


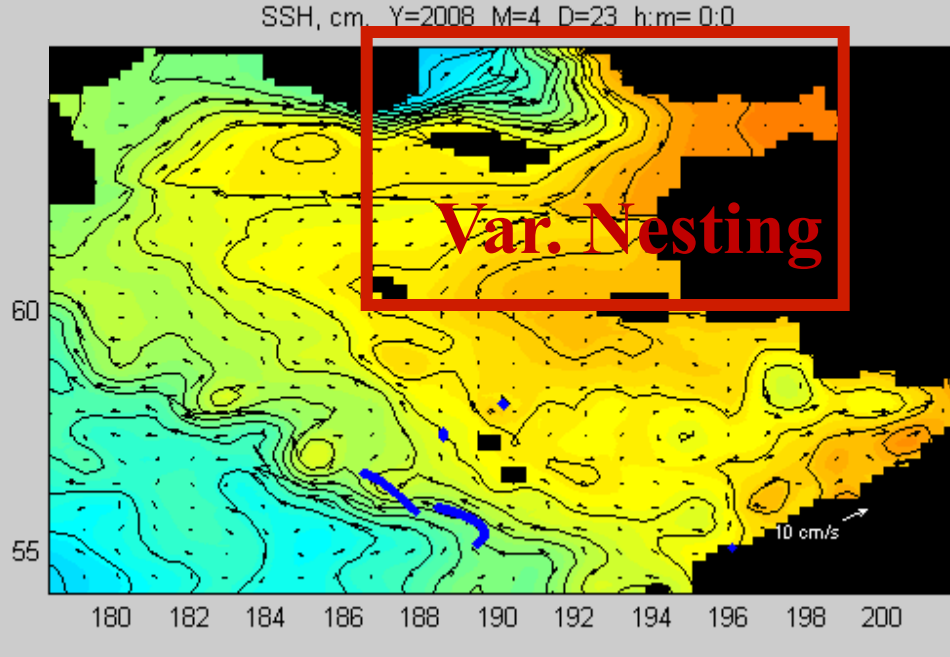




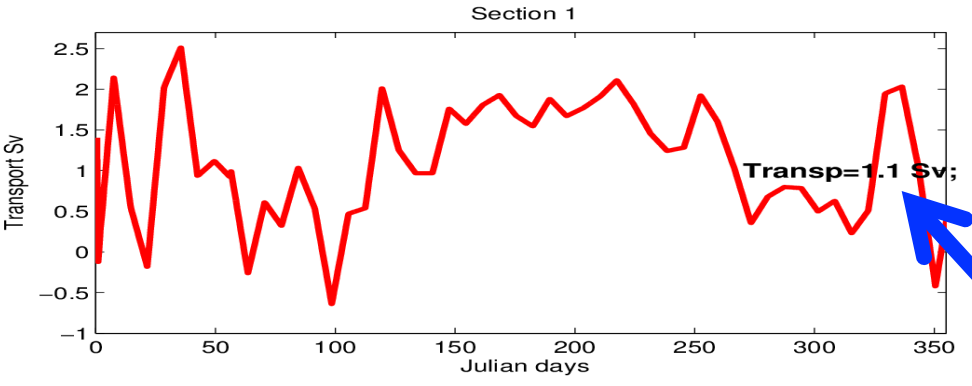
Preliminary results of the SIOM/BESTMASS 4Dvar DA

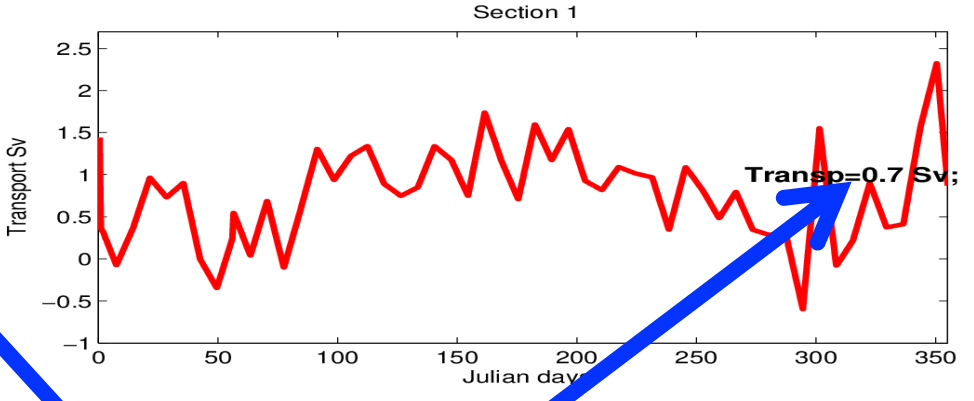
Eastern Bering Sea, Resolution 15km

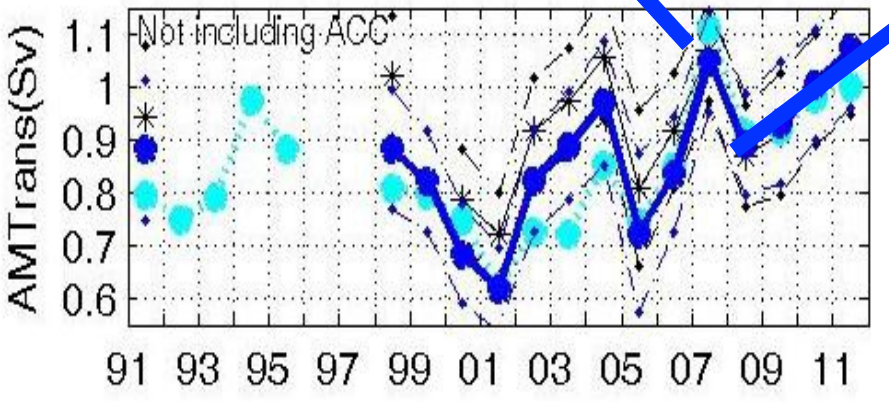




Increased transports through the Bering Strait.







Why?

