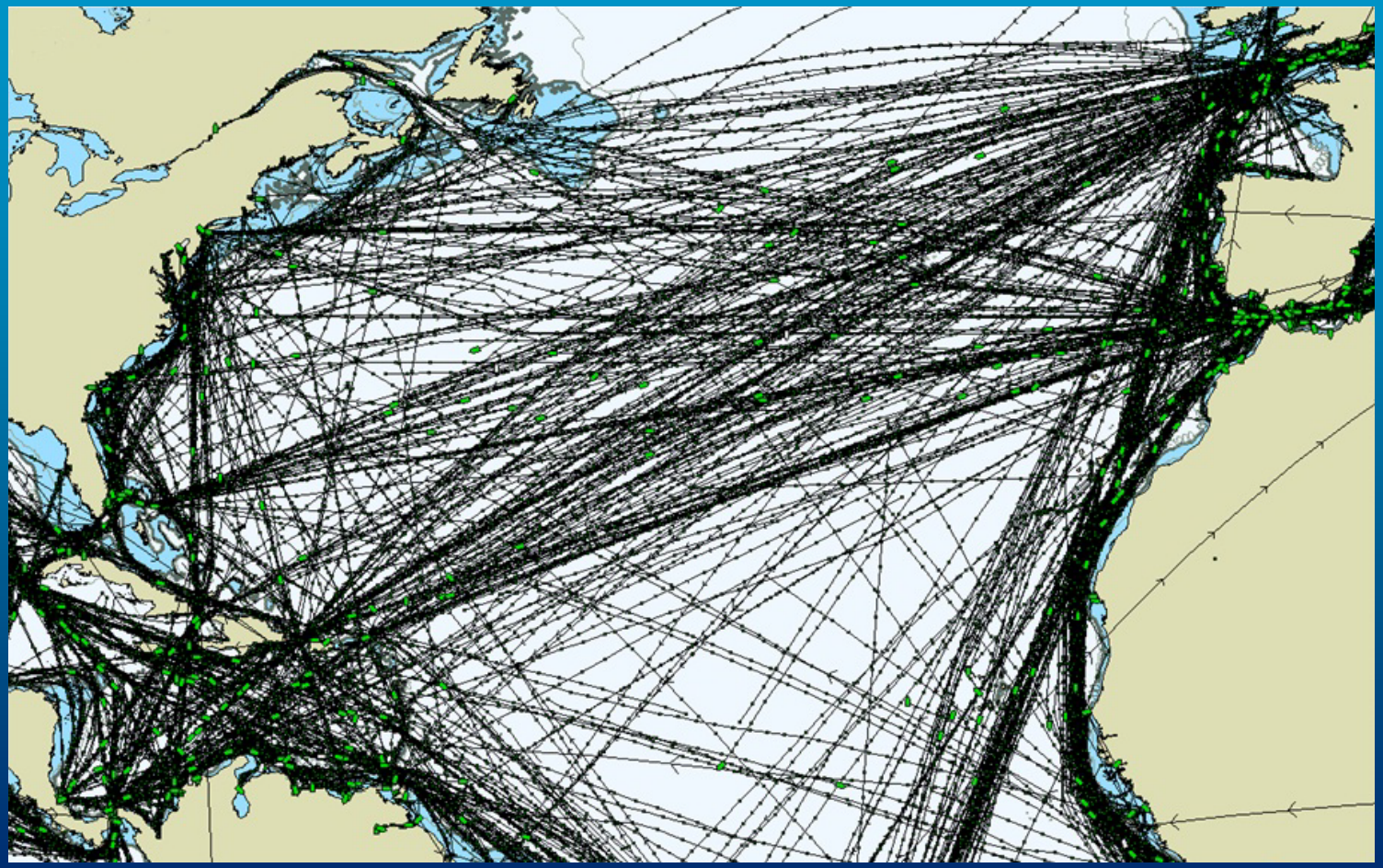
OceanScope: Satellites of the Sea

Peter B. Ortner

Cooperative Institute for Marine & Atmospheric Studies

Rosenstiel School/University of Miami

Ship tracks January 2012, courtesy ICS (incomplete record)



The Vision

Bringing ocean scientists and the marine industries together to enable systematic study of the oceanic water column and thereby better understand the ocean's interior dynamics and its impact on climate and global change.

