AOMIP Workshop 6, WHOI, 8-9 May 2003

Pathways and properties of Atlantic Water in the Arctic

From eight (of ten) AOMIP models

AWI	Alfred Wegener Institute	Germany
GSFC	Goddard Space Flight Center	USA
IOS	Institute of Ocean Science	Canada
LANL	Los Alamos National Lab	USA
NPS	Naval Postgraduate School	USA
NYU	New York University	USA
RAS	Russian Academy of Science	Russia
UW	University of Washington	USA

compare **temperature**

salinity

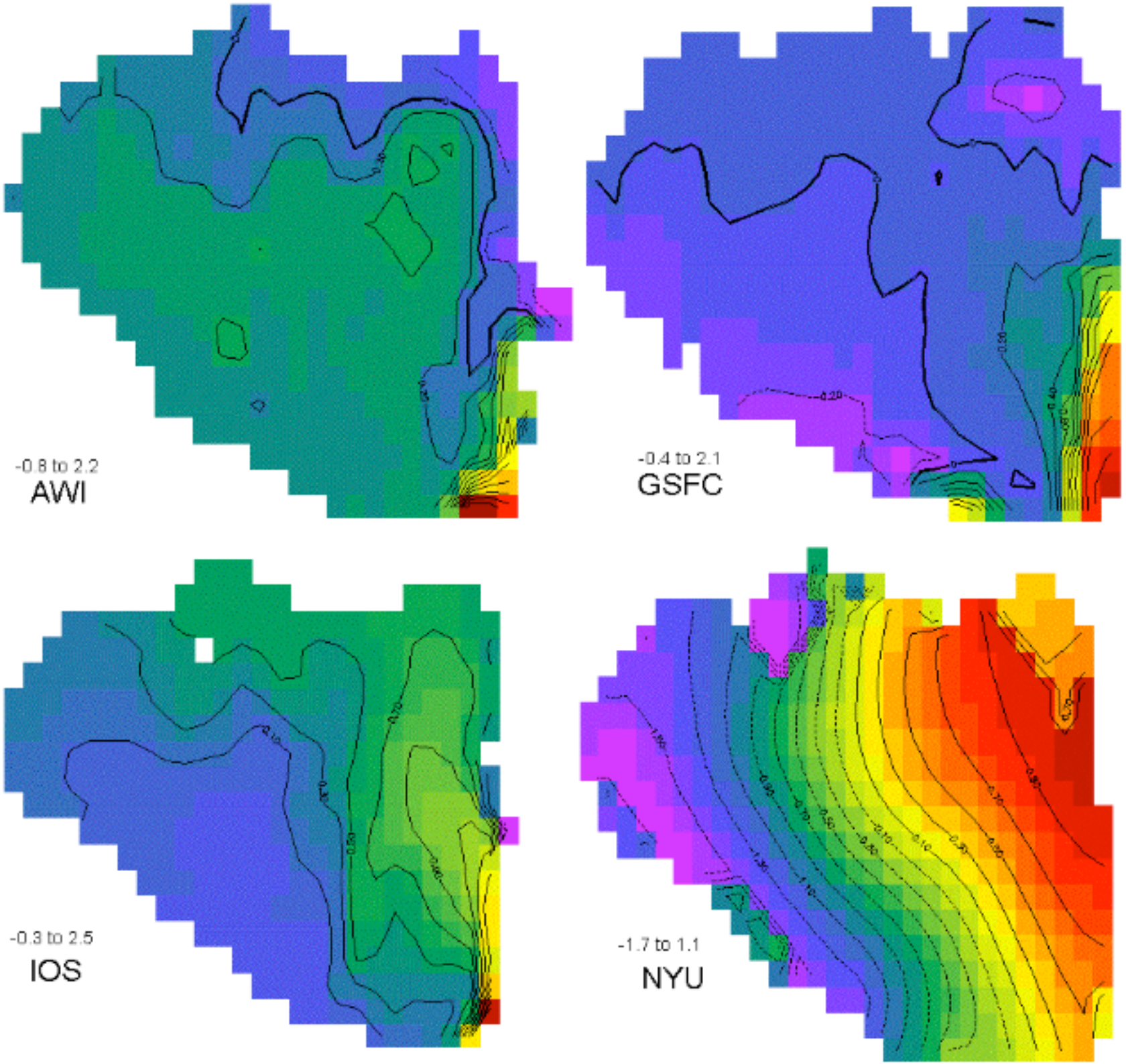
velocity at 500m after 30 years common spinup (to April 1978)

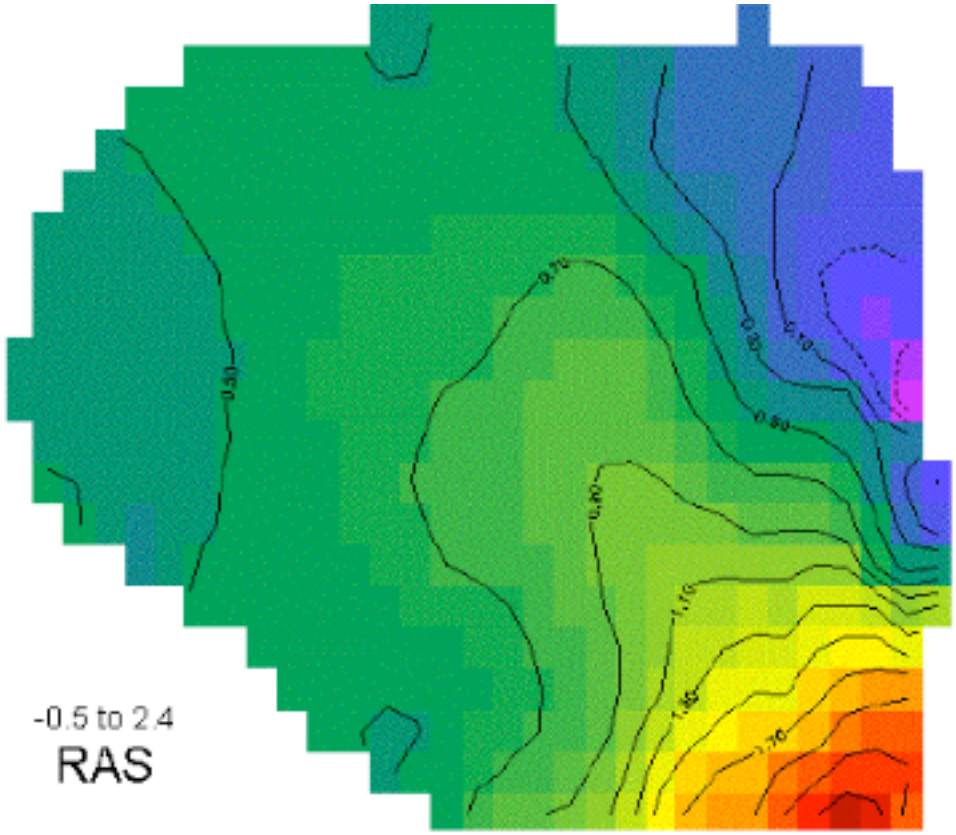
What is alike?