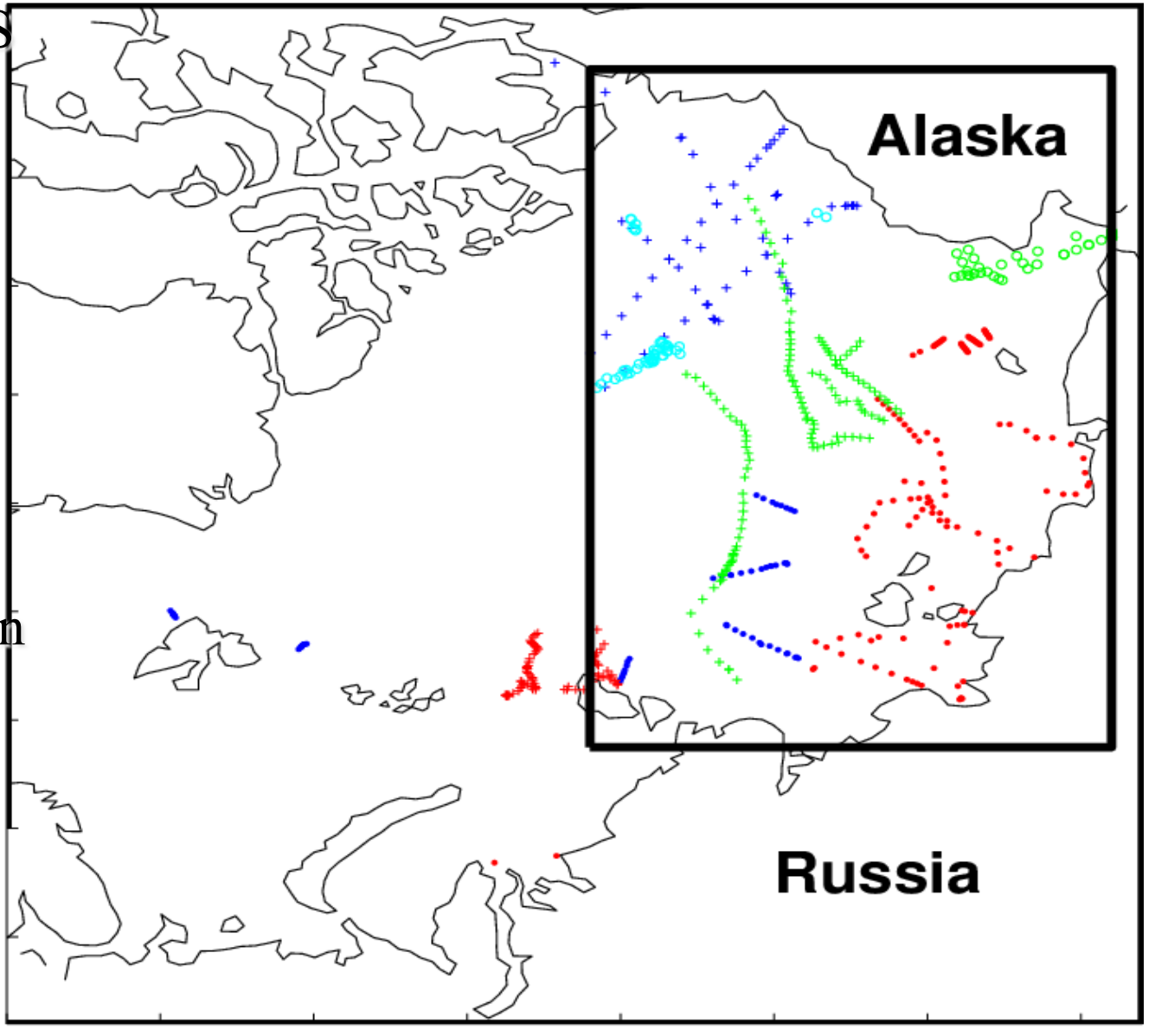
2008

1. Hydrophysical data
   - a) T,S –CTD,POPS
   - b) Velocity
   - c) Bering Strait Transport (Woodgate)

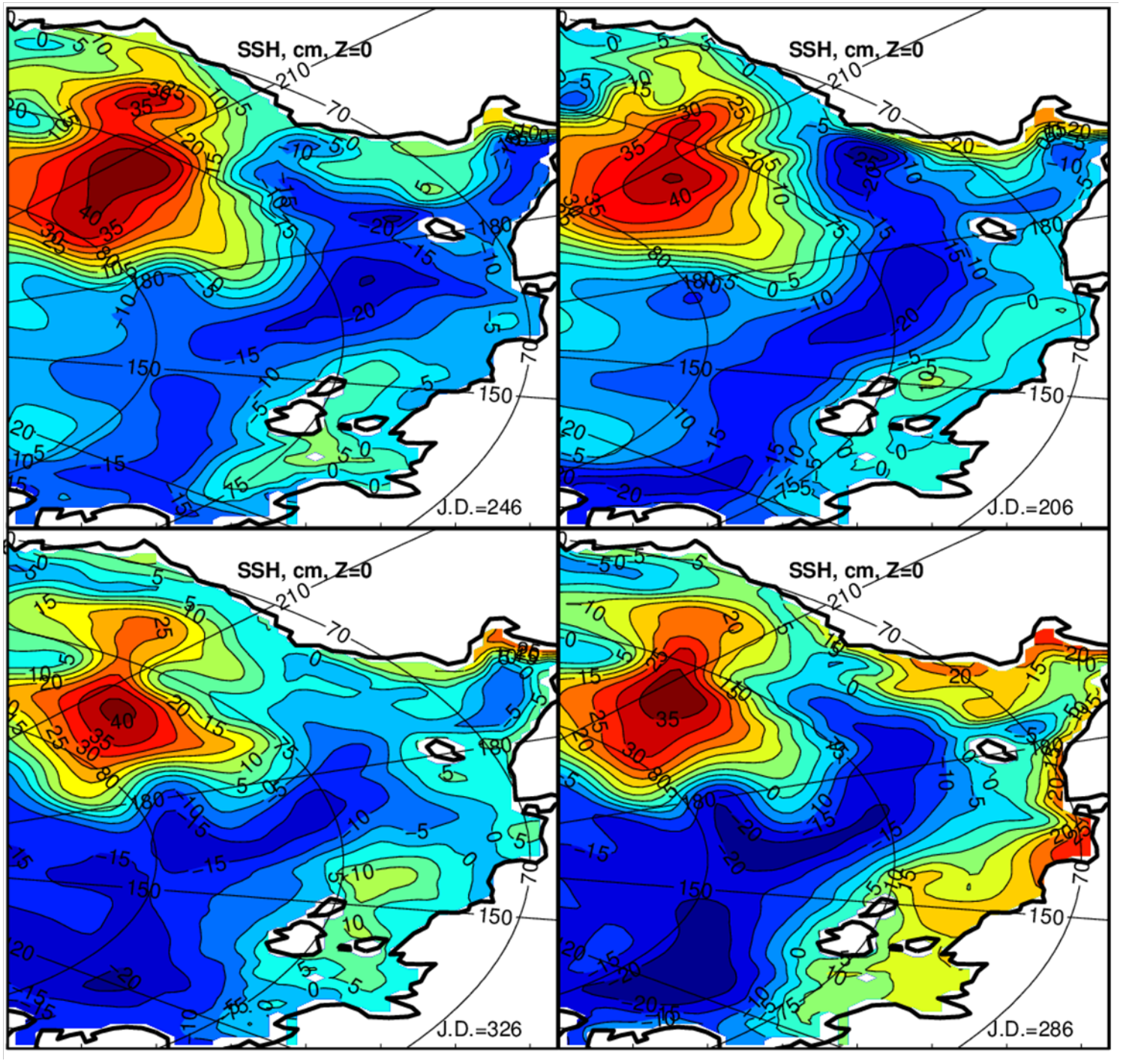
2. Surface fluxes from PIOMAS

3. Ice concentration and velocity

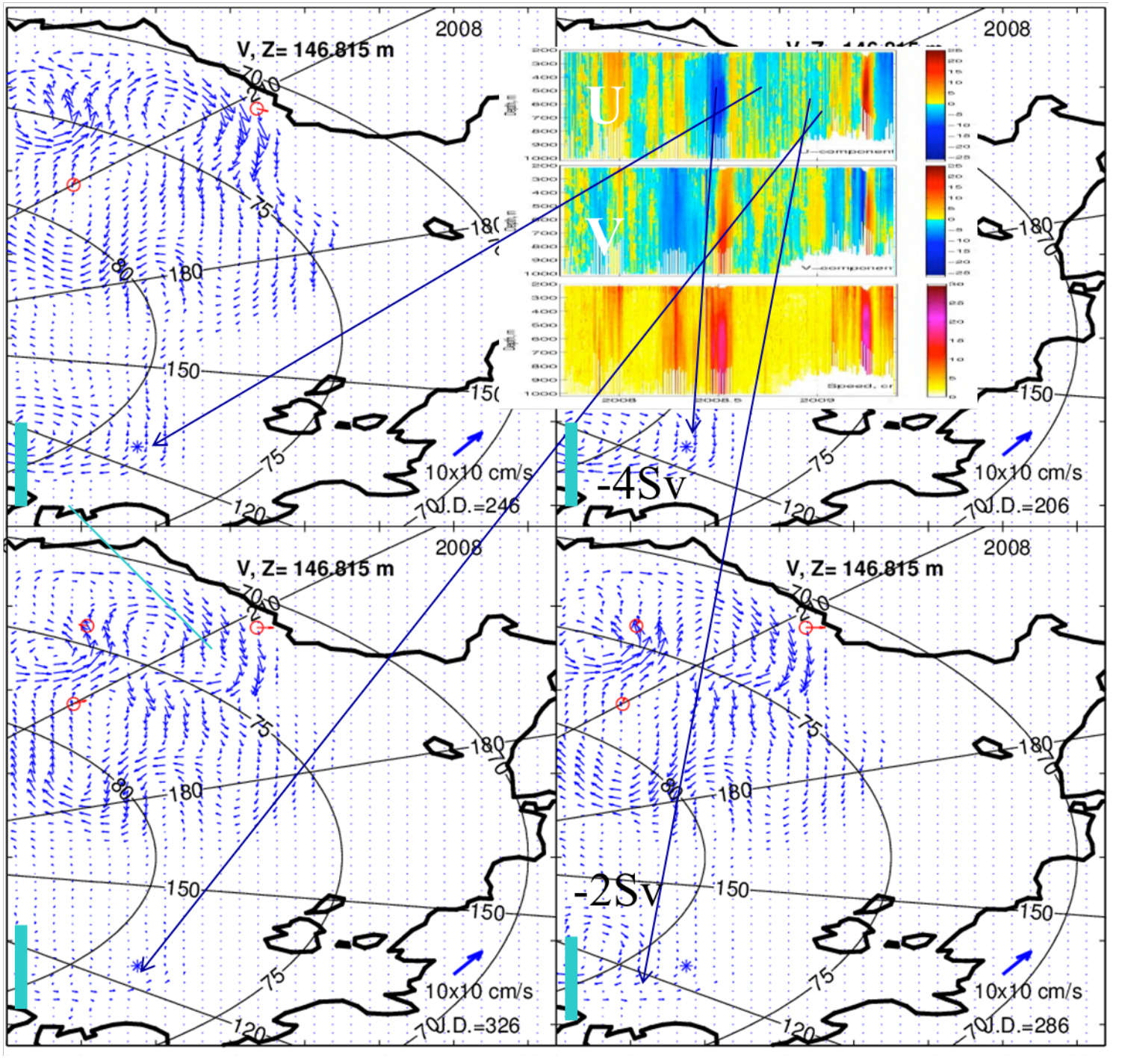
4. Sea Surface temperature



