Southward Flow Under the Florida Current and Coastal Countercurrent in the Straits of Florida

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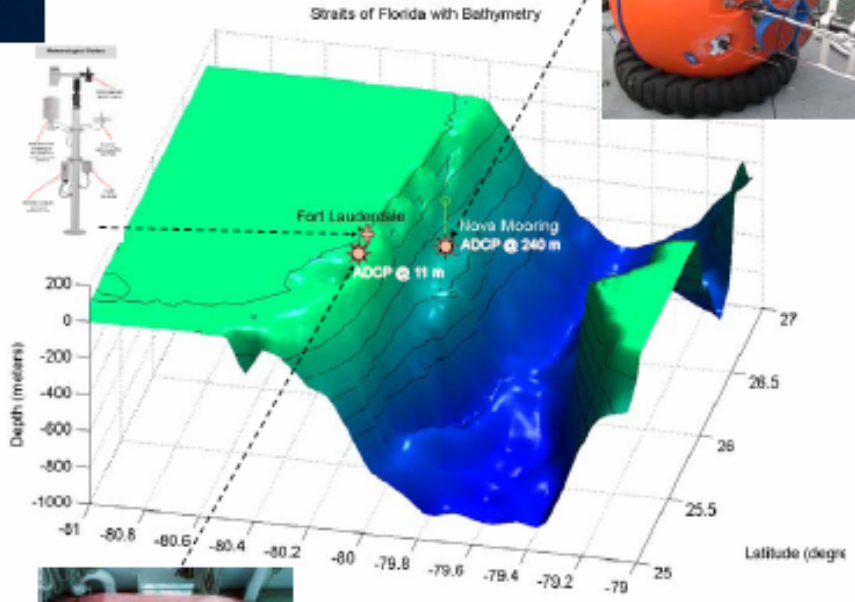
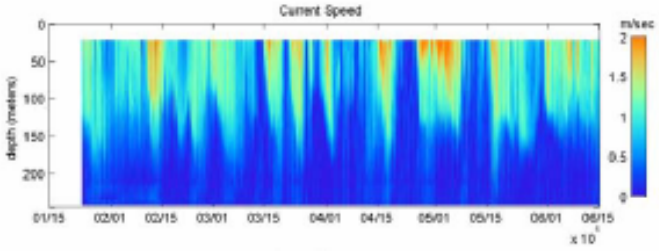
- **Long-term observations in the Straits of Florida**
- **Seasonal patterns**
- **Interannual variability**
- **Conclusions**

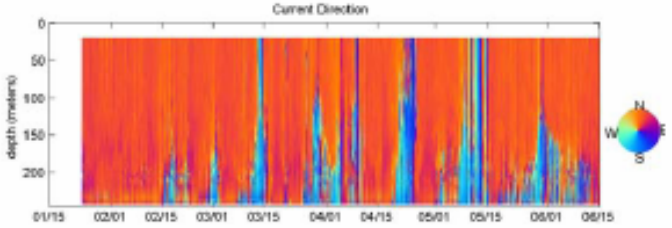
NSUOC Ocean Observing System in the Straits of Florida

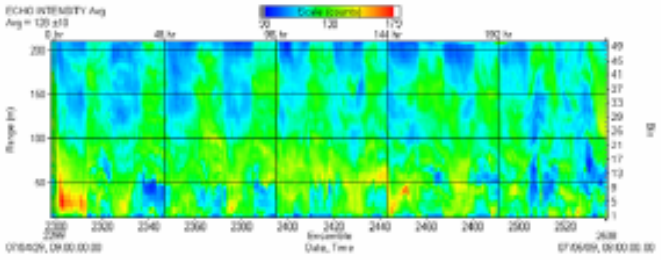
Stripmap, 3 m resolution: Credit to the German Aerospace Center (DLR).



