

AOMIP activities at UW: 2004-2005

M. Steele, J. Zhang, & W. Ermold



I'm the
modeler.



I'm not a
real modeler!

But I'm friends
with some of them...



I'm the
data jockey.

Outline

1. Data activities

- PHC 3.0
- Bering Strait
- SCICEX

2. Modeling activities

- “super-regional” model
- mixing & AW circulation studies

PHC update: spring 2005

PHC Contents - Netscape

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http://psc.apl.washington.edu/Climatology.html

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PHC Contents

Polar science center Hydrographic Climatology (PHC)

A Global Ocean Hydrography with a High Quality Arctic Ocean

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NATIONAL SCIENCE FOUNDATION ARCTIC PROGRAM

DEPARTMENT OF THE NAVY DOD Science & Technology

NASA

SURFACE

Winter Temperature

-2 1 4 7 10 13 16 19 22 25 28

ABSTRACT

A new gridded ocean climatology, the Polar science center Hydrographic Climatology (PHC) has been created that merges the 1998 version of the World Ocean Atlas (Antonov *et al.*, 1998; Boyer *et al.*, 1998) with the regional Arctic Ocean Atlas (EWG, 1997, 1998). The result is a global climatology for temperature and salinity that contains a good description of the Arctic Ocean and its environs. Monthly, seasonal, and annual average products have been generated.

NEW This site has recently been updated. Please let us know if you experience any problems with it. (3/05/05) **NEW**

PHC 3.0

The PHC 2.1 fields have been updated as of March 5th, 2005. This page describes the improvements, and contains the new PHC 3.0 fields. To access the old PHC 2.1 site and data, click on [PHC 2.1](#).

♦ [A quick overview of PHC 3.0](#)

♦ [Technical Details](#)

♦ [Optimal Interpolation Information and Software](#)

 ◦ **Annual Fields**

[Explanation](#)
[Sample Graphics](#)
[Download Data](#)

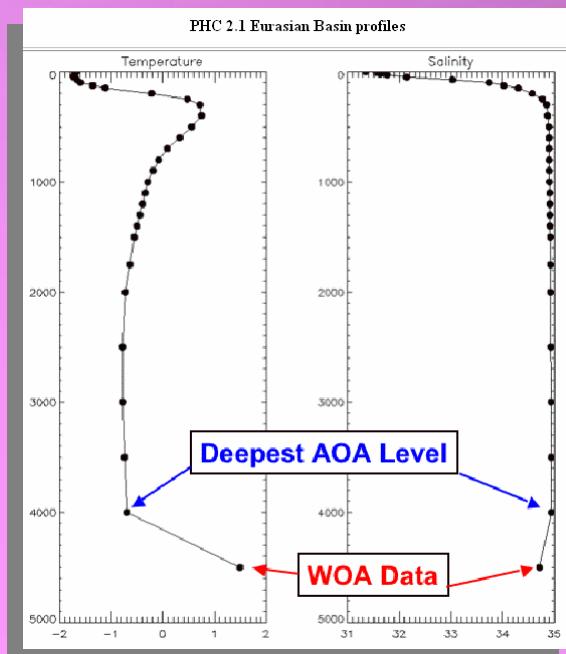
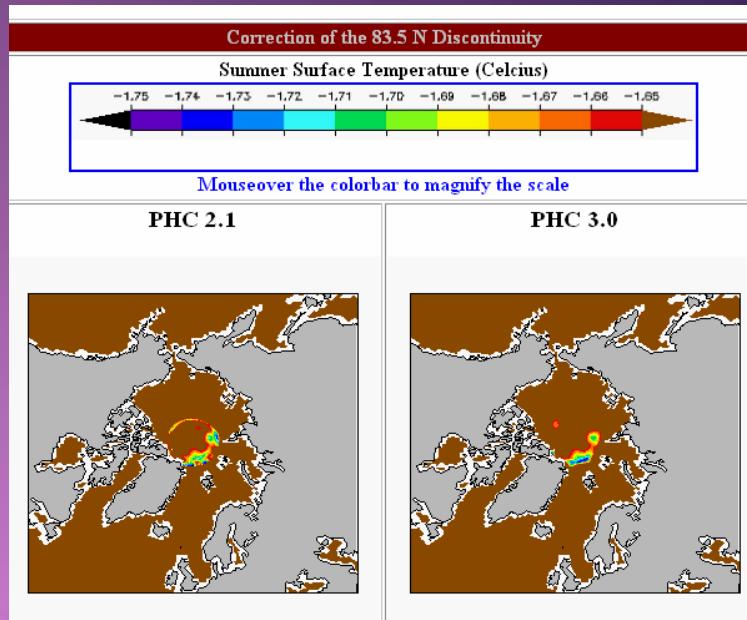
 ◦ **Seasonal Fields**