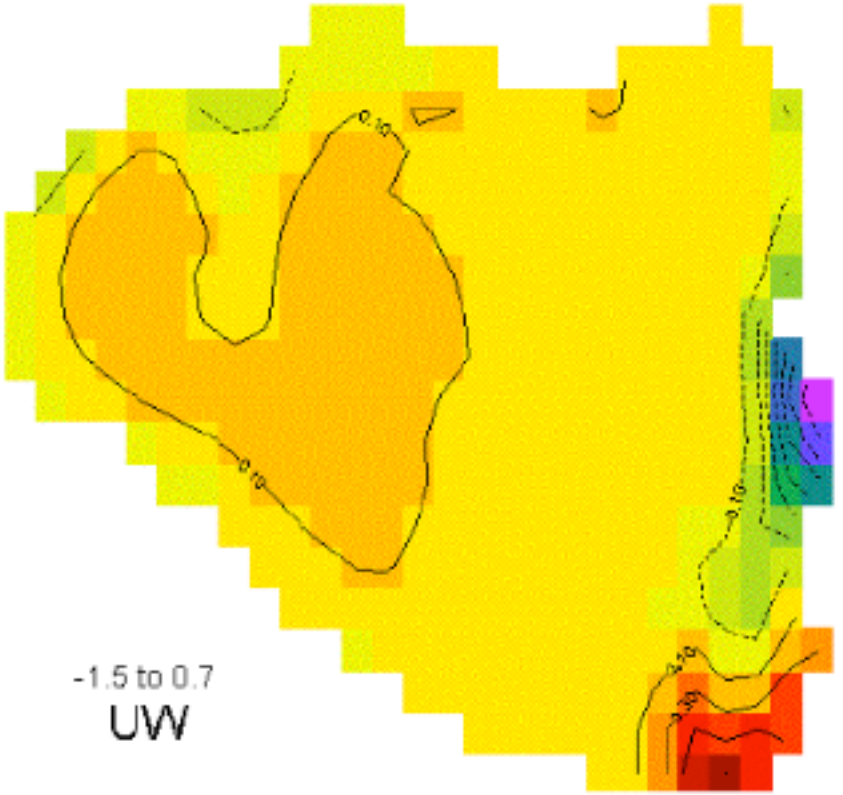
What differs?

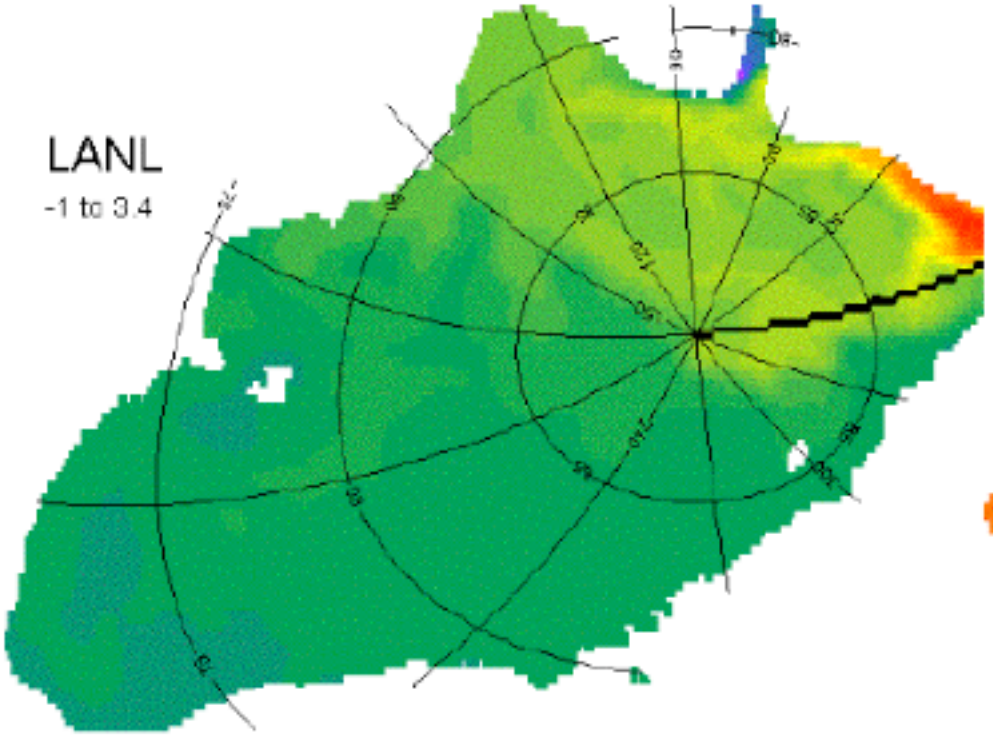
Why?