Partnership Began with the WG Membership (unique in SCOR)

The WG readily recognized the potential of a formal partnership that could:

1) coordinate the installation and operation of instrumentation on a fleet of commercial vessels,

2) identify vessels and vessel-builds relevant to routes of interest, and

3) stimulate and realize the development of full water-column capable measurement technologies.

What is truly unique about the OceanScope concept is its proposal to directly measure ocean currents, to create synergies by integrating circulation measurements with simultaneous present and next-generation chemical and biological measurements and to freely distribute these data to the international research and operational ocean communities.

Our Current “Fleet”

- CMV/Oleander (BCL)
- M/S Norröna (Smyril Line)
- CMV/Nuka Arctica (Royal Arctic Line)
- Explorer of the Seas > Freedom of the Seas (RCCL)
- Allure of the Seas (RCCL)
- Equinox (Celebrity)

Representative Vessels

“OceanScope” Vessel Capabilities

Near Surface Properties/Met Data – AMOS
ADCP(s) – supplementary GPS/B_T
Automated XBT launchers

……..

pCO2 systems
M-AERI
Full VPN connection to shoreside if available

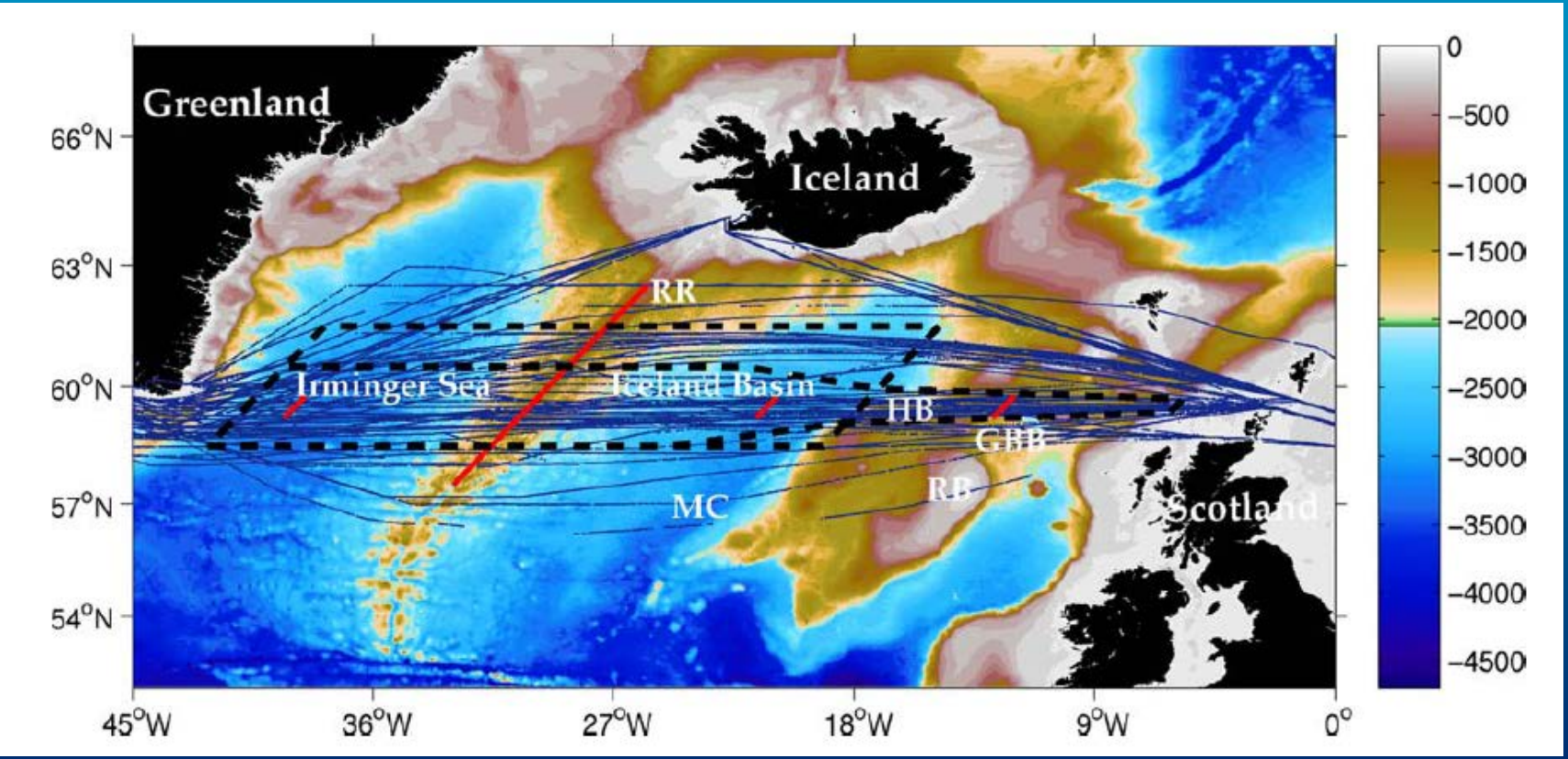
Cruise vessel tracks in Caribbean

Eastern, Western and Southern Caribbean itineraries

Approximately 20 ports of call throughout the Caribbean: ~ six U.S. ports, Miami largest number; typically 3 – 10 days

Celebrity Equinox

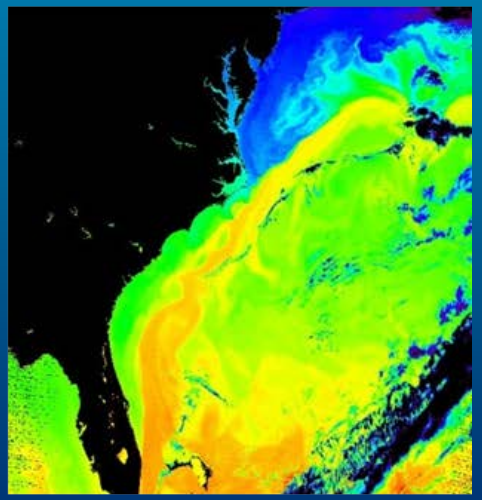
Nuka Arctica Tracklines



Explorer measurement of skin SST by M-AERI

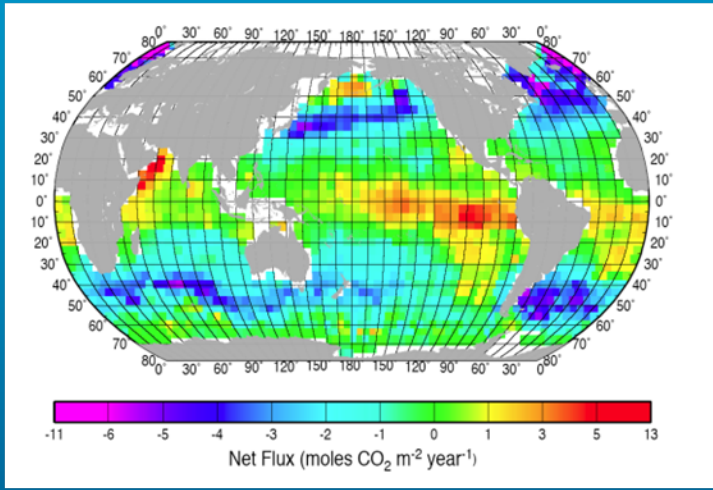
The M-AERI is a Michelson-Morley Fourier-transform infrared interferometric spectro-radiometer. We use it to make very accurate measurements of the sea-surface temperature. We also measure surface emissivity and the temperature profile through the skin layer.

The data is essential to calibrate

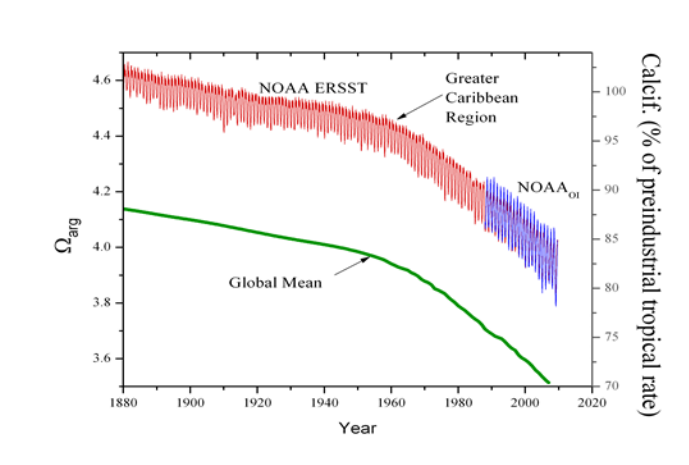


Satellite SST

Since 2002 over a half a million CO_2 measurements have been made on Explorer of the Seas to determine:



We have determined that the ocean absorbs about 1.7 Pg C each year or about 20 % of the CO_2 released by fossil fuel burning.