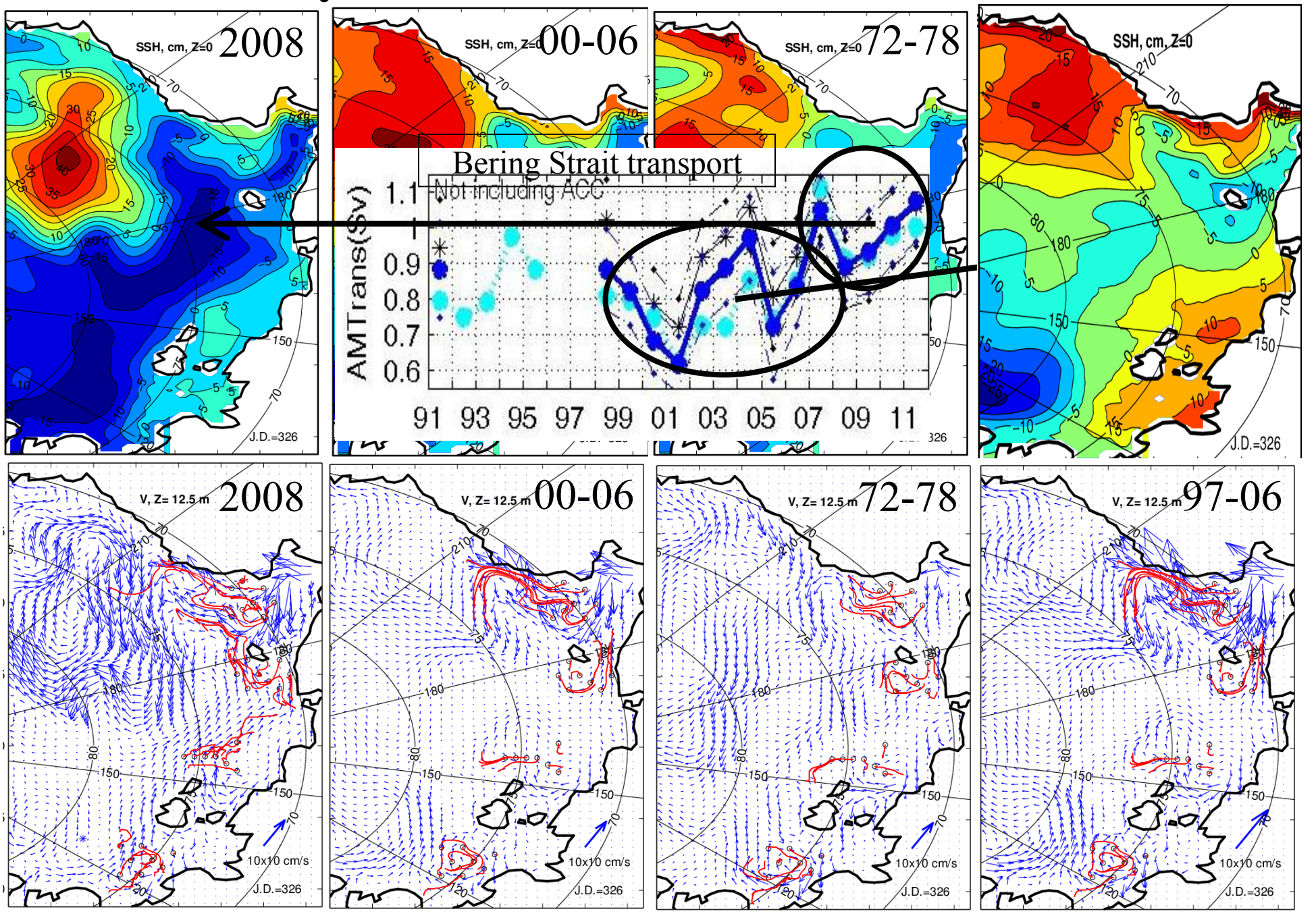
2008 circulation



2008 circulation

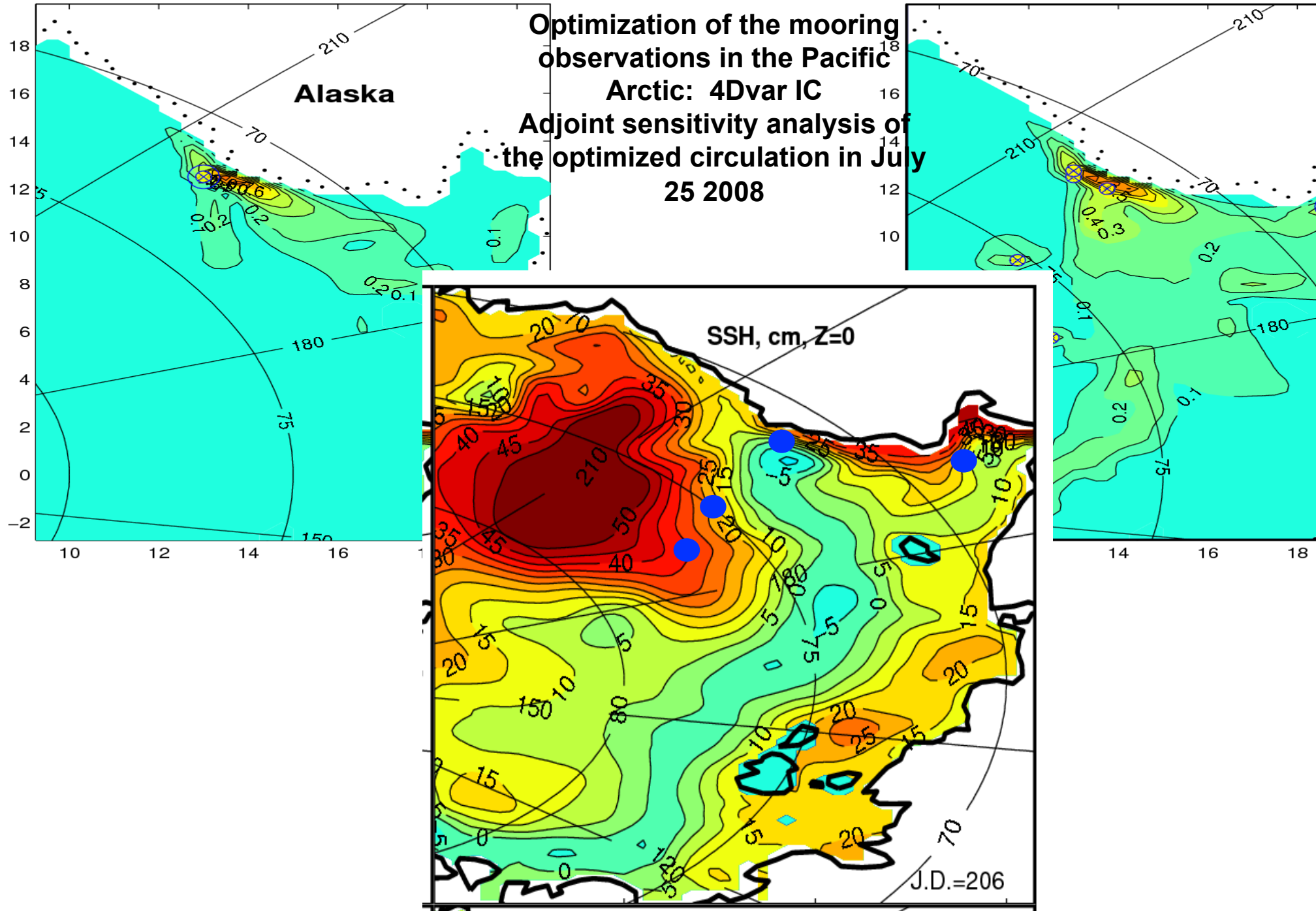


4Dvar analysis of the circulation in the Arctic Ocean



Optimization of the mooring observations in the Pacific Arctic: 4Dvar IC

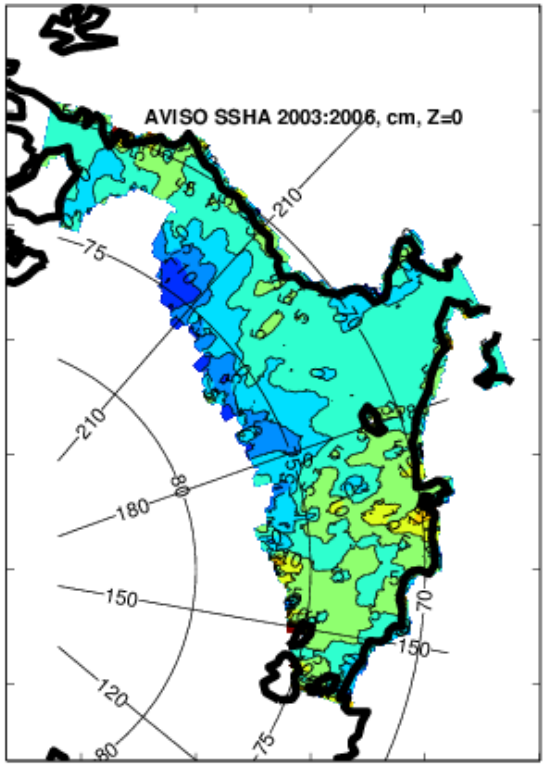
Adjoint sensitivity analysis of the optimized circulation in July 25 2008