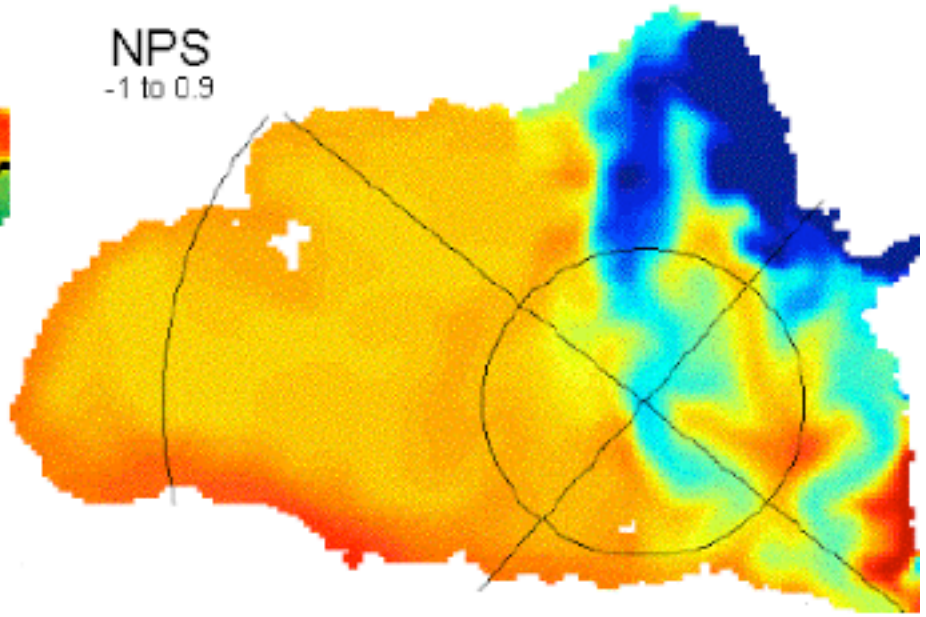
Forward?