We have measured seasonal changes and long-term decline in pH-controlled coral calcification rates.

Quantifying GS Variability

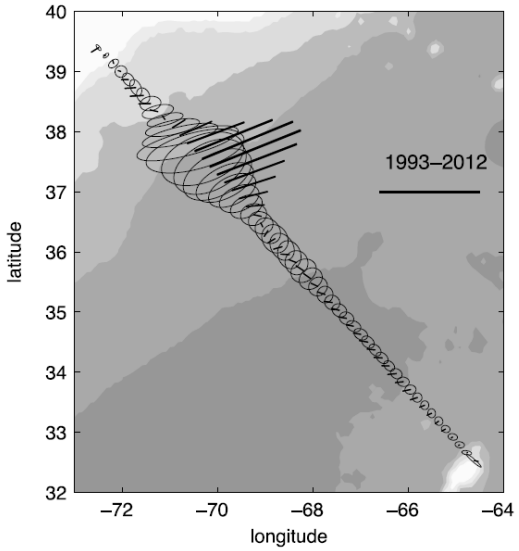
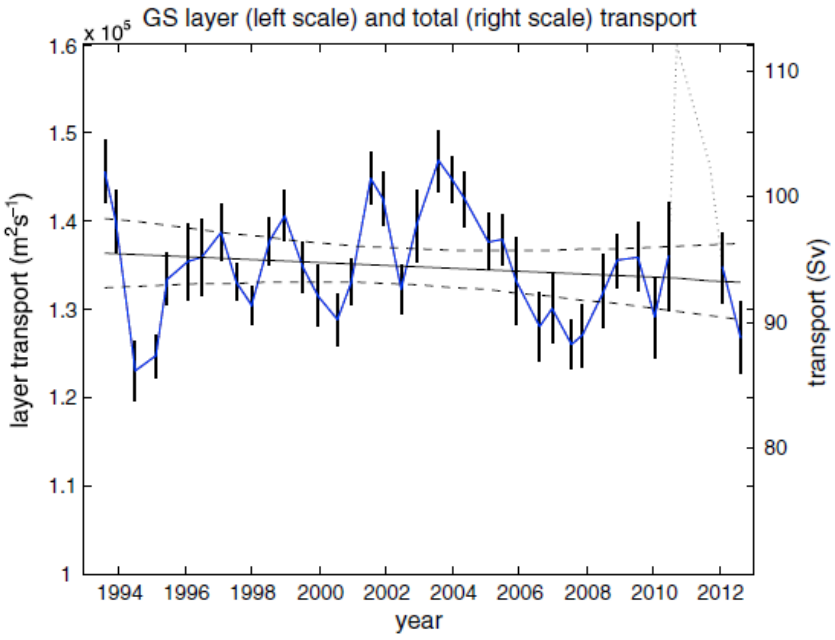
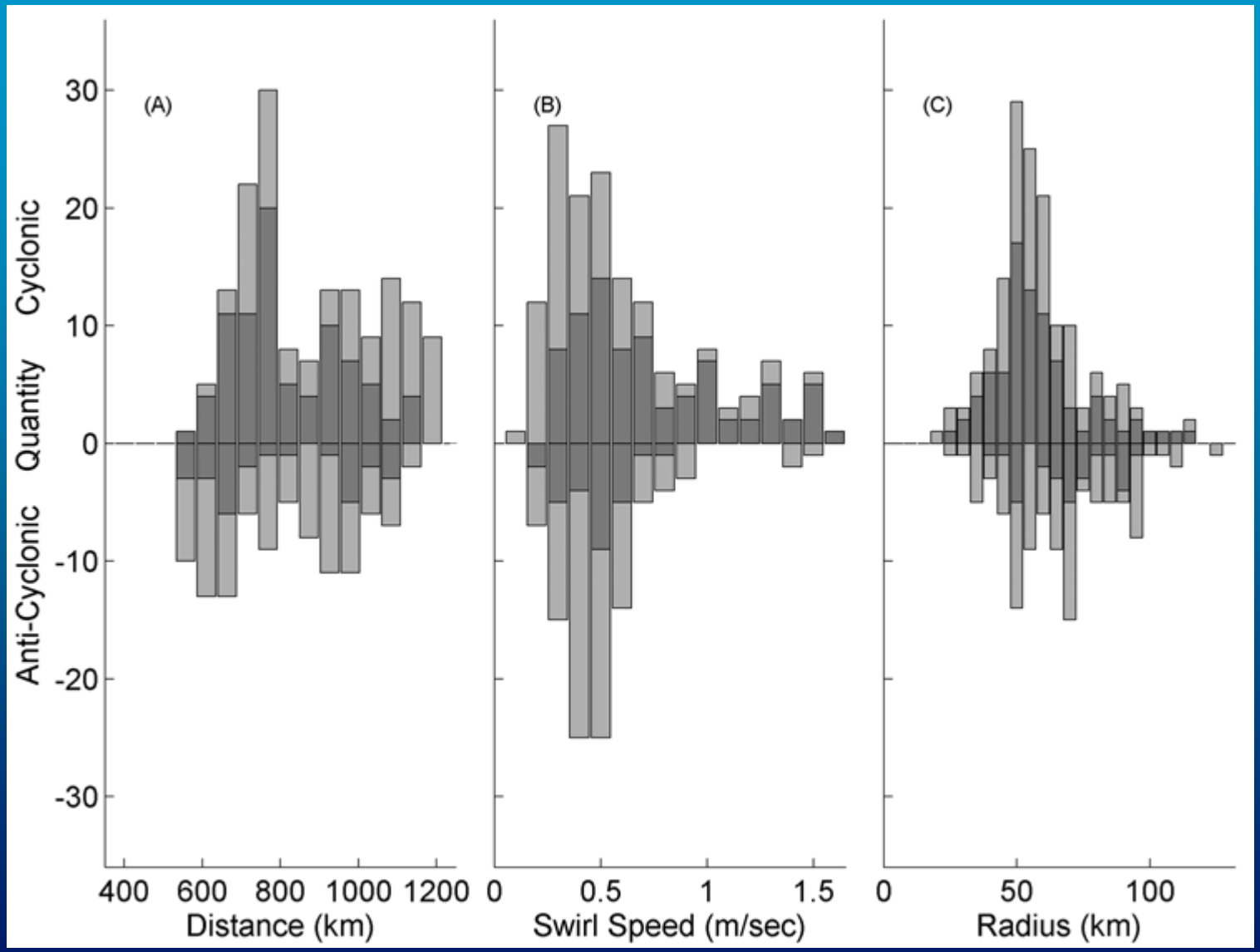