[Explanation](#)
[Sample Graphics](#)



PHC update: spring 2005

- (1) • Numerical issue: EWG anomalies
→ zonal anomalies
(OI background field)
• Physical problem: small ice-ocean
heat flux anomalies
• Fix: gaussian background field

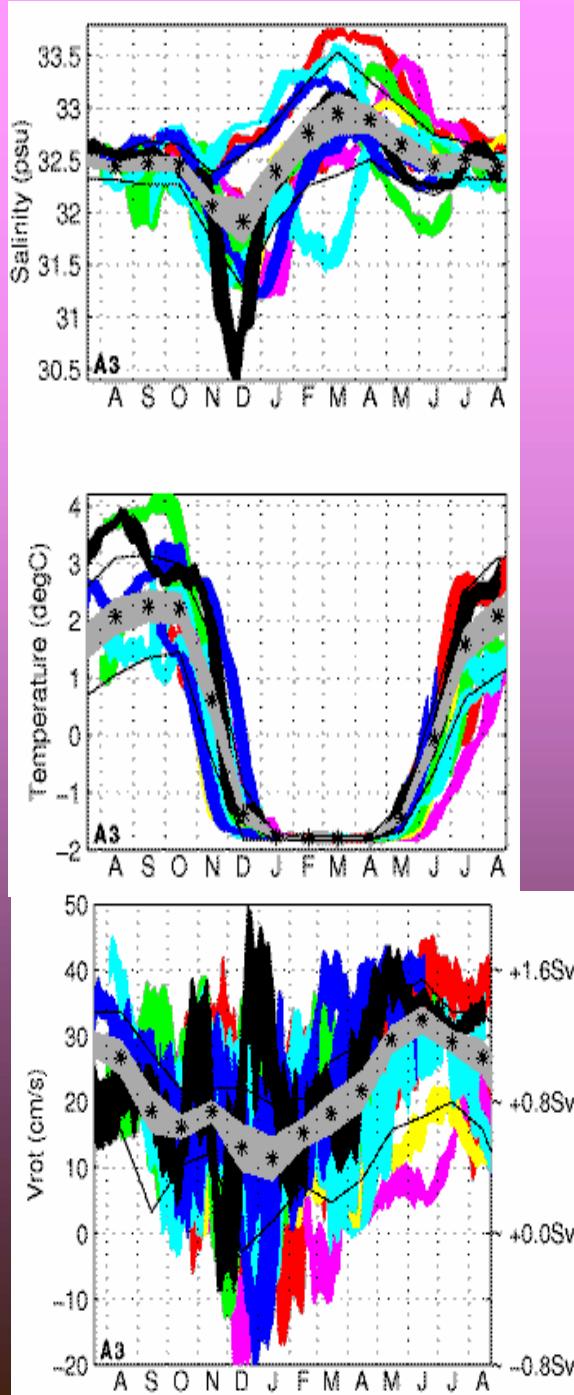


- (2) • Numerical issue: Bad deep WOA data
• Physical problem:
instability →
overturning →
isolated SSH anom's →
long-lived stationary eddies
• Fix: interpolate/extrapolate AOA data

<http://psc.apl.washington.edu/Climatology.html>

Bering Strait fluxes

Woodgate et al., 2004/2005



	T (degC)	S (psu)	V (cm/s)	Vol (Sv)
Jan	-1.77(01)	32.39(16)	11.4(3.3)	0.4
Feb	-1.79(01)	32.76(17)	15.3(2.2)	0.6
Mar	-1.80(01)	32.95(20)	18.2(3.0)	0.7
Apr	-1.78(01)	32.88(13)	21.7(3.0)	0.8
May	-1.44(08)	32.65(12)	29.5(2.0)	1.2
Jun	-0.06(20)	32.45(10)	32.5(2.0)	1.3
July	+1.59(30)	32.51(06)	29.2(1.6)	1.1
Aug	+2.07(31)	32.44(04)	26.8(2.6)	1.0
Sep	+2.25(27)	32.47(06)	18.6(3.2)	0.7
Oct	+2.22(26)	32.46(06)	16.1(1.7)	0.6
Nov	+0.62(35)	32.07(11)	18.6(1.5)	0.7
Dec	-1.36(15)	31.91(21)	13.1(3.5)	0.5
AM	-0.1(02)	32.5(0.1)	20.9(2.5)	0.8