Long Ranger Acoustic Doppler Current Profiler

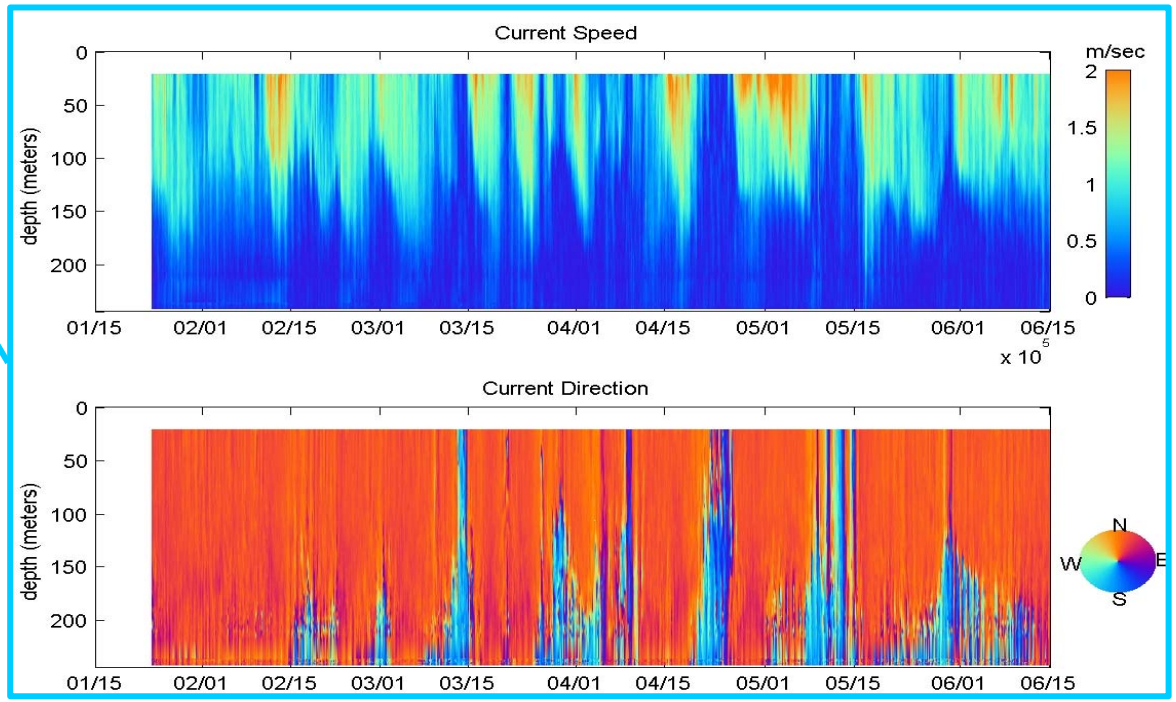




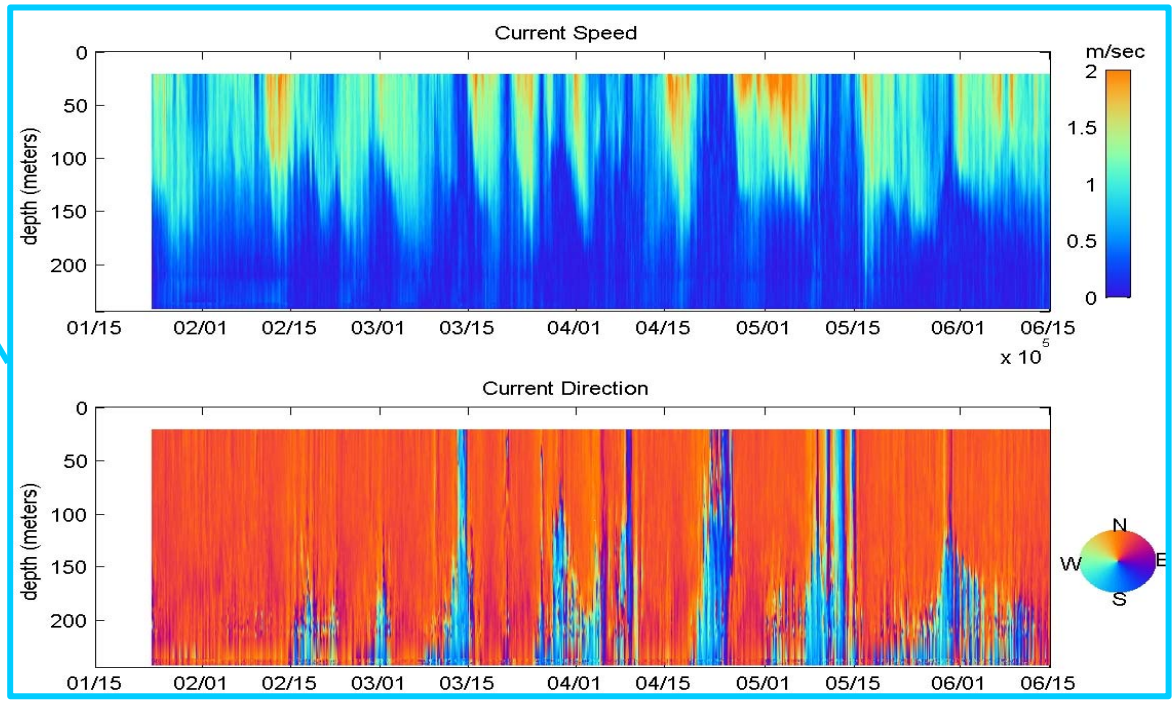


Sentinel Acoustic Doppler Current Profiler

Calypso ADCP Buoy
January – June 2007