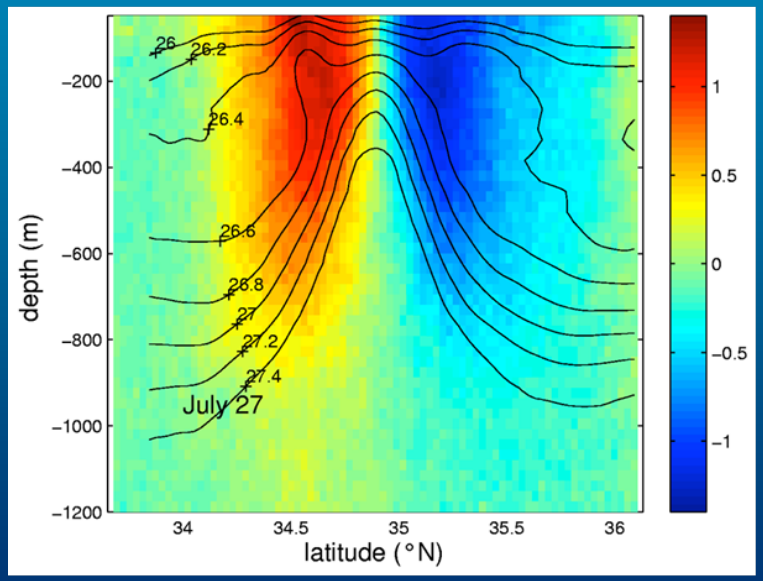
Figure 1. Mean velocity and variance ellipses between the mid-Atlantic Bight shelf break and Bermuda at 52/55 m depth for the 1993–2012 period. The bar corresponds to 1 m s^{-1} and 0.5 m^2 s^{-2}, respectively. The depth contours range from 1000 to 5000 m.