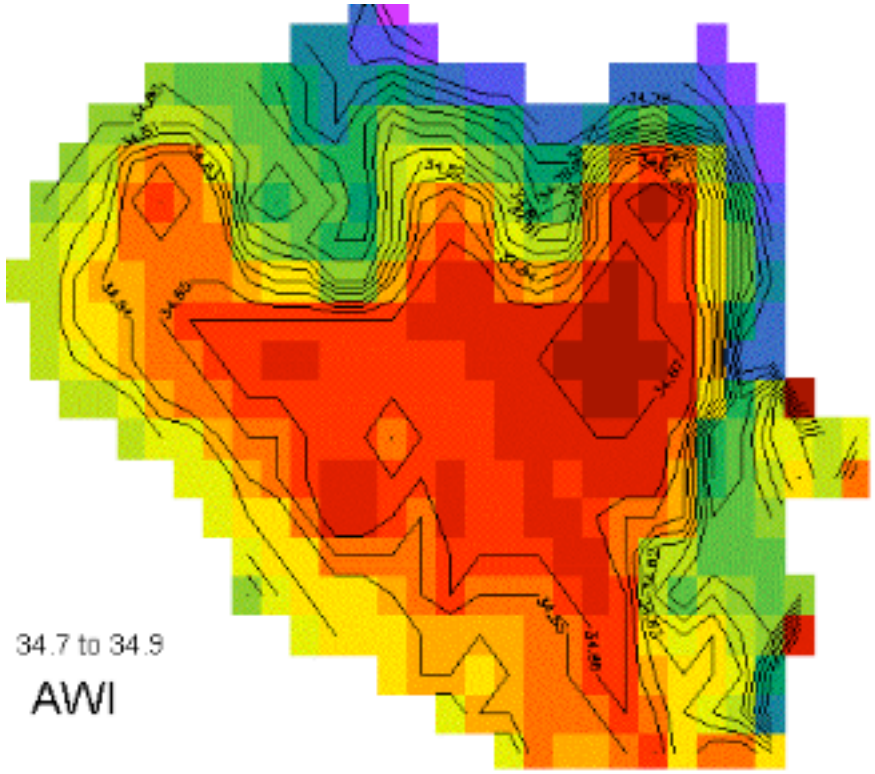

-0.8 to 2.2
AWI
-0.4 to 2.1
GSFC
-0.3 to 2.5
IOS
-1.7 to 1.1
NYU


-0.5 to 2.4
RAS


-1.5 to 0.7
UW

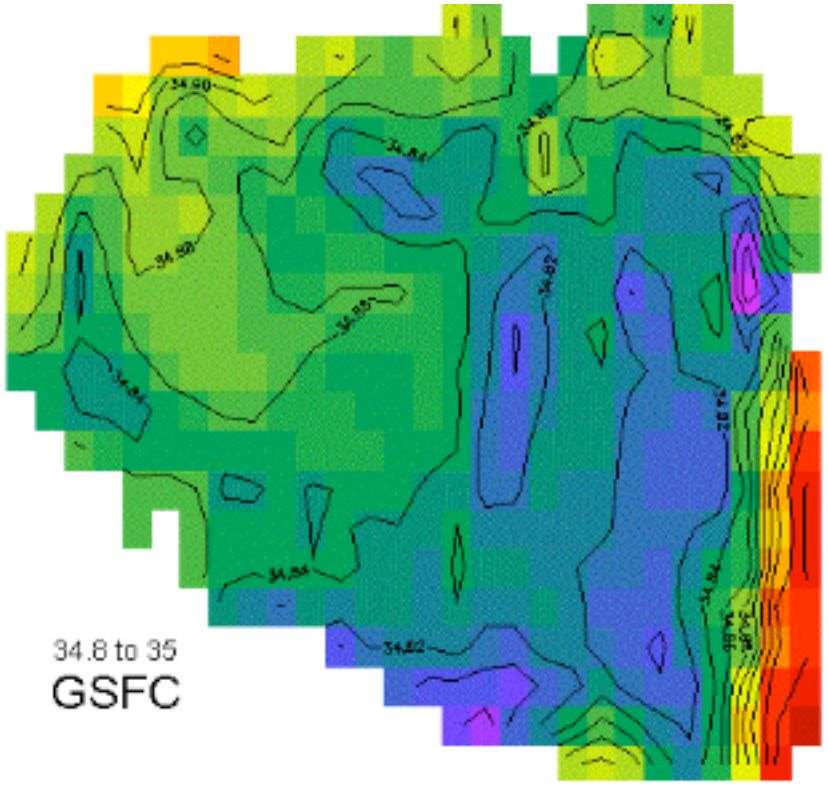

LANL
-1 to 3.4


NPS
-1 to 0.9



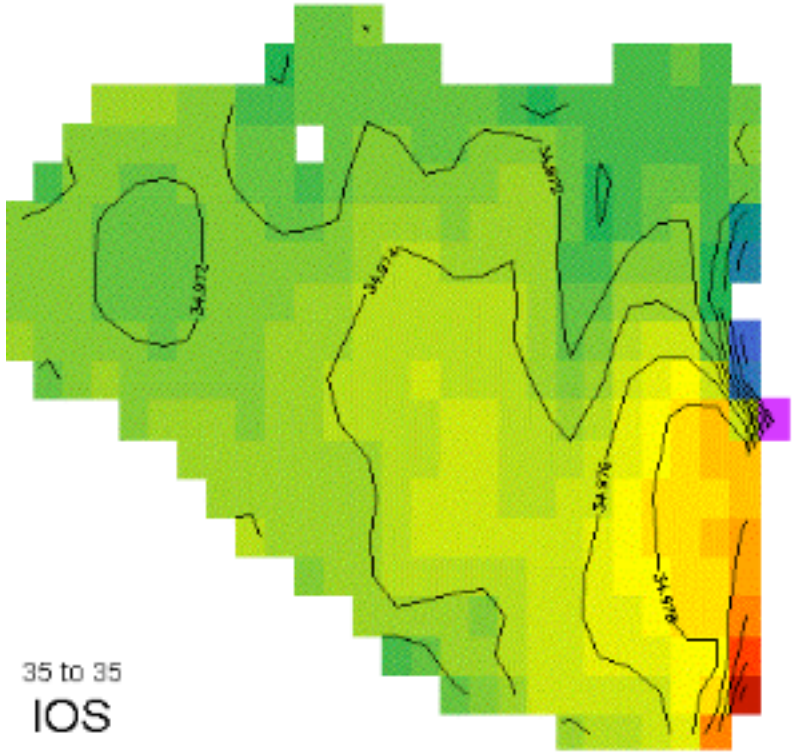
34.7 to 34.9

AWI



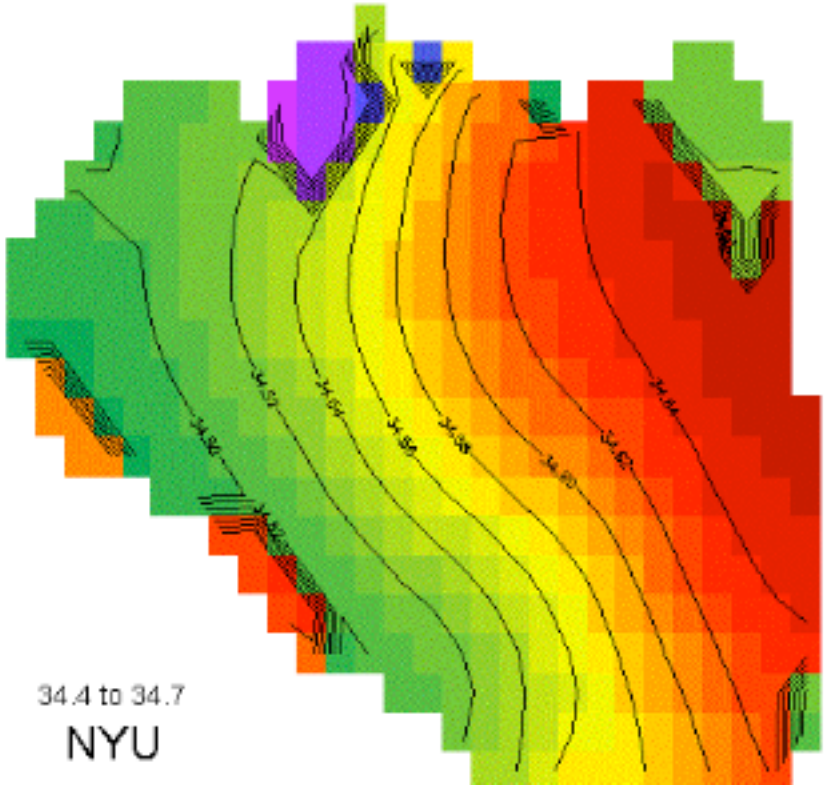
34.8 to 35

GSFC



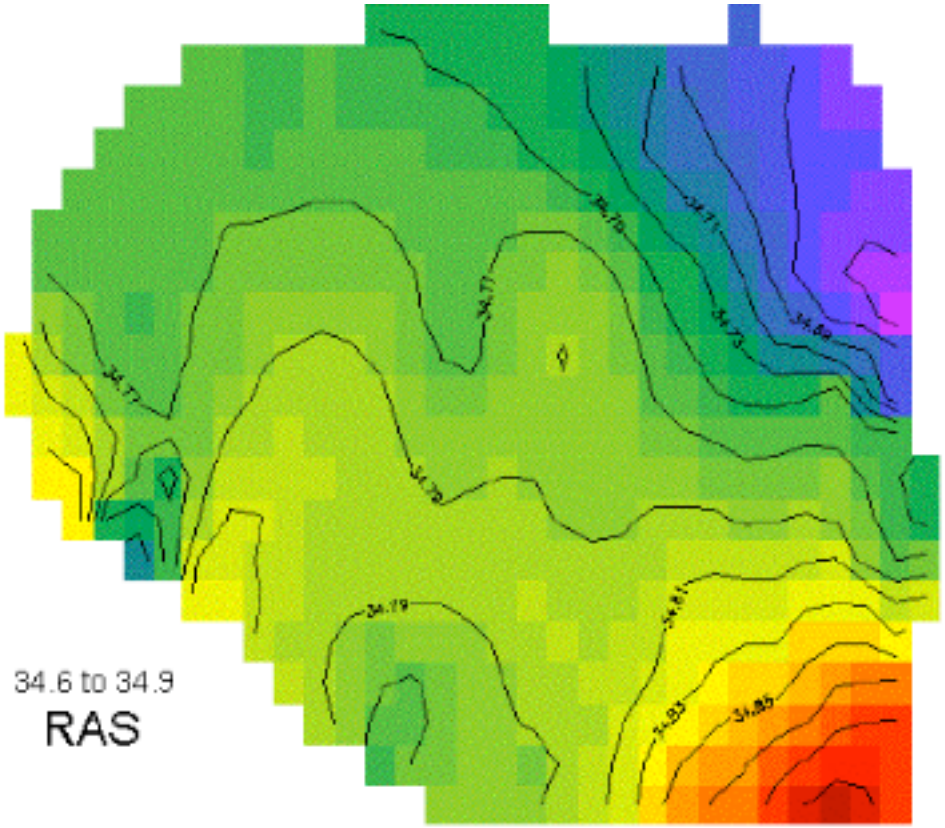
35 to 35

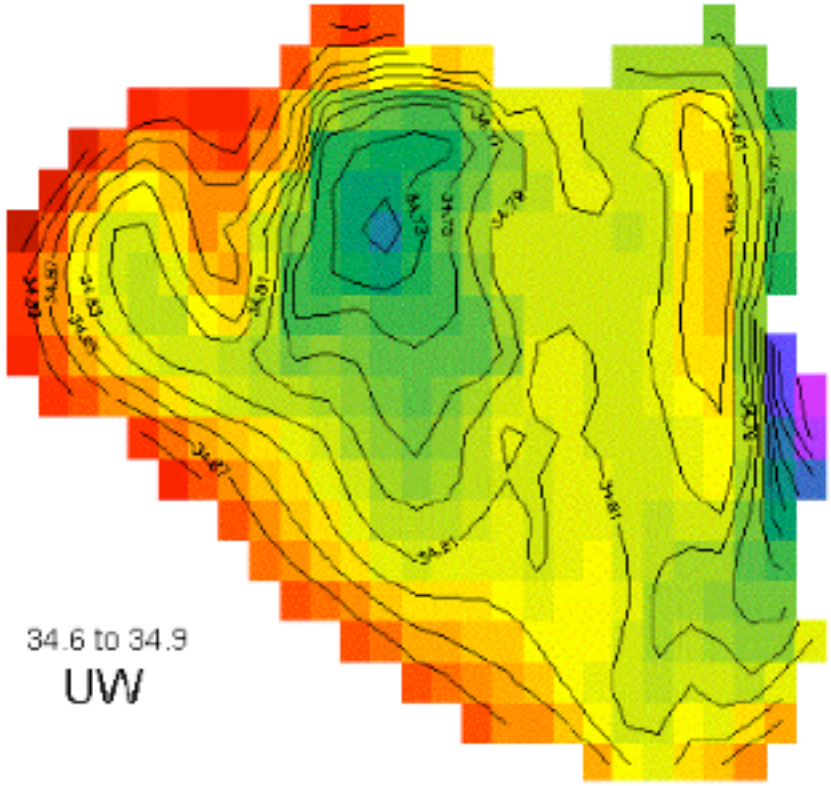
IOS

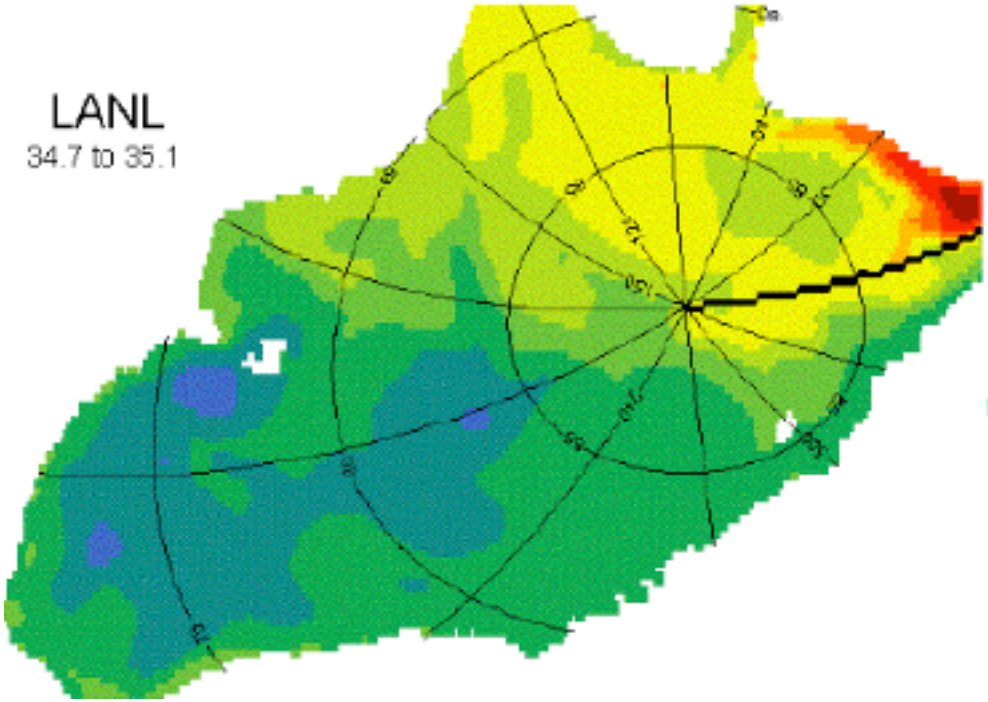