Table 1. Climatological near-bottom temperature (T), salinity (S) and principal component (V) of velocity (heading 329°) at A3, with estimated errors in brackets (grey areas on Figures 2, 3, 4, and 5). Standard deviations (thin black lines on Figures 2, 3, 4, and 5) are ~3 times these errors. Estimated transports (Vol) have errors ~ 25%. Water column means are probably ~ 0.5 to 1 psu fresher and 1 to 2°C warmer than these values during summer/autumn (~ May - October). AM = annual mean.

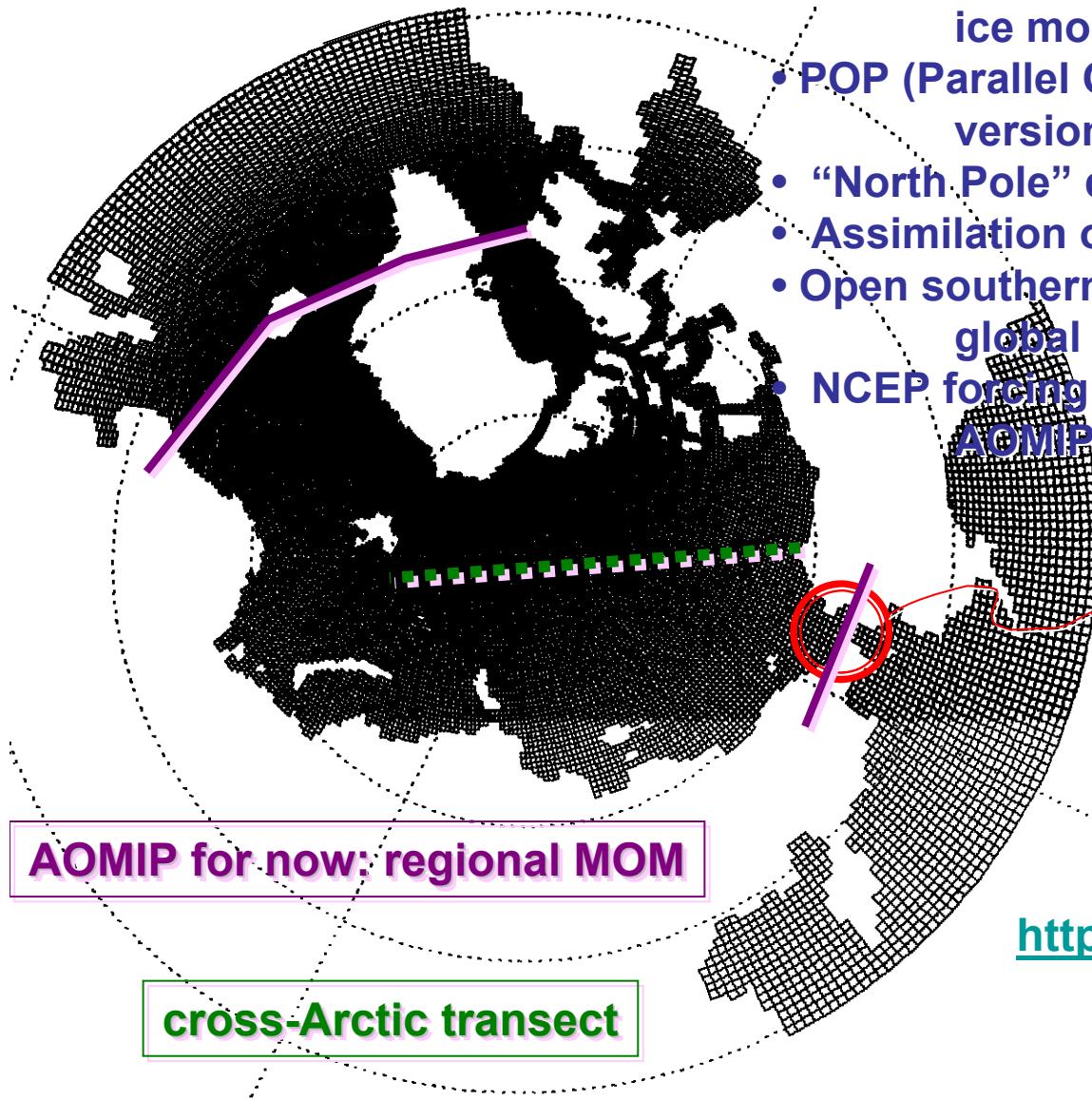
<http://psc.apl.washington.edu/HLD/Bstrait/bstrait.html>

SCICEX cross-arctic sections

- A paper **maybe** in the works...