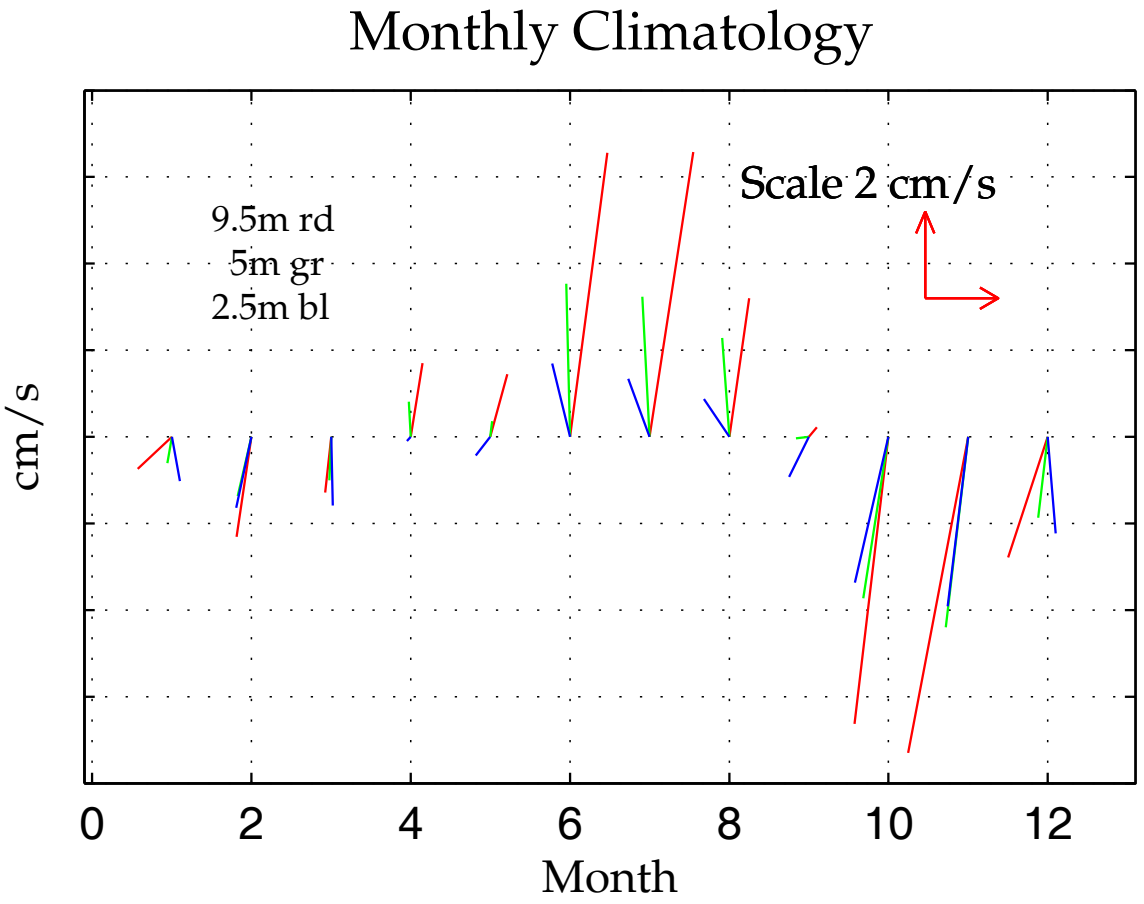


Calypso ADCP Buoy
January – June 2007



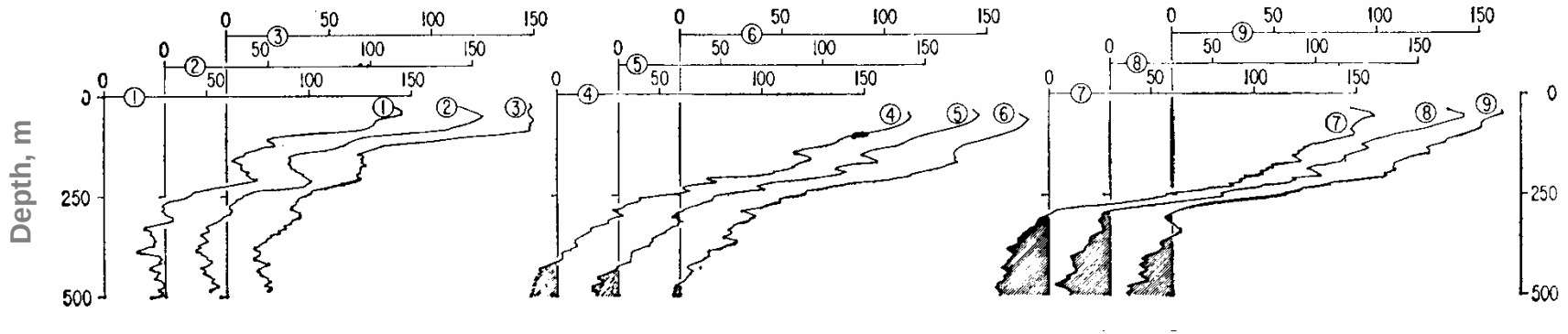
11 m ADCP mooring

Seasonality of the Coastal Current on the Southeast Florida Shelf (11 m mooring)



Monthly mean vector current climatology produced by averaging over five years of data. Red to green to blue shows a left hand turning of the monthly mean currents from the surface to the bottom. (Provided by Dr. Robert Weisberg.)