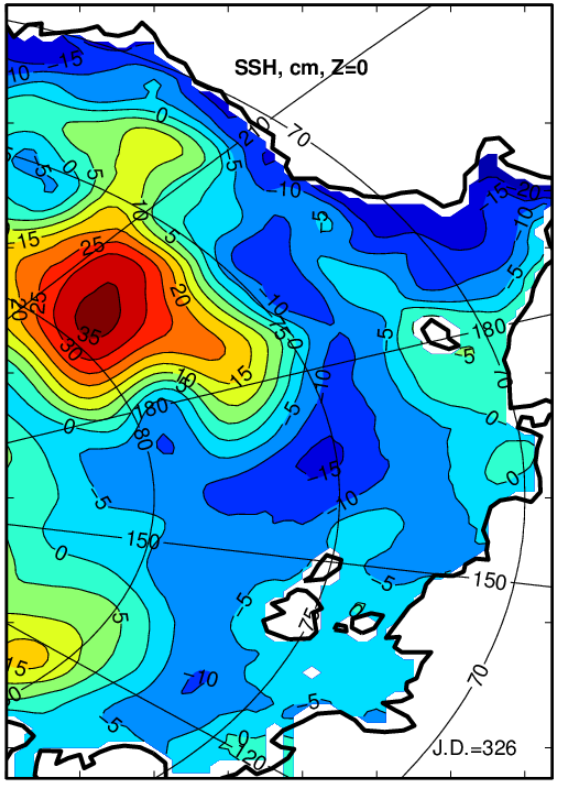


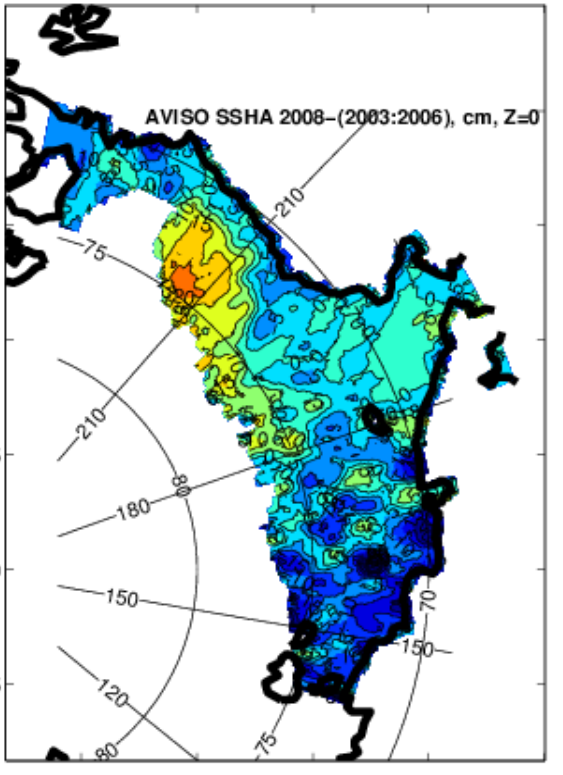
Satellite (Envisat) Sea Surface Height Anomaly (SSHA)