Muench et al...

Pan-Arctic Ice–Ocean Modeling and Assimilation System (PIOMAS)

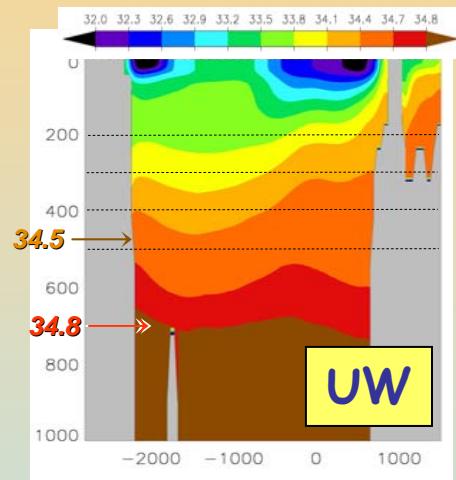
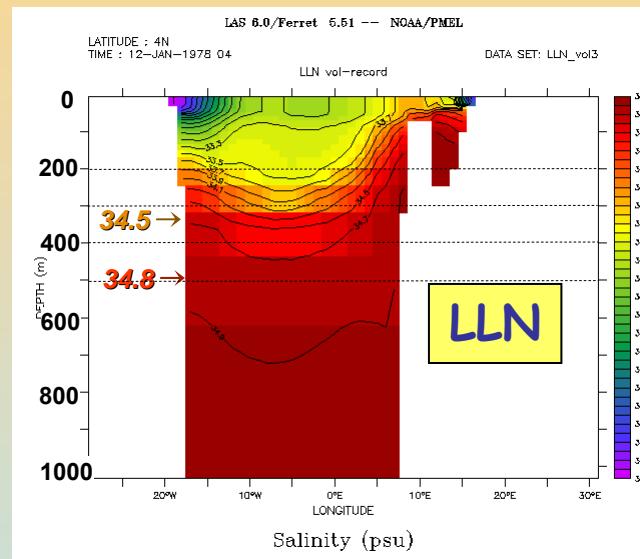
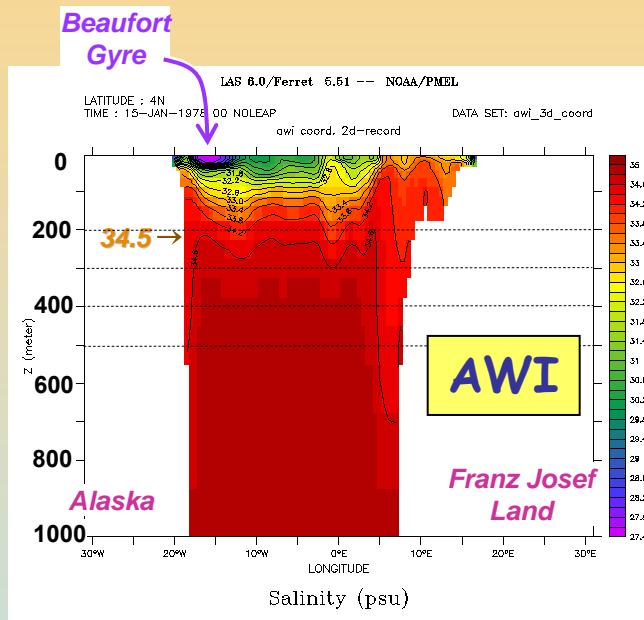


- TED (Thickness & Enthalpy Distribution) sea ice model
- POP (Parallel Ocean Program) ocean model, version 1.4
- “North Pole” displaced to Greenland
- Assimilation of SSM/I ice concentration
- Open southern boundary at 45°N (inflow from global model)
- NCEP forcing now; ERA-40 forcing this summer; AOMIP forcing in the future?