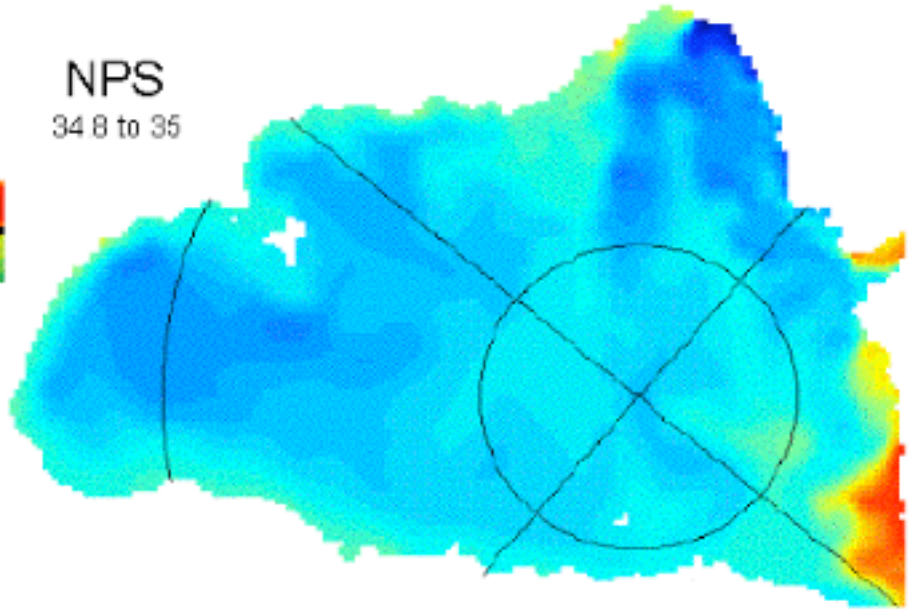
34.4 to 34.7

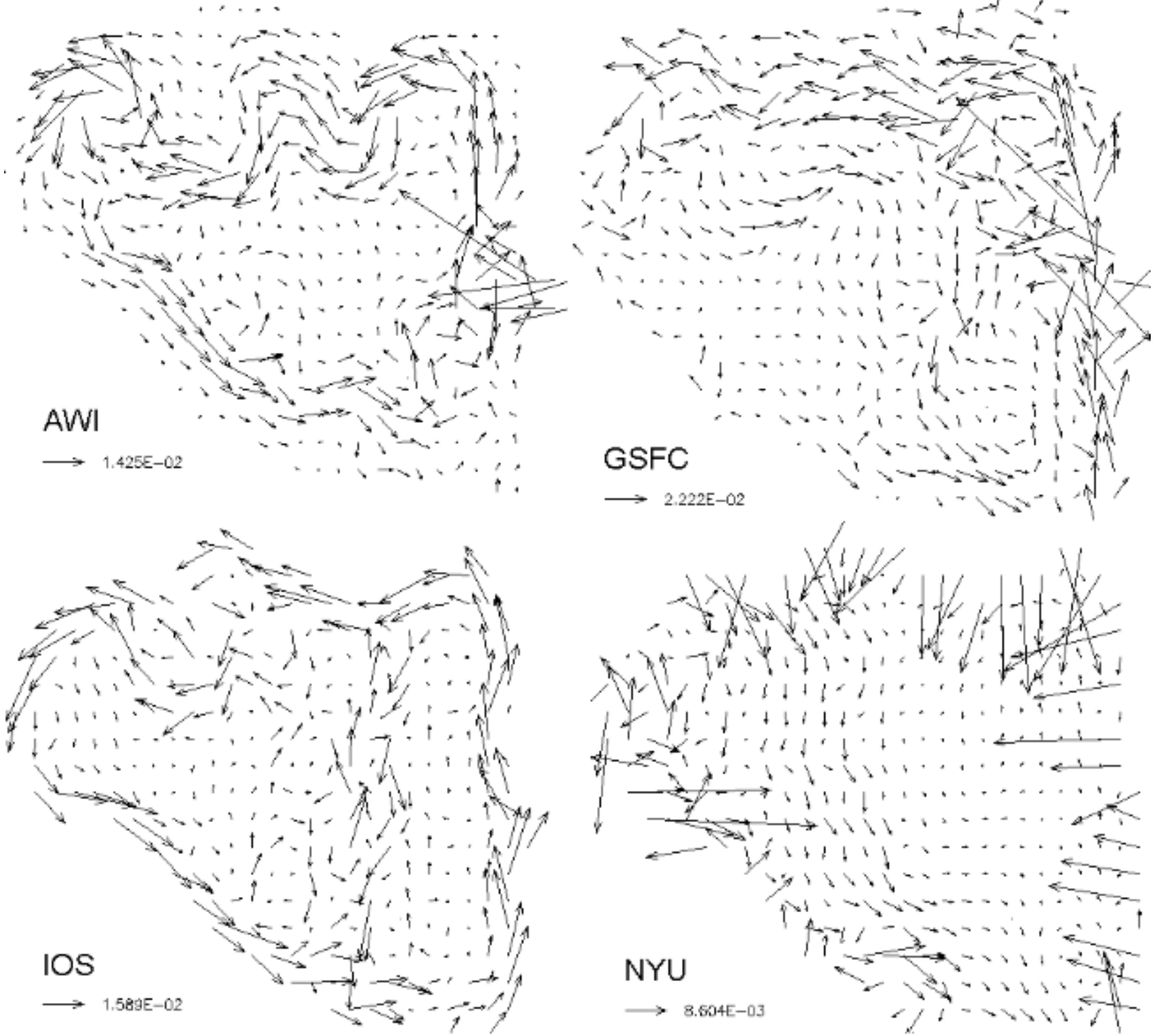
NYU

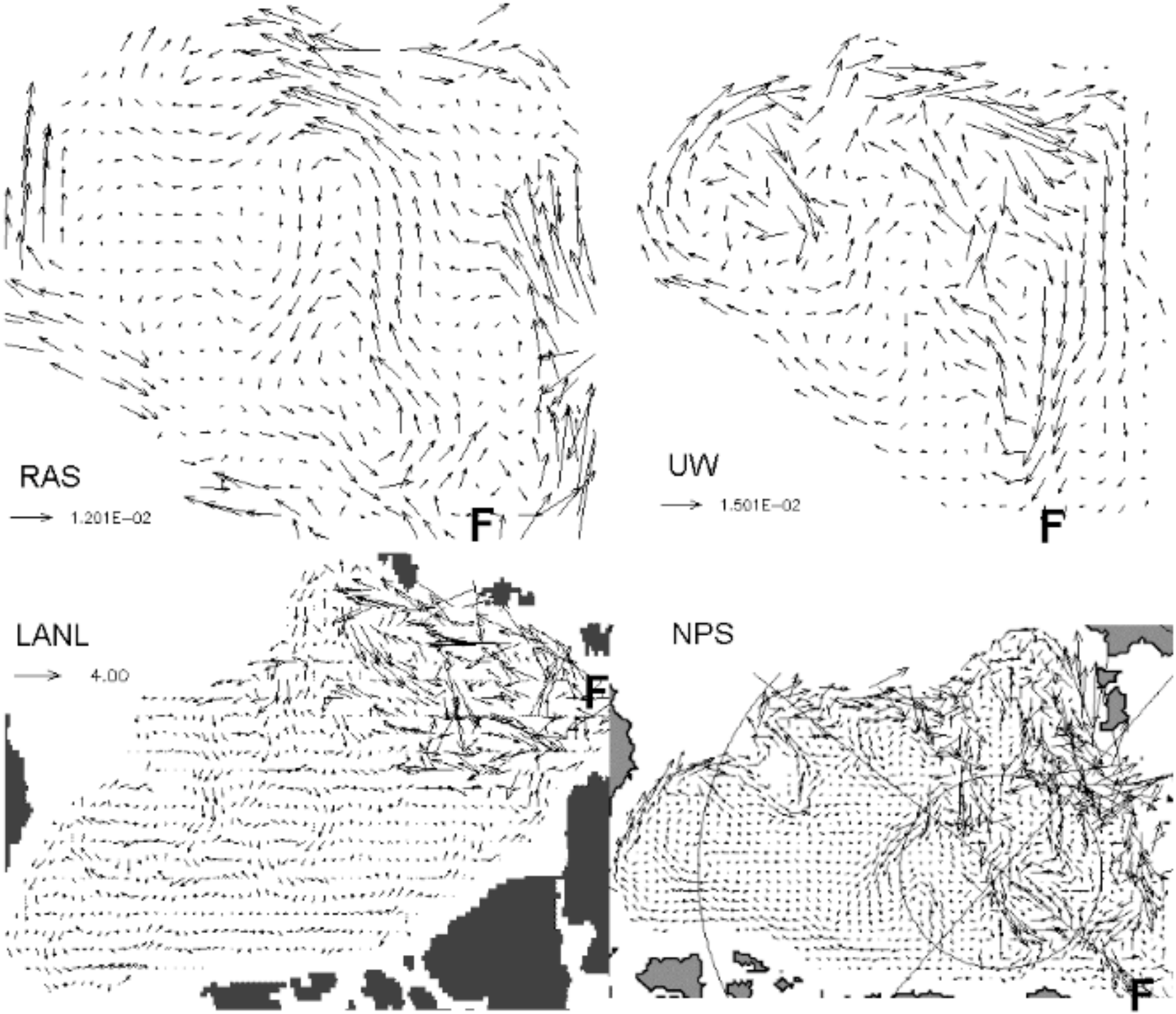

34.6 to 34.9
RAS


34.6 to 34.9
UW

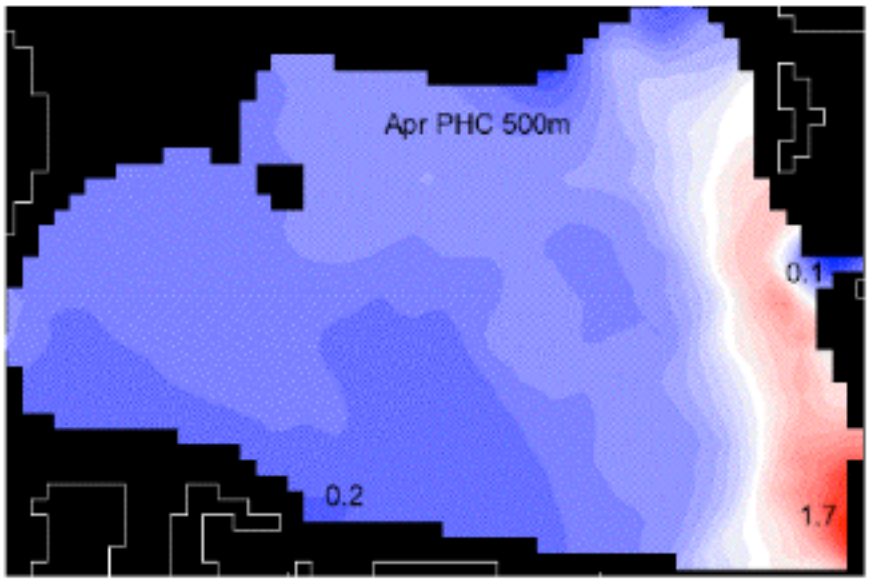

LANL
34.7 to 35.1

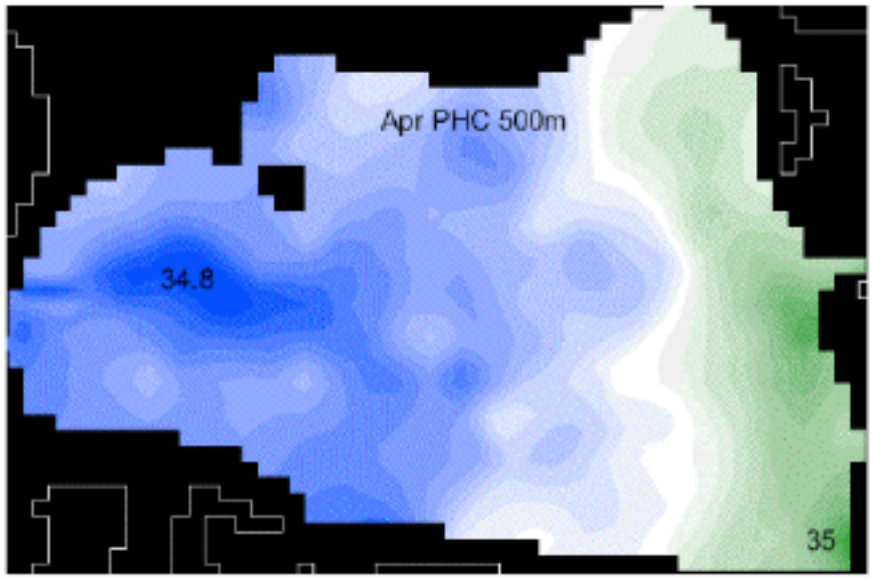

NPS
34.8 to 35


AWI
1.425E−02
GSFC
2.222E−02
IOS
1.589E−02
NYU
8.604E−03

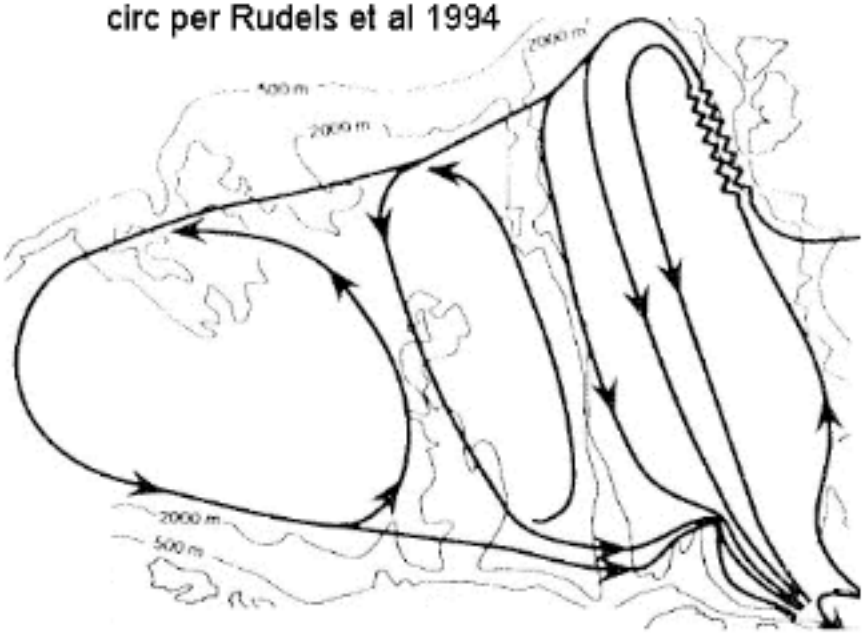

RAS
1.201E−02
F
UW
1.501E−02
F
LANL
4.00
F
NPS
