Monitoring the strength and variability of the MOC

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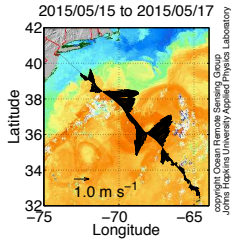
THE OLEANDER Project

Oleander Project

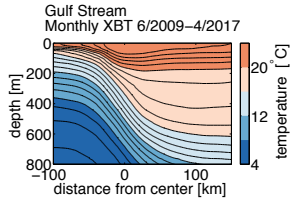
GOAL: Determine mass and heat fluxes across four distinct regions: the continental shelf, Slope Sea, Gulf Stream, and northwest Sargasso Sea.

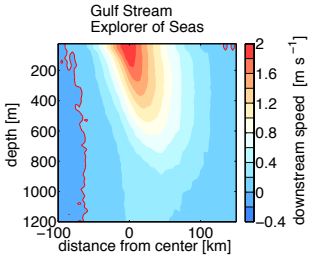


- Weekly NJ to Bermuda
- 1992-2004 150 kHz ADCP
- 2004-present 75kHz ADCP
- 2001-present TSG
- 1977-present monthly XBT

Recent and Future Advancements

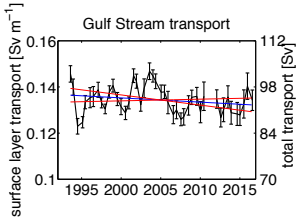
- Weekly XBT sections across GS and Sargasso due to AXIS system *Fratantoni et al. 2017* and NOAA support
- New partnership with Bermuda Institute of Ocean Sciences
- UHDAS implemented.
- Future ADCP enhancement:
  - 150 kHz to provide observations of near-surface and shelf waters,
  - 38 kHz ADCP capable of measuring currents through the base of the thermocline.





Gulf Stream Transports

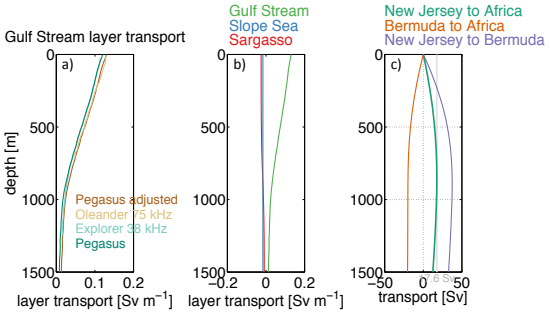
- No clear evidence of a decrease.
- Not significant at 95% confidence level.
- Factor 2-4 less than accelerated US sea level rise north of Hatteras.



Updated from Rossby et al. 2014

Trans-Atlantic Transports

The Oleander Project will be able to track the strength and interannual variability of the MOC with new enhancements.



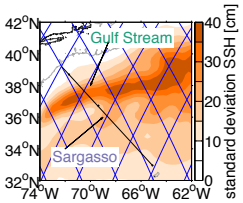
- 75 kHz ADCP velocities extended with mean velocity profiles from historical moorings.
- Trans-Atlantic section completed with Bermuda Station S and Argo to determine geostrophic shears.
- Between the North American continent and Bermuda the GS dominates the poleward upper-ocean contribution with net maximum poleward flow of 37.4 Sv at 900 m.
- Full trans-Atlantic section has poleward flow reaching a maximum of about 17.5 Sv near 800 m depth.

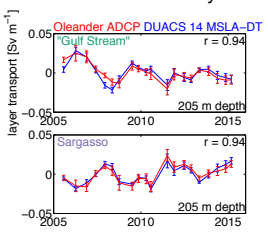
Conclusions

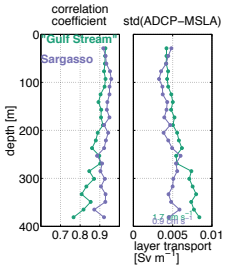
- The high-horizontal resolution afforded by the ADCP is essential to resolve GS transport.
- Direct observations show no long-term trend in GS surface transport.
- ADCP transports over long distances are possible.
- Improvements to the Oleander system will provide additional information regarding the MOC connectivity along the western boundary.

Oleander ADCP and SSH surface layer transports

- Transport calculation places strong demands on ADCP accuracy.
- Unrealistically wide GS region required due to altimeter horizontal and temporal resolution.
- Update to *Worst et al. 2014* to examine agreement below the influence of Ekman layer.







- ADCP and SSH layer transport anomaly times series track each other well.
- Correlations are excellent: 0.93 Sargasso, 0.88 GS.
- Standard deviations of differences are smaller for the long ~570 km Sargasso section compared to the ~300 km GS section.
- Sargasso equivalent velocity error is less than 1 cms^{-1}.

NSF-OCE
1536851,1536586,1536517

Project web site and data delivery:
Oleander.bios.edu
Oleander Workshop II: 25 Years Operations
Eos.org/meeting-reports/packing-science-into-a-shipping-vessel

Recent work using Oleander data sets:

Callies et al. Seasonality in submesoscale turbulence. Nature 2014.
Forsythe et al. Recent accelerated warming of the continental shelf off NJ: Observations from the CMV Oleander XBT line. JGR 2015
Schloesser et al. Evaluation of TSG and VIIRS to evaluate near surface temperature. J. Tech. 2016.
Smith et al. Applying automated underway ship observations to numerical model evaluations. J. Tech. 2016.

References

Fratantoni et al. AXIS – the Autonomous eXpendable Instrument System. J. Tech, in revision, 2017.
Rossby et al. On the long-term stability of GS transport based on 20 years of direct measurements. GRL. 2014.
Worst et al. A Comparison of ADCP and altimeter SSH along the CMV *Oleander* Route. J. Tech. 2014.