<1979–2004> Bering St. inflow:
1.06 Sv

<http://psc.apl.washington.edu/IDAO>
zhang@apl.washington.edu

2004 LAS study, part I: Salinity sections (1978 mean)

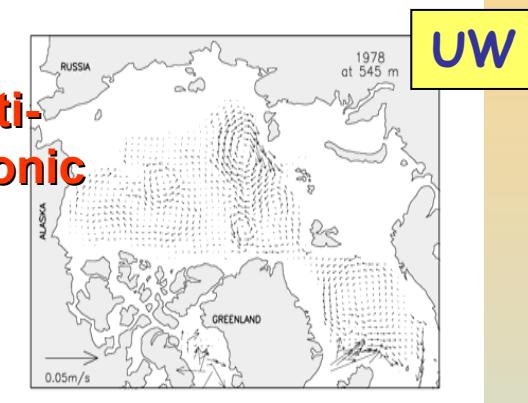
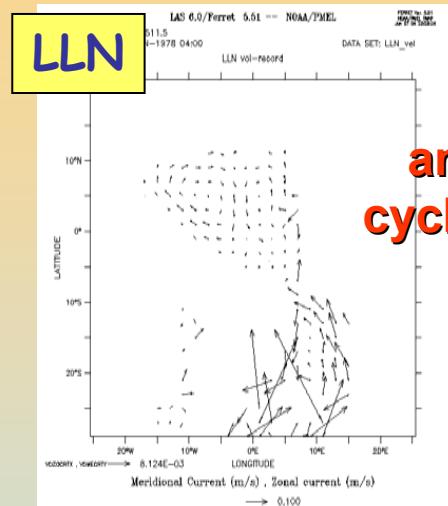
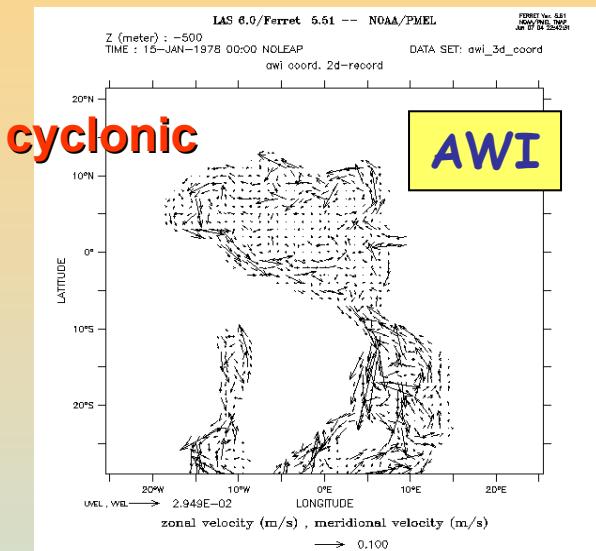


Relative to PHC:
Freshwater is **too shallow**

Relative to PHC:
Freshwater is **too deep**

Ditto, but worse!

2004 LAS study, part II: Velocity at 500 m (1978 mean)



2-layer fluid (0 – 800 m)

Top: *wind-driven B.Gyre*

Bottom: *cyclonic bound. current*

The 2 current systems
are (unrealistically?)
vertically decoupled!

1-layer fluid (0 – 800 m)

wind-driven B.Gyre

Deep anticyclone
“destroys” the cyclonic
boundary current.

What's going on?

Hypotheses:

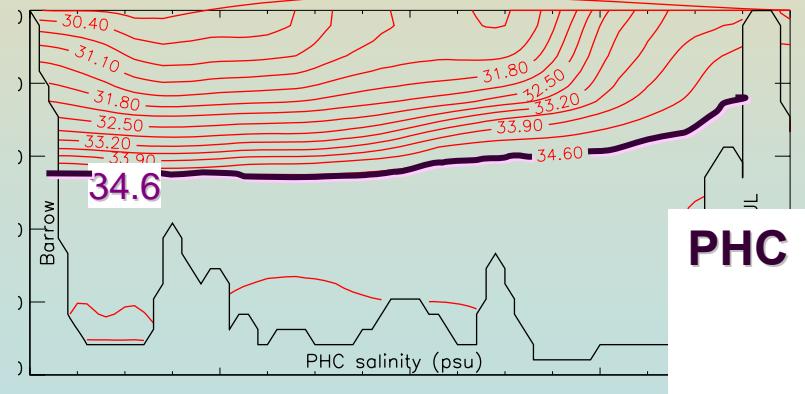
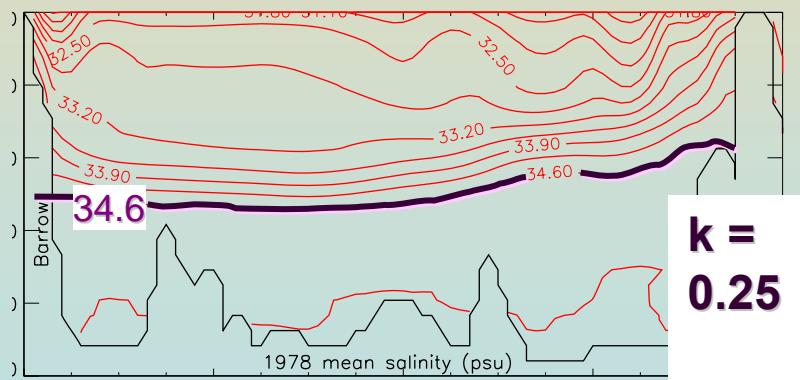
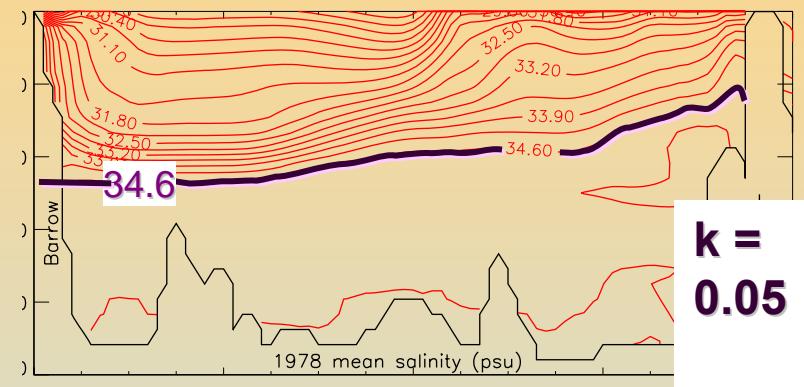
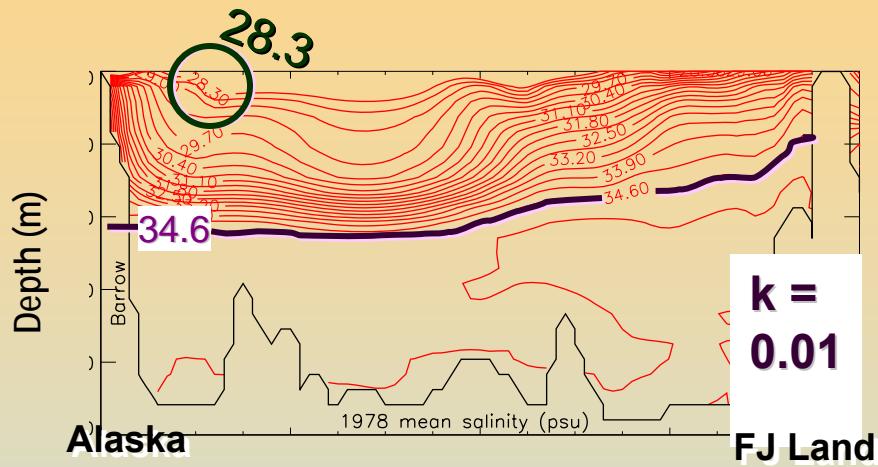
- resolution: *no...*
- surface stress differences (ice motion): *probably plays a role*
- AW inflow differences: *AWI study*
- advection schemes: *AWI & others' studies*
- **vertical mixing**

New work:

Sensitivity experiments with the UW model

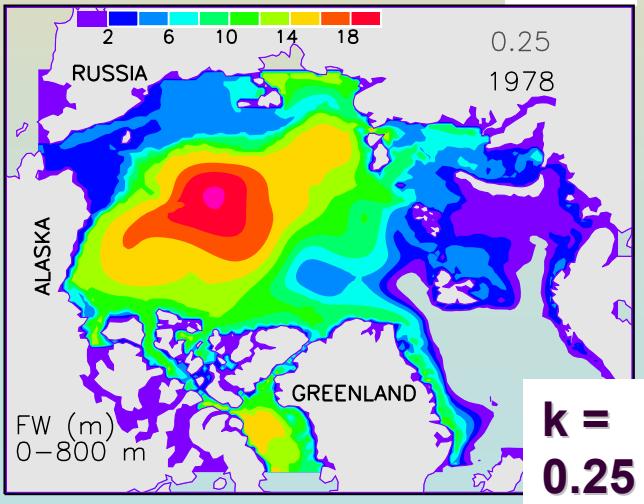
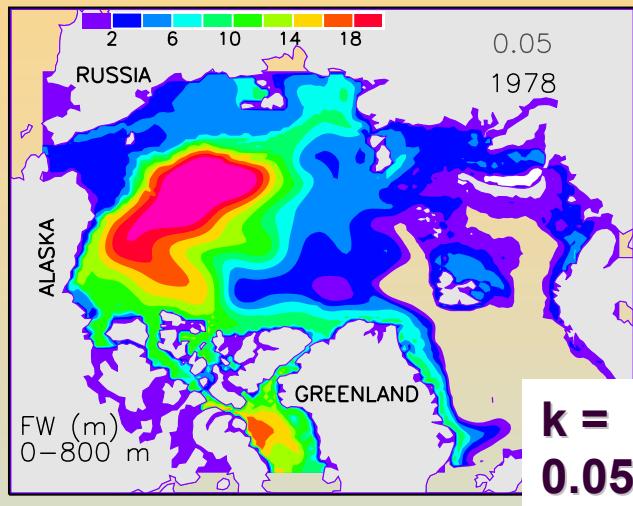
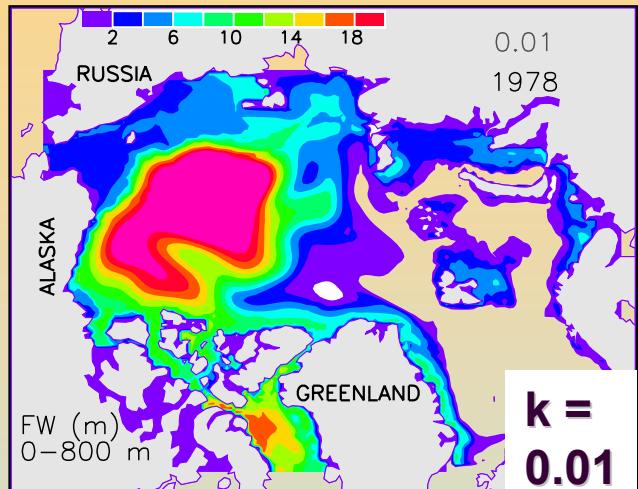
- vertical viscosity & diffusion coefficients =
 0.01, 0.05, 0.25 cm²/s
- UW MOM + TED regional model
- Kraus-Turner mixed layer
- Levitus'82 initial condition,
 but AOMIP restoring to PHC (!)
- analyze 1978 annual ave's

Salinity sections: Alaska – Franz Josef Land



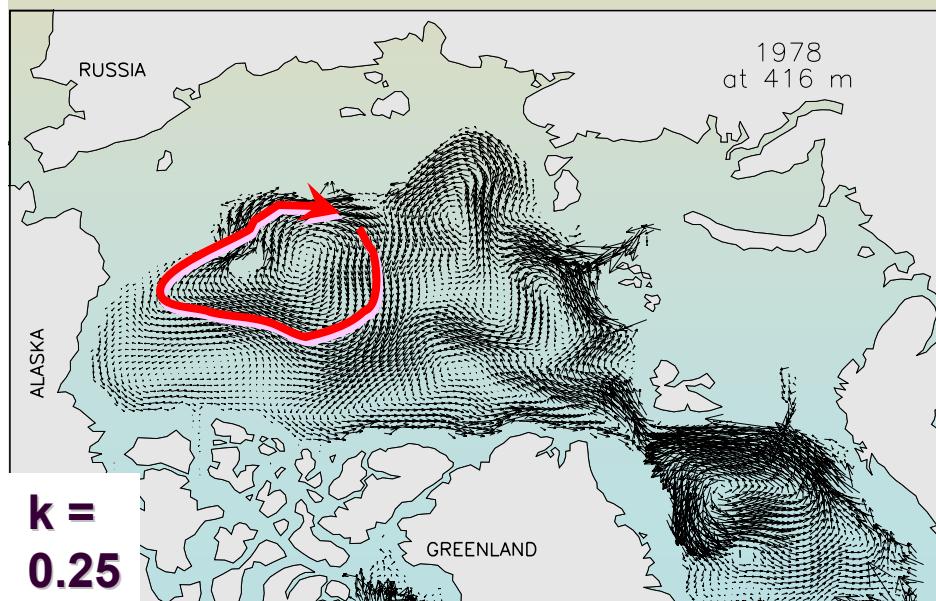
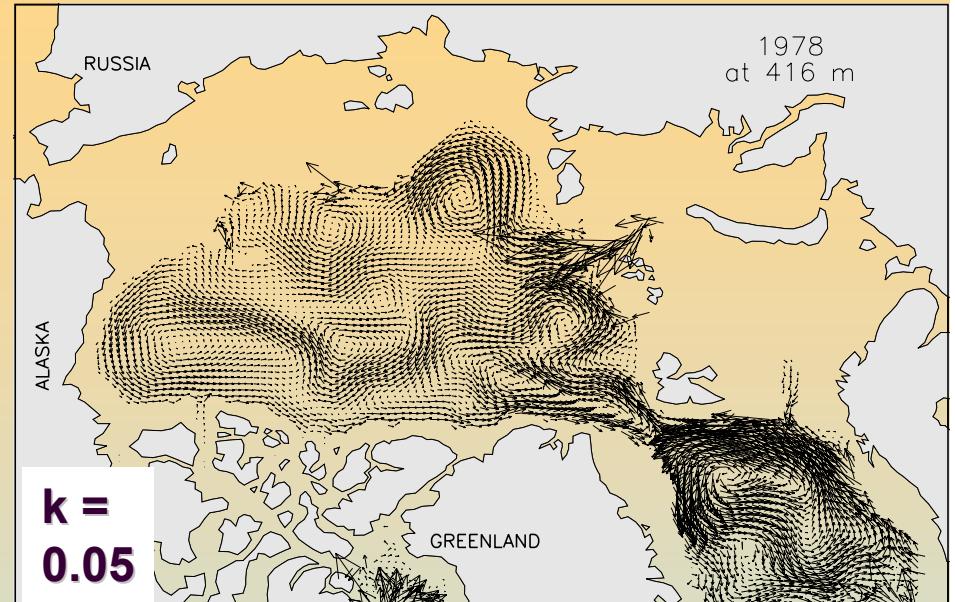
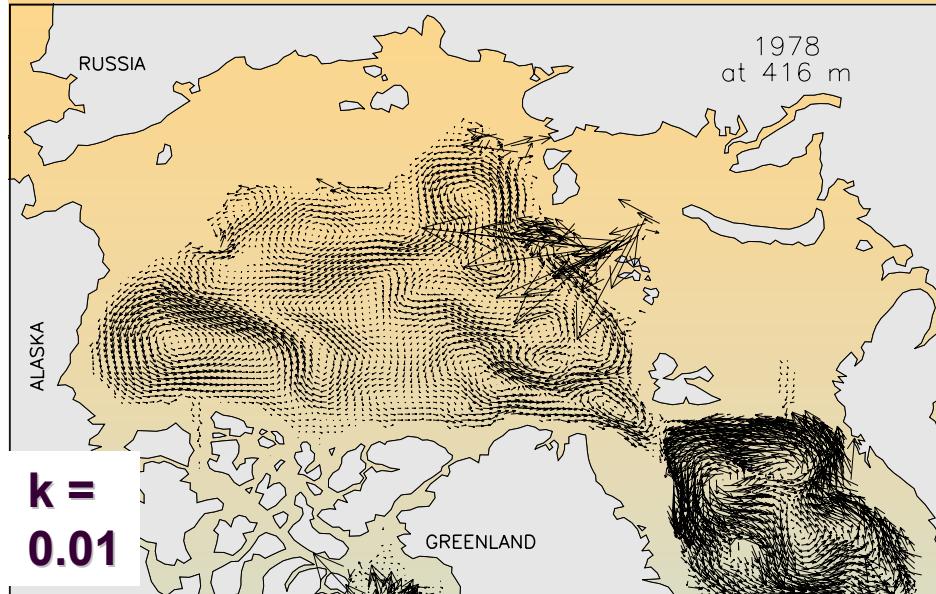
More mixing → deeper freshwater

Freshwater content (0-800 m, rel. to 34.8)



More mixing →
less *column* freshwater,
but it spreads *laterally*!

Velocity at 416 m



It's mostly cyclonic!

• WOA initial condition

From St. inflow:

- old standard: $k = 0.25 \text{ Sv}$
- $0.01 \quad 1.77$
- $0.05 \quad 1.80$
- $0.25 \quad 1.95$

The Beaufort Gyre: baroclinic vs. barotropic