Southward Flow Under the Florida Current

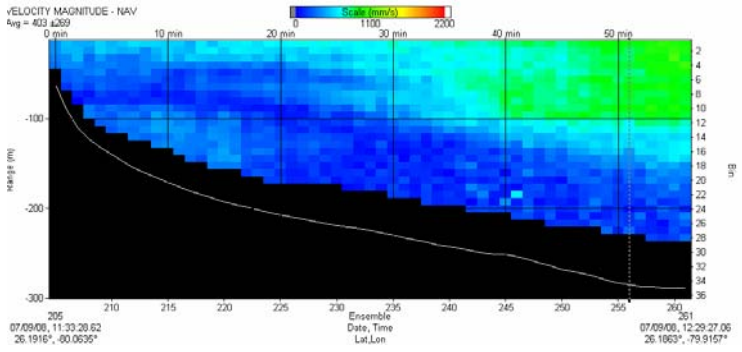


Vertical current profiles observed at an anchor station in the Florida Current, 26 km east of Fowey Rock (25°41.2'N, 79°50.3'W) at a water depth of 580 m. The horizontal scale is in cm s^{-1}. The row of profiles shows the northward velocity component, with the hatched areas indicating the southward flow. (After Düing and Johnson 1971.)

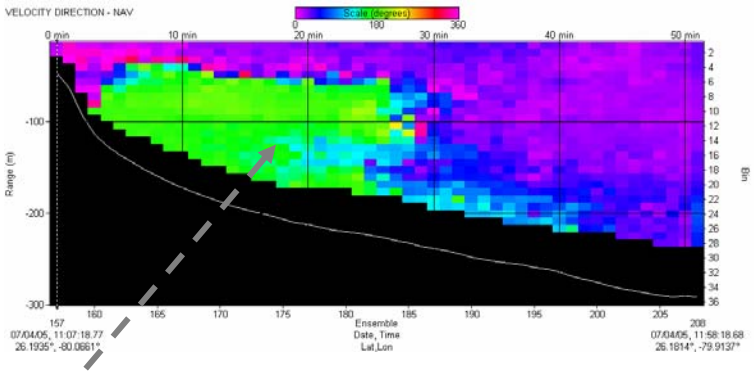
Southward Flow Under the Florida Current

April 5

Current speed



Current Direction



Southward jet attached to the Florida shelf

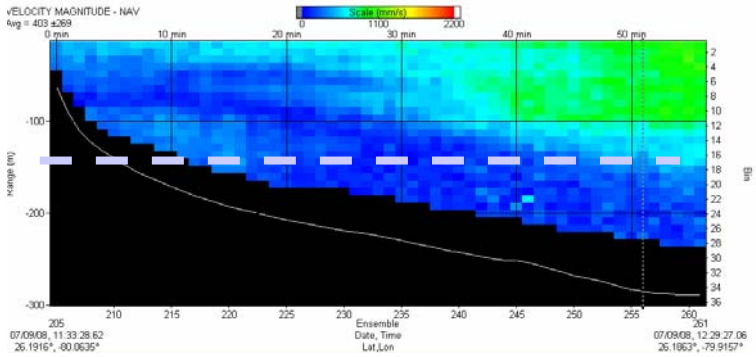
R/V *F.G Walton Smith*

UM RSMAS

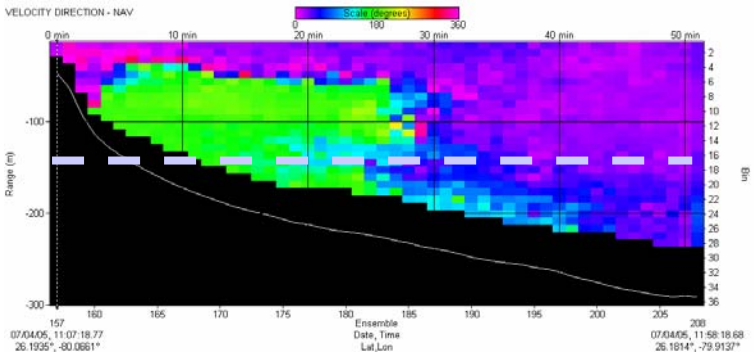
Southward Flow Under the Florida Current