4Dvar SSH2008-
4Dvar SSH1997-2006

AVISO_SSHA 2008-
AVISO_SSHA 2002-2006



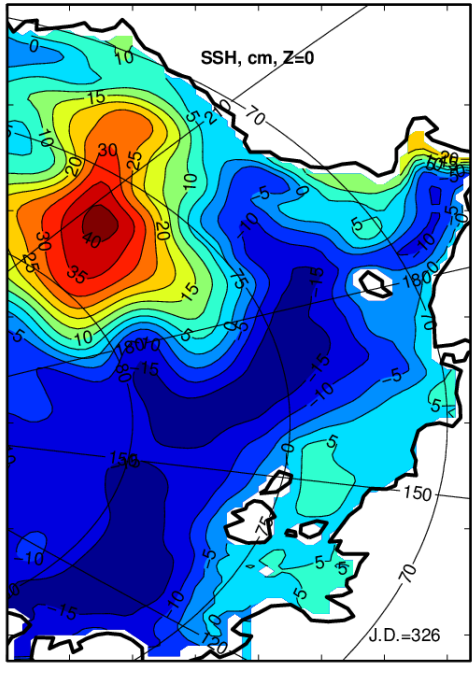


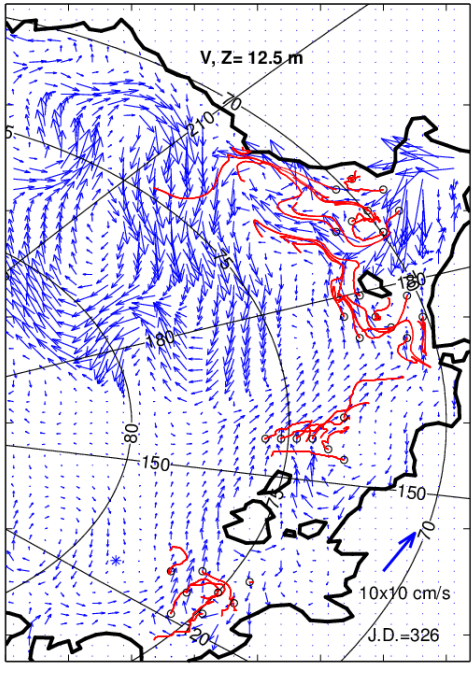


AVISO_SSHA_2002-2006

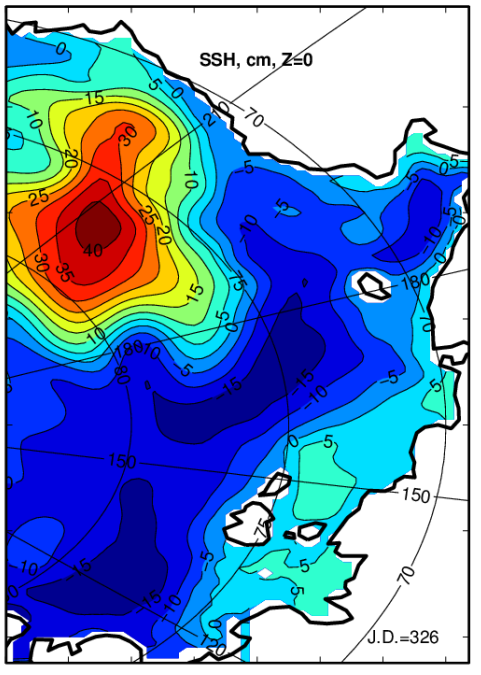
AVISO_SSHA_2008

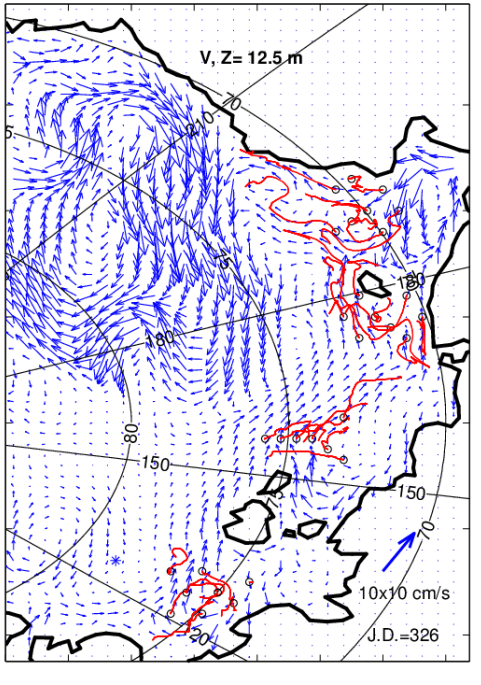
2008



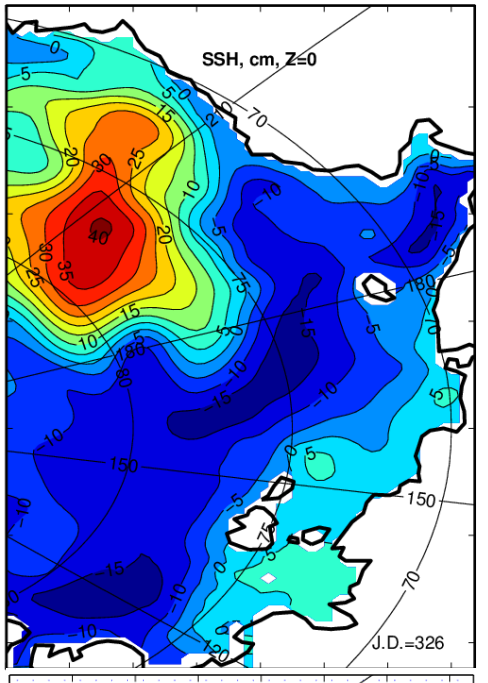


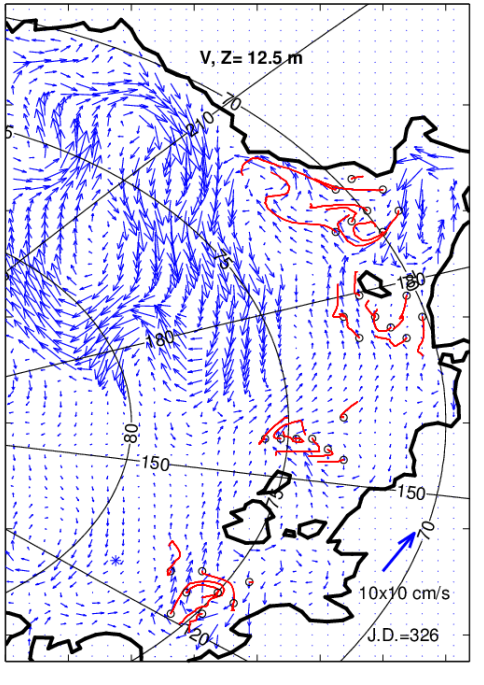
2008 BST/2



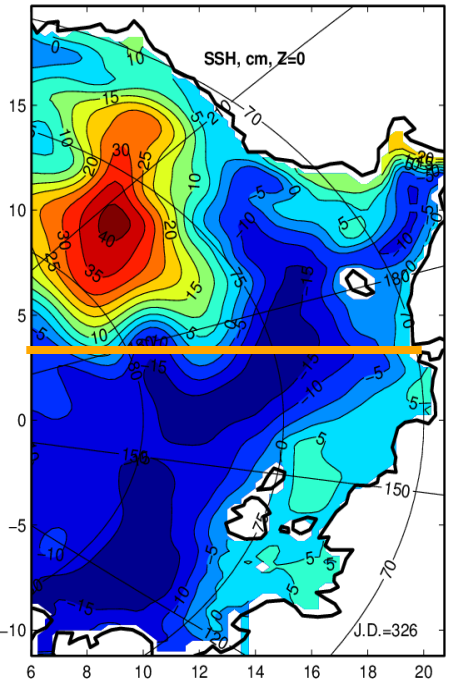


2008 wind=0





Temperature and salinity along the section



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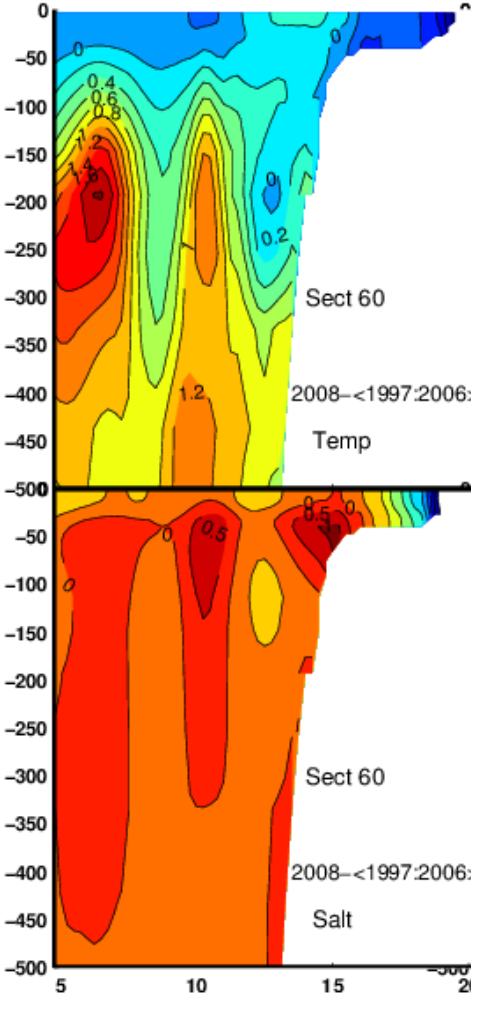

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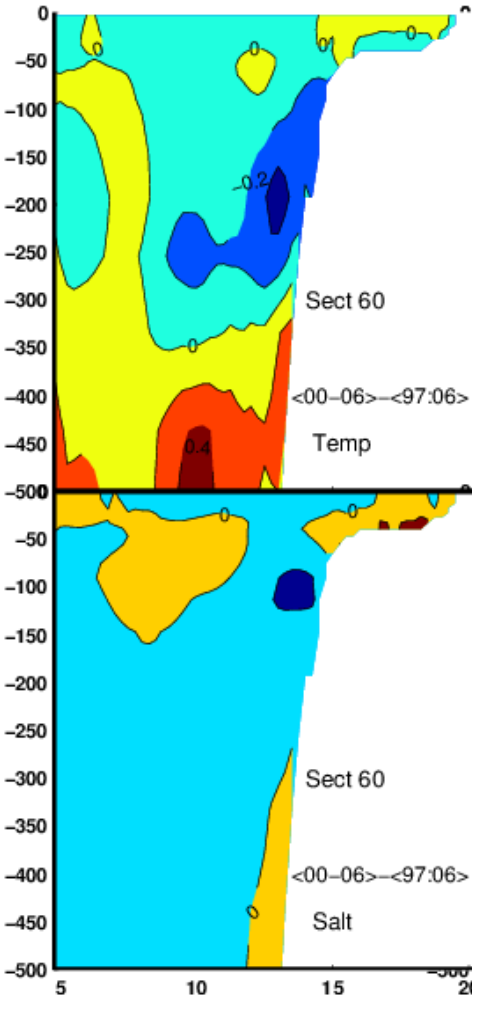

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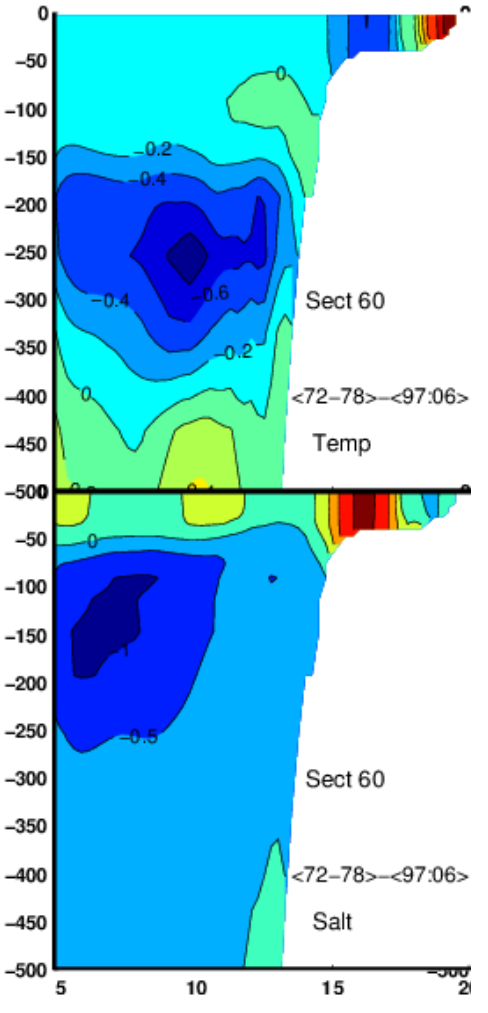
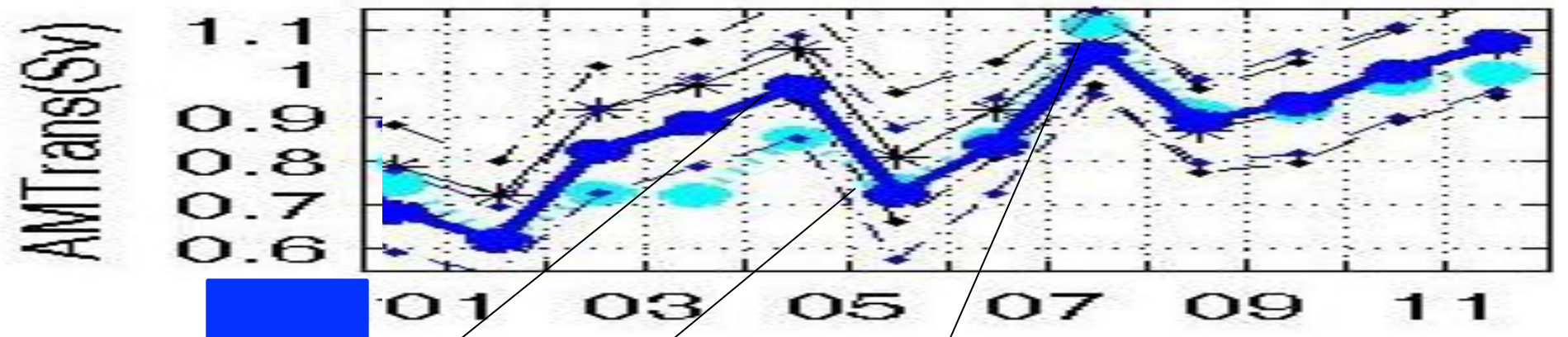
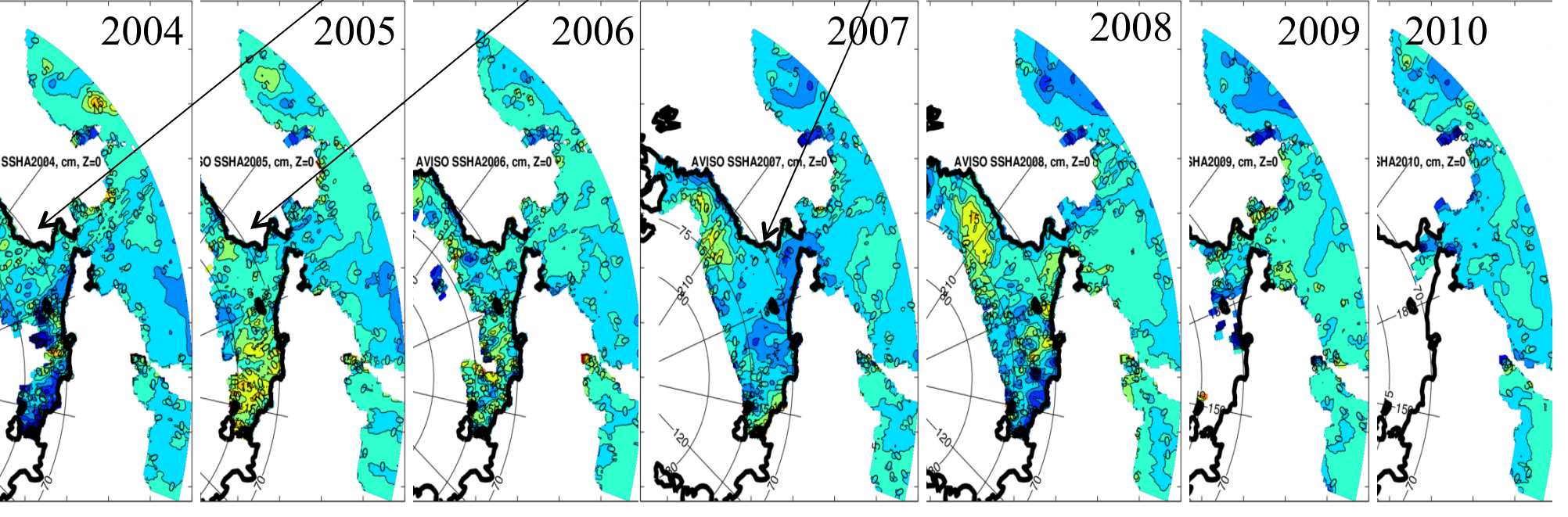