F

Estimated climatological (PHC) temperature and salinity at 500m,
and sketches of plausibly representative circulation mid-depth.

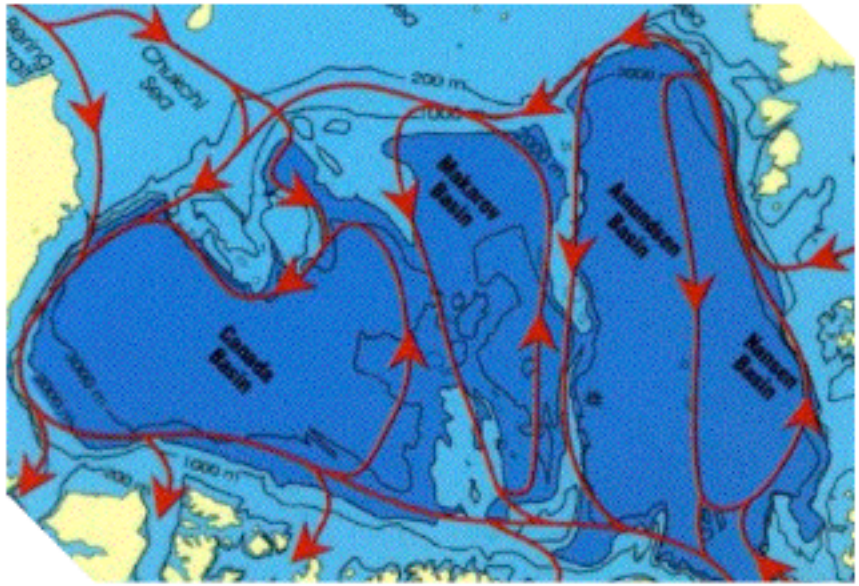




circ per Rudels et al 1994



circ per McLaughlin et al 1996



Why so much variation among models?

Hypoth #1: T & S sensitivity to FSB vs BSB & BS transform

Hypoth #2: AW circ pattern delicately balanced => variable

Hypoth #3: systematic problems -- models? physics? ???