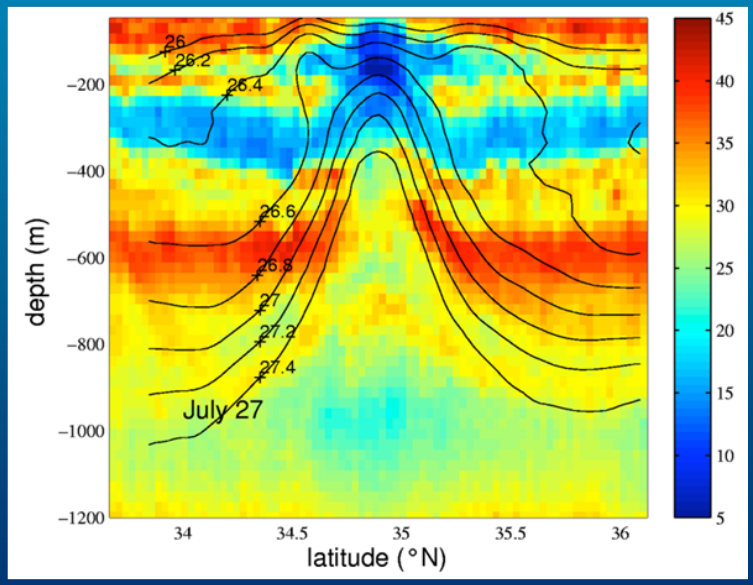
The Statistics of Coherent Vortices within the Northern Sargasso Sea



Resolving Ocean Eddy Structure (Physically and Biologically)