April 5

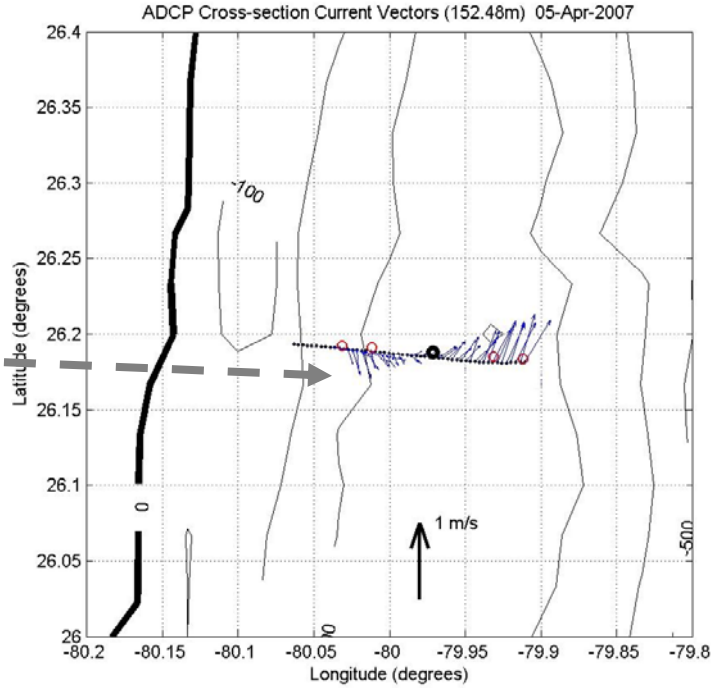
Current speed



Current Direction



Undercurrent

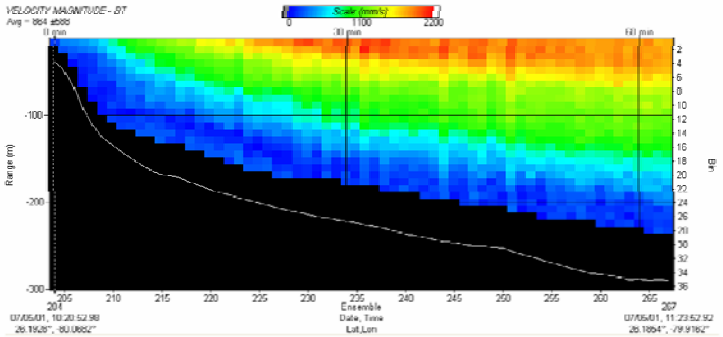


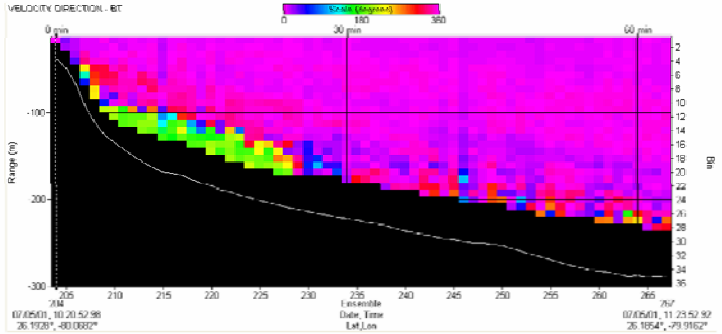
Southward Flow During Summer Months

Current speed

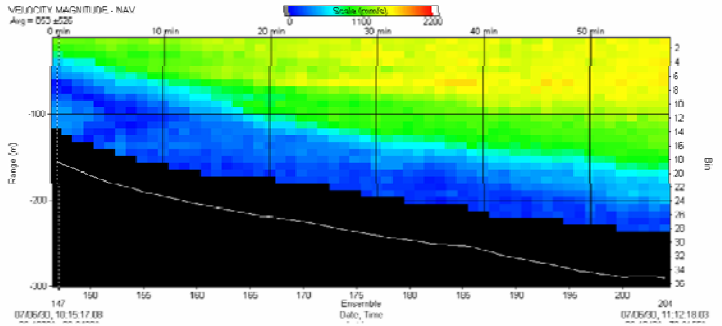
Current direction