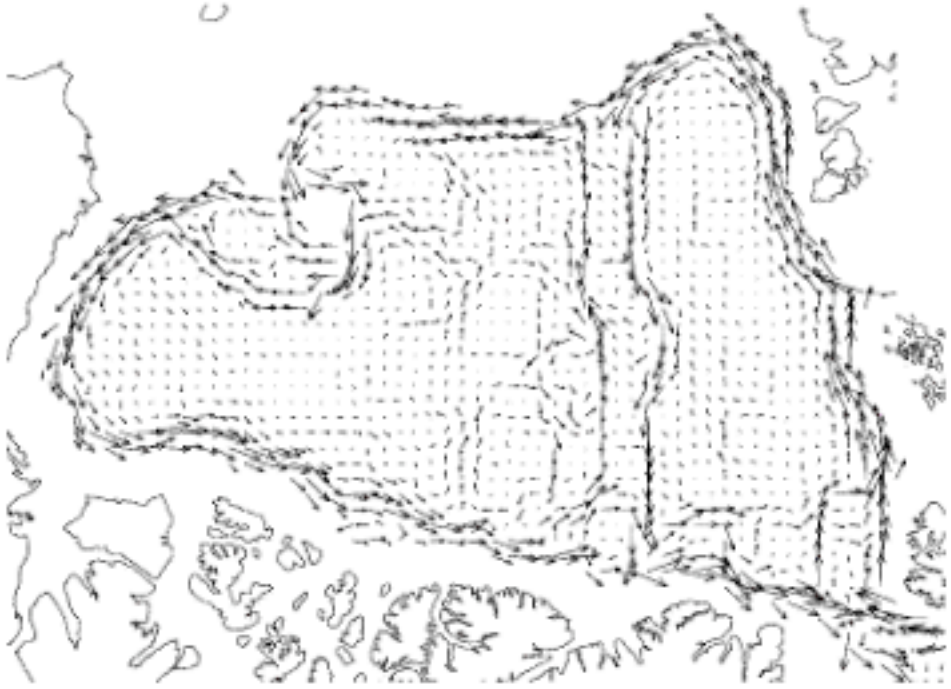
Ocean dynamics (hence models) follow classical mechanics + fudge (*e.g.*, eddy viscosity).

Real oceans have way too many degrees of freedom. Statistical dynamics?

Using "IOS" (from AOMIP), flow at 500m at year 30 (1978) under common spinup expt:

Classical eddy viscosity: $\partial_t \mathbf{u} = \ldots + \nabla A \nabla \mathbf{u}$

Statistical: $\partial_t \mathbf{u} = \ldots + K \partial_{\mathbf{u}} S$, $S \equiv -\int \log(P) dP$



$K \partial_{\mathbf{u}} S \approx \nabla A \nabla (\mathbf{u} - \mathbf{u}_*)$ where $\mathbf{u}_*$ such that $\partial_{\mathbf{u}} S \approx 0$ and $\mathbf{u}_* H = k \times \nabla \Psi_*$ where $\Psi_* \approx -f L^2 H$

Diagnostics?

1. Timeseries of total FSB & BSB transport. Definition?
2. Timeseries of total heat & FW exchange Barents sea?
3. Timeseries of topostrophy $\tau = \mathbf{U} \bullet \mathbf{f} \times \nabla \mathrm{H}$ (500m or ?)