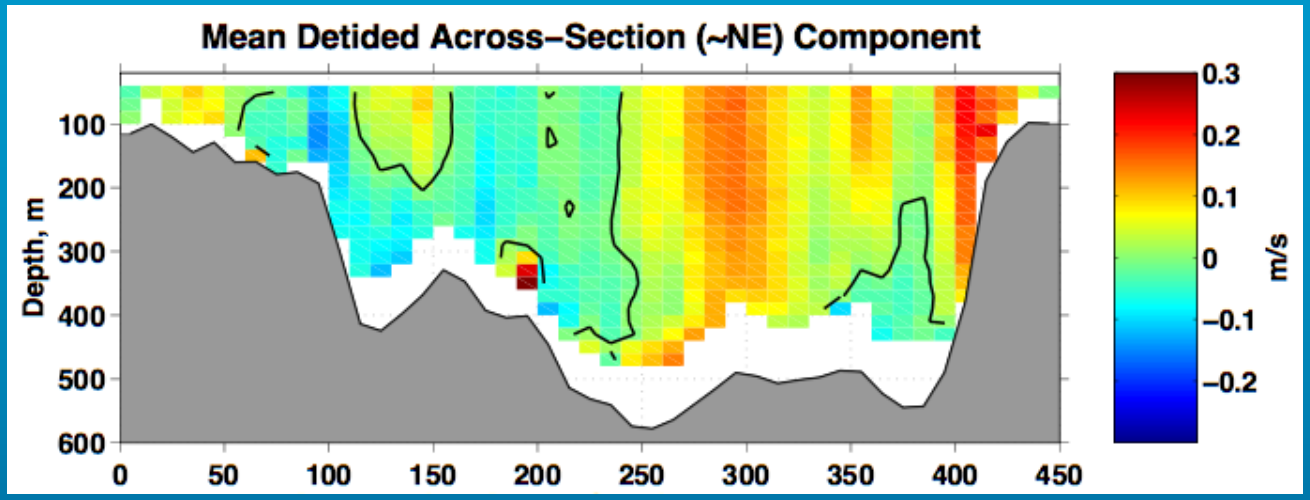


Velocity



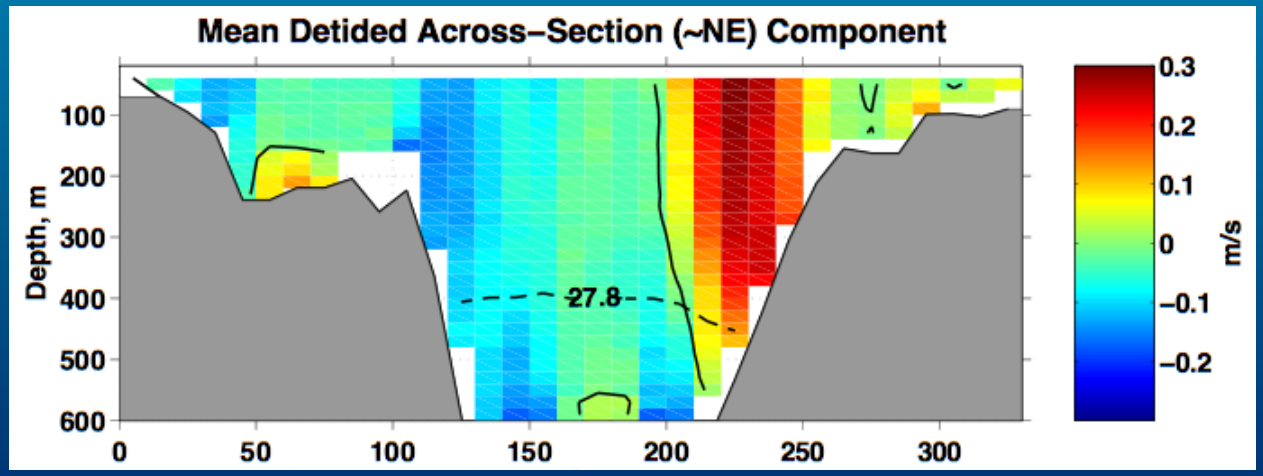
Backscatter

Directly measuring the global MOC



Iceland-Faroe mean north flow = 4.5 Sv

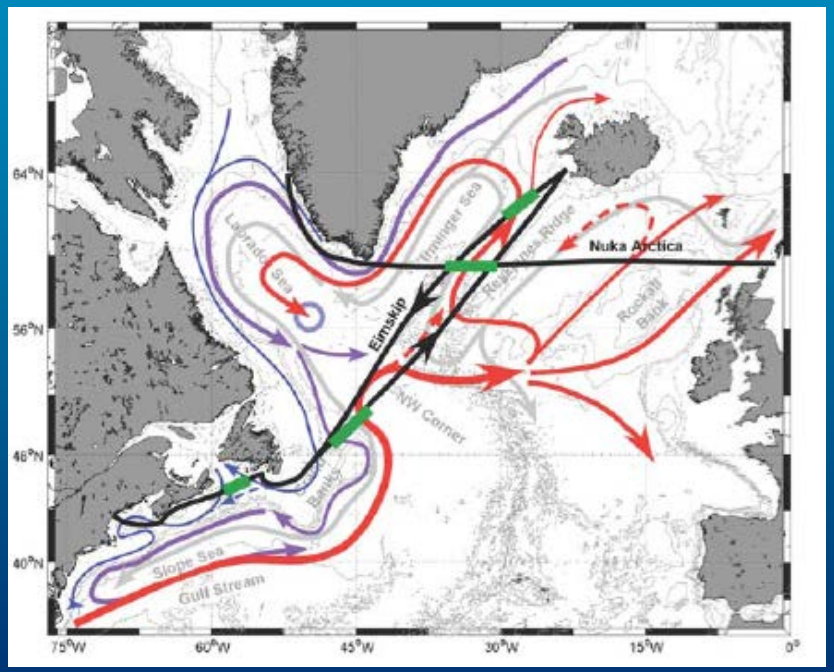
Faroe-Shetland mean north flow = 4.1 Sv



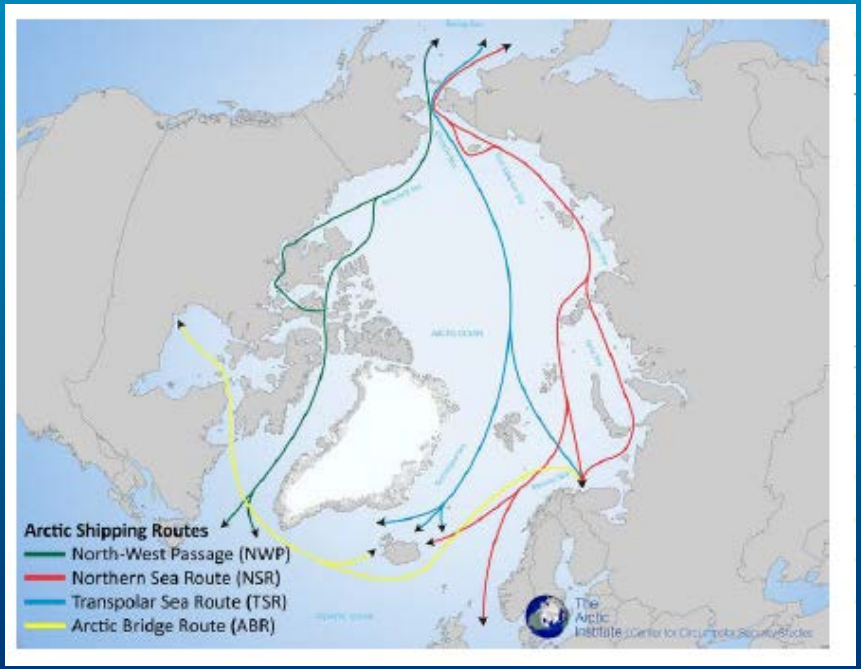
Directly estimated inflow into the Nordic Seas between Iceland and Scotland = 8.6 Sv.