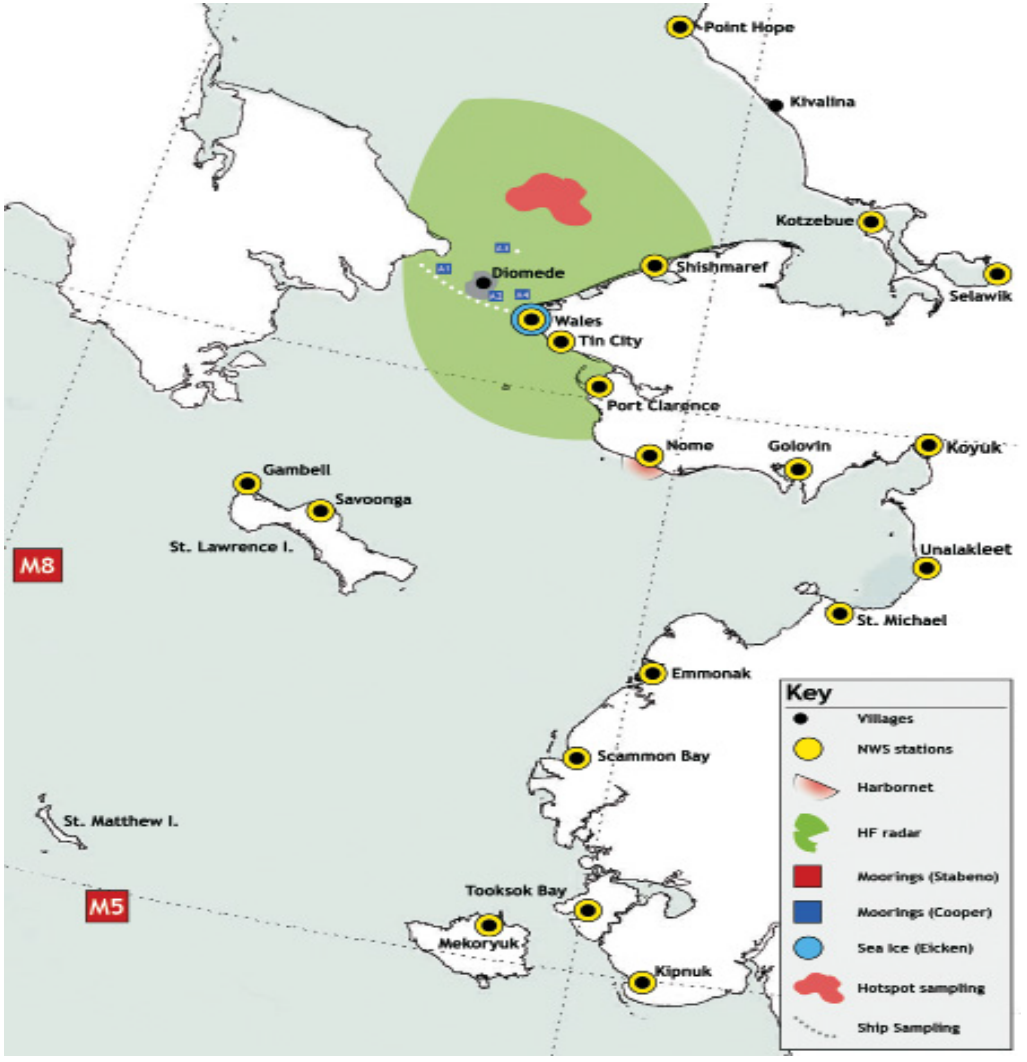
Bering Strait Transport (R.Woodgate)



Composite of the SSHA from Envisat satellite tracks



Optimization of the High-Frequency Radar observations



Schematic showing desired coastal HFR observations in the Bering Strait region (Calder et al., 2009)

Adjoint sensitivity analysis: approach

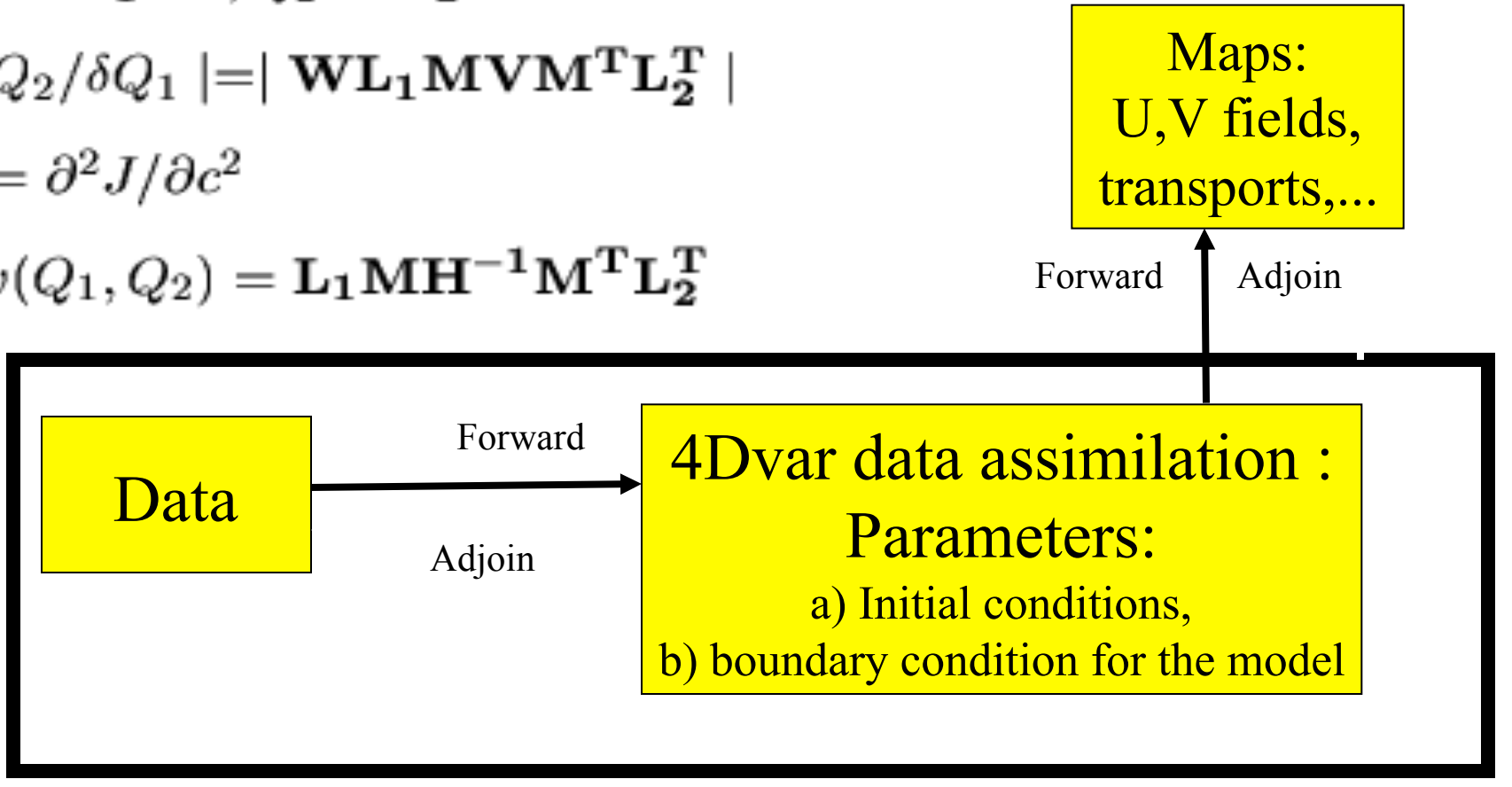
$$\mathbf{y} = \mathbf{M}c$$

$$Q_1 = \mathbf{L_1 M}c, Q_2 = \mathbf{L_2 M}c$$

$$| \delta Q_2 / \delta Q_1 | = | \mathbf{W L_1 M V M^T L_2^T} |$$

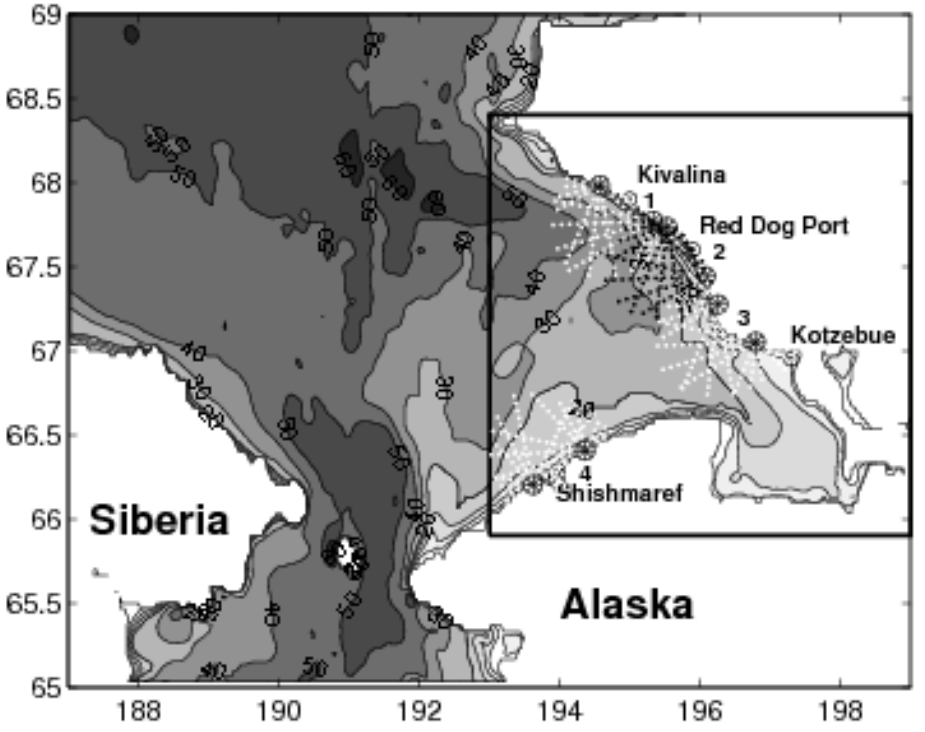
$$\mathsf{H} = \partial^2 J / \partial c^2$$

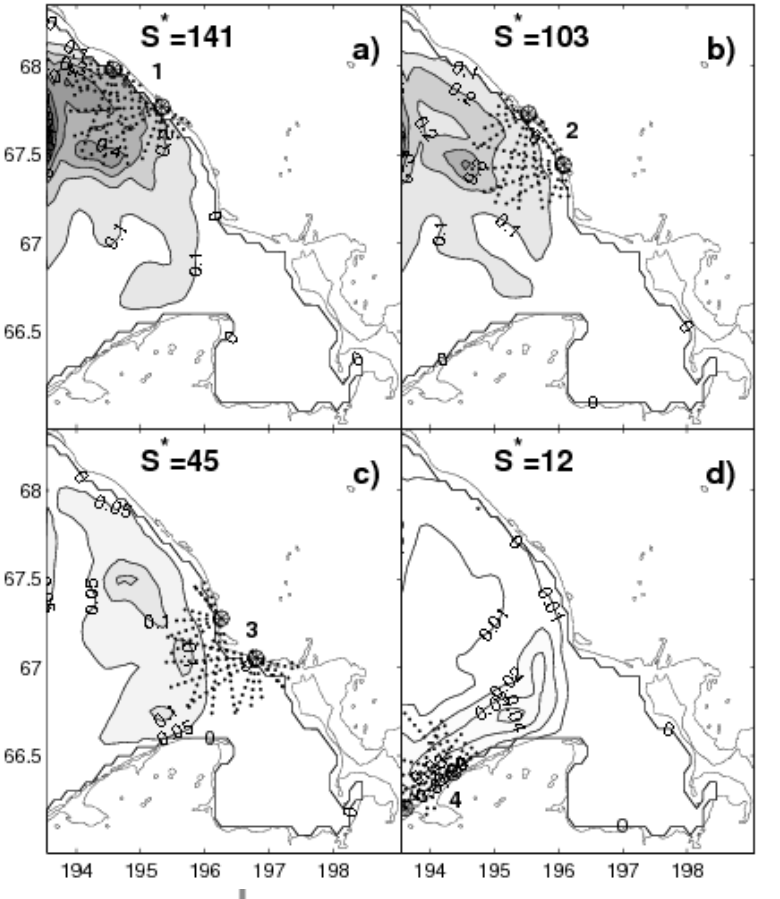
$$cov(Q_1, Q_2) = \mathbf{L_1 M H^{-1} M^T L_2^T}$$

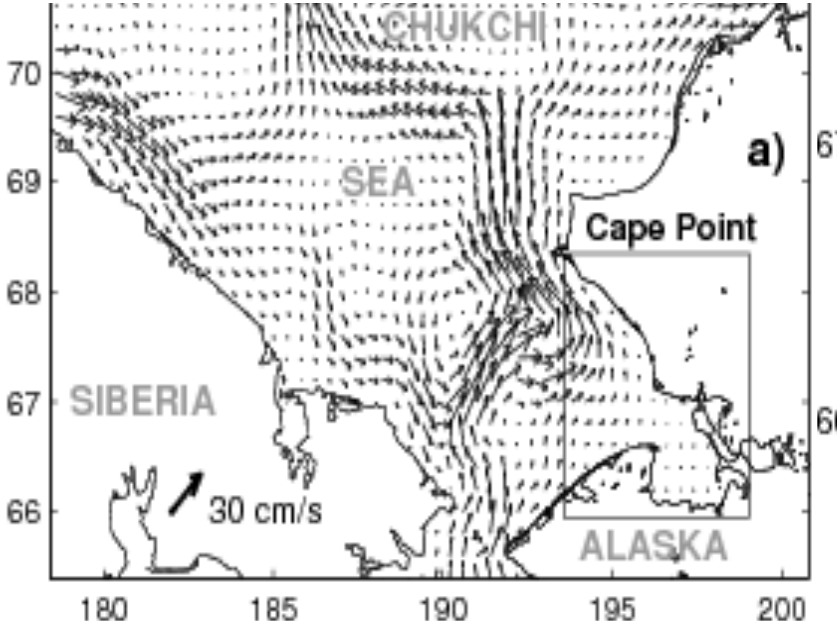


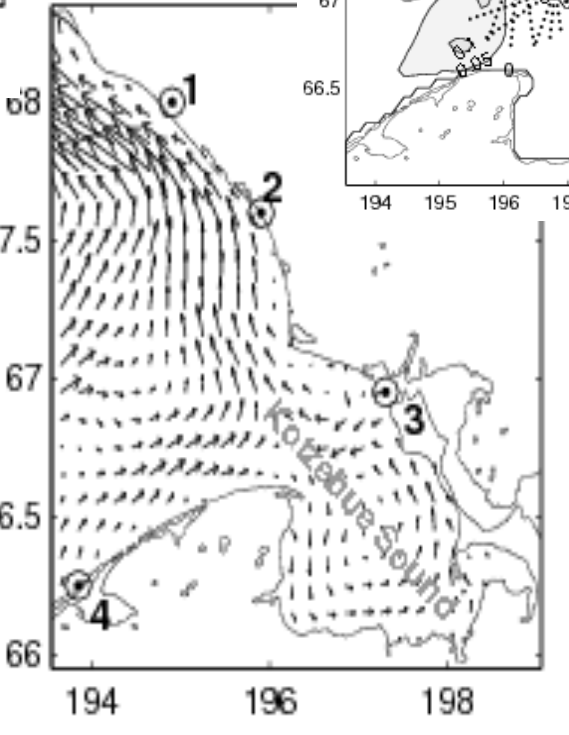
What kind of data cause the major changes in the “map”?

Optimal observations: HFR



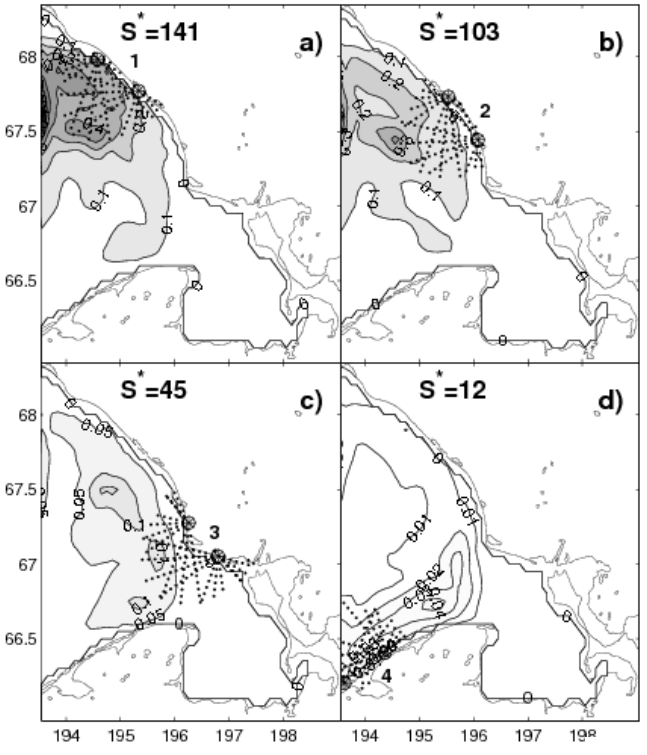


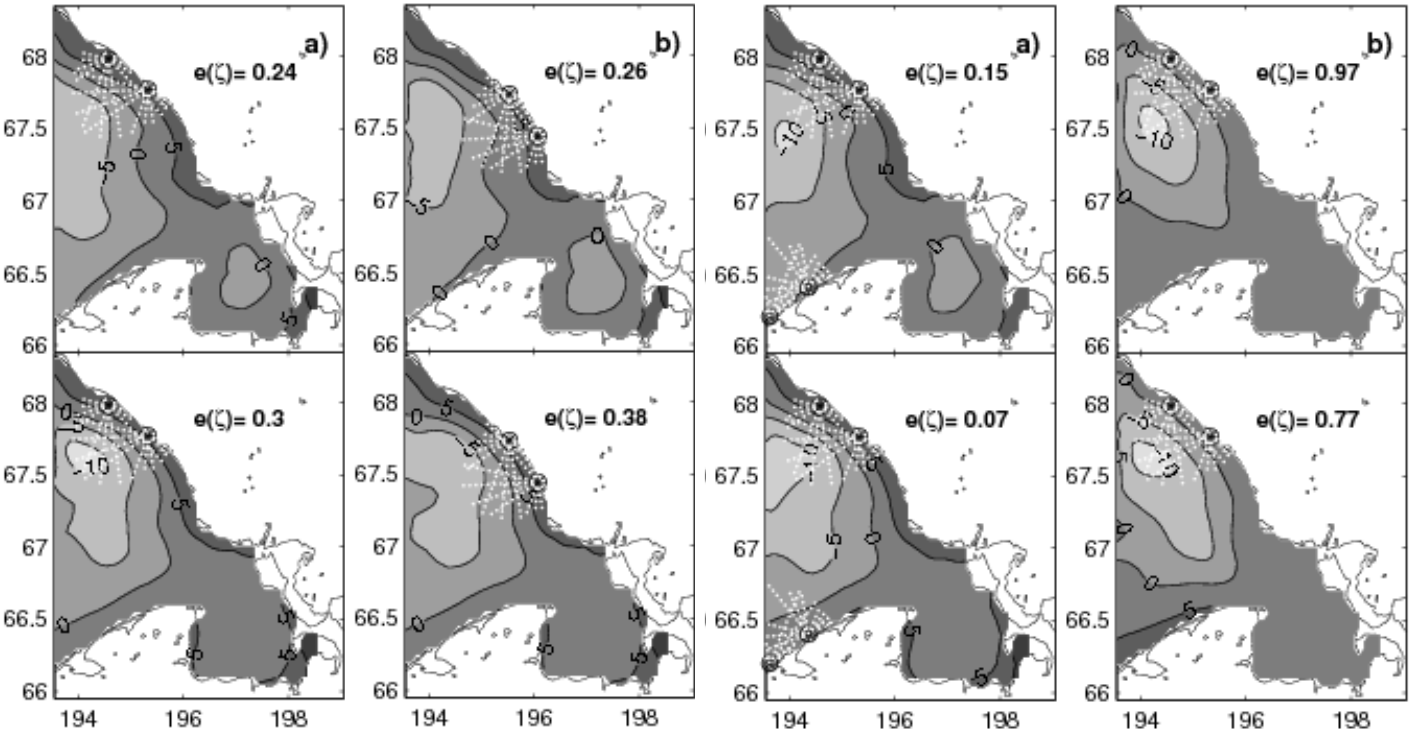




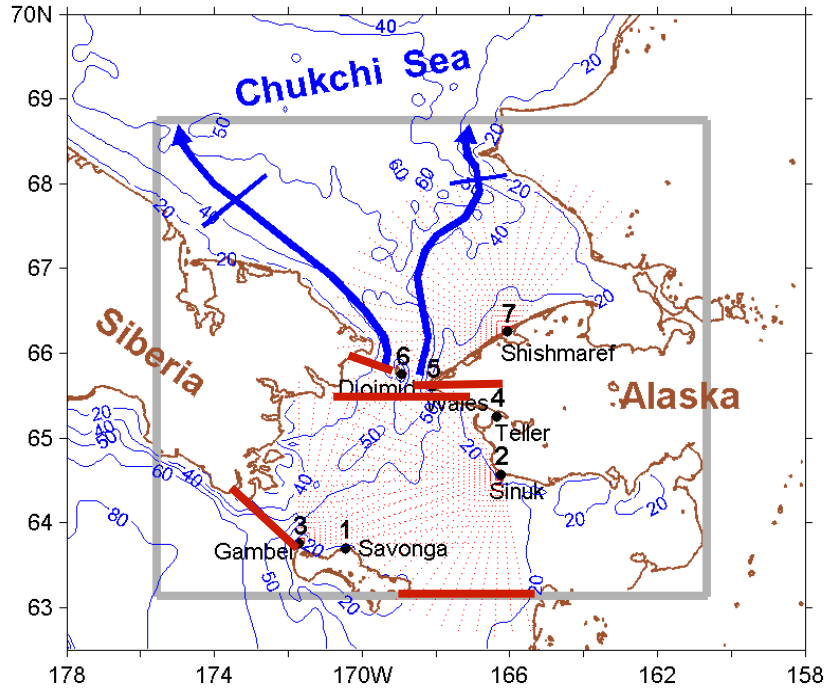
Optimal observations: HFR

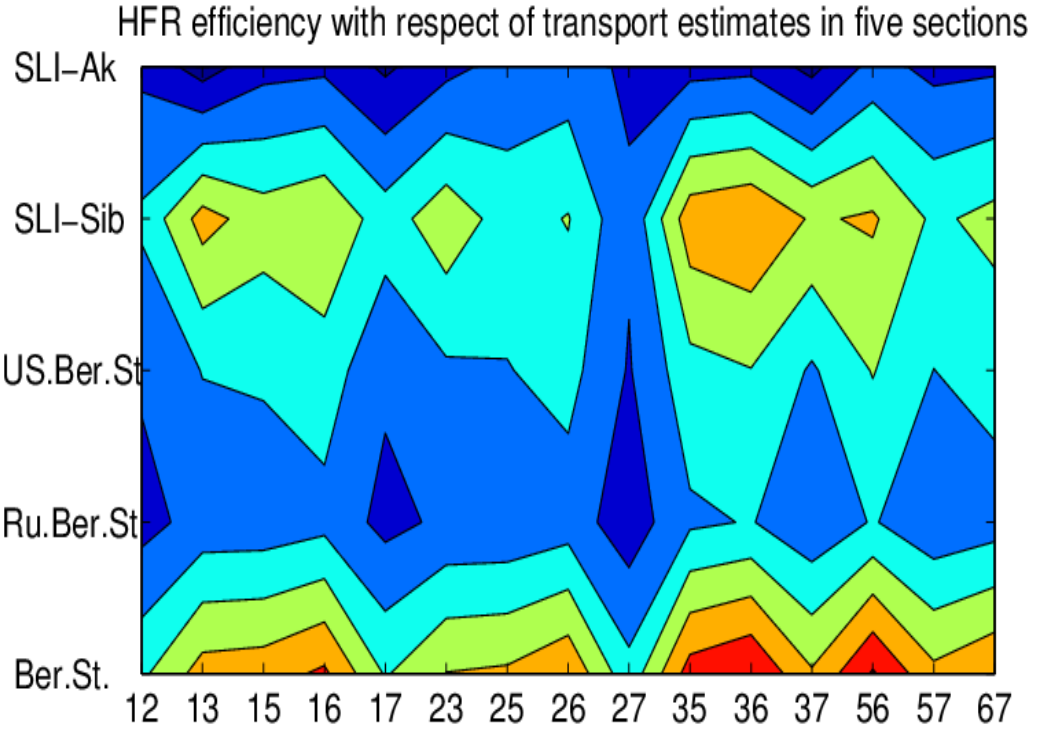
Adjoint sensitivity analysis and OSSE's

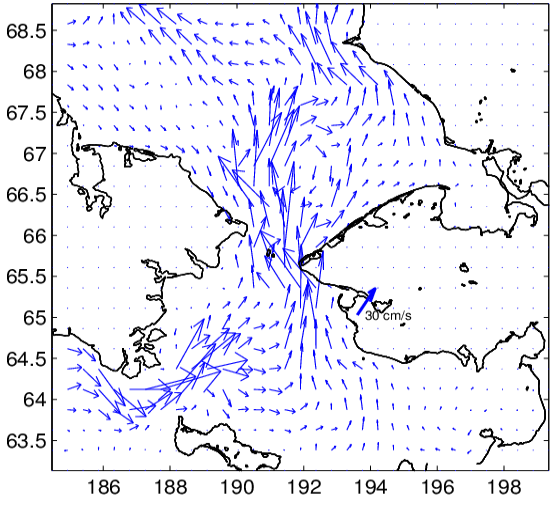


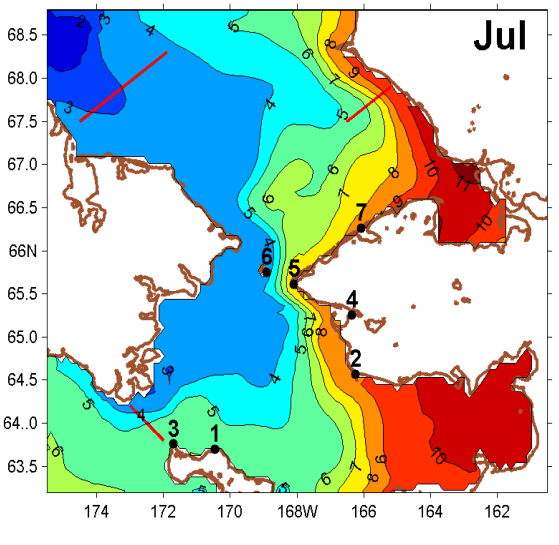


Optimal observations:
HFR for operational hindcast for the Bering Strait flow









Summary:

1. 2008 circulation in the Pacific Sector of the Arctic Ocean differs significantly from others circulations. It can be done in similar way for any years: 2011,2012,2013..

2. Combine analysis of the SSHA and reconstructed circulation shows significant decrease of the SSH during 2007-2009 that may explain the increased flow through the Bering Strait

3. Adjoint sensitivity analysis allows to construct optimal observational HFR network for the Bering Strait, and can be extended for the mooring observations

Thanks