Emerging Opportunities to Expand the Fleet

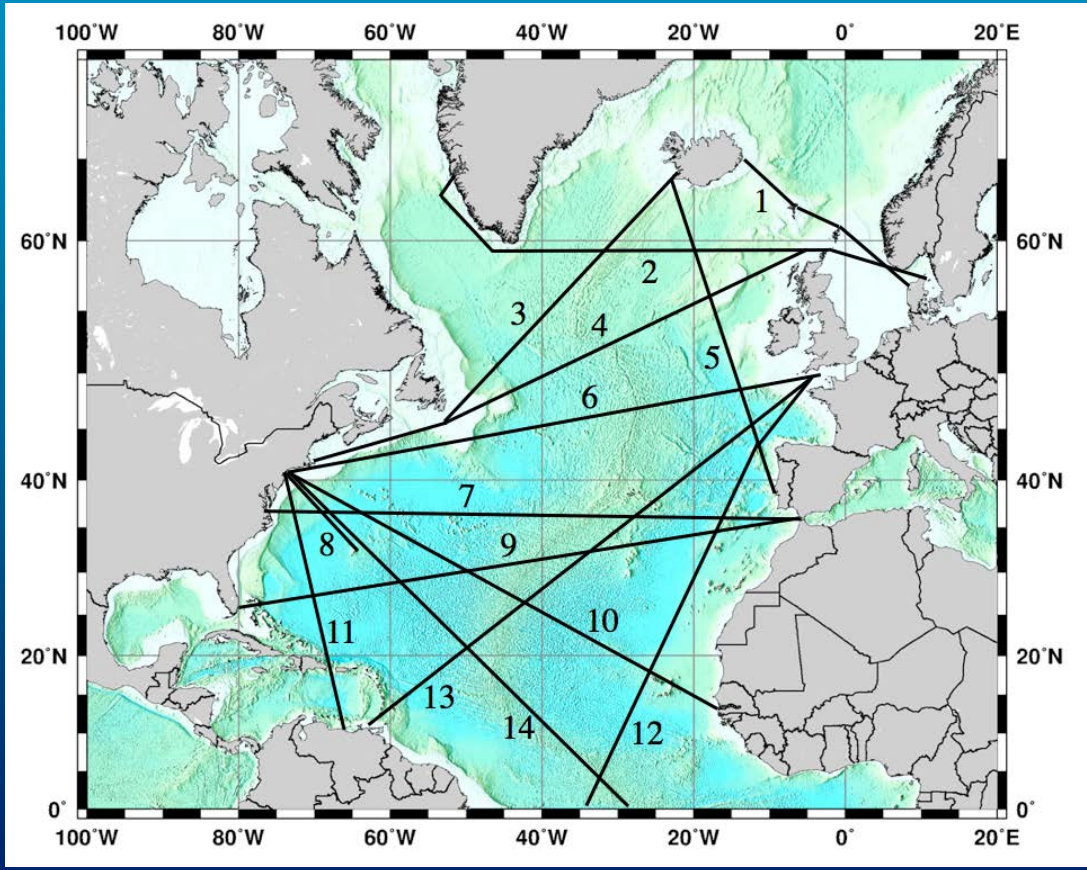
Elm-Skip / NSF



Arctic Ocean / S.Korea



Beginning to Populate OceanScope Phase One



Promising Technology Developments

- AutoXBT Launcher Options
- Improved Expendable Probes - Climate Quality Physics and BioChemical Parameters
- Dual Frequency/Adjustable Beam Angle Phased Array ADCPs

Conclusions

Realizing OceanScope could open up entirely new fields (of oceanic properties) for detailed and quantitative description.

OceanScope can provide unique information complementing research fleet and GOOS

Progress Slow and Timing Terrible

BUT

We are Moving Forward !!

QUESTIONS

http://www.scor-int.org/Publications/OceanScope_Final_report.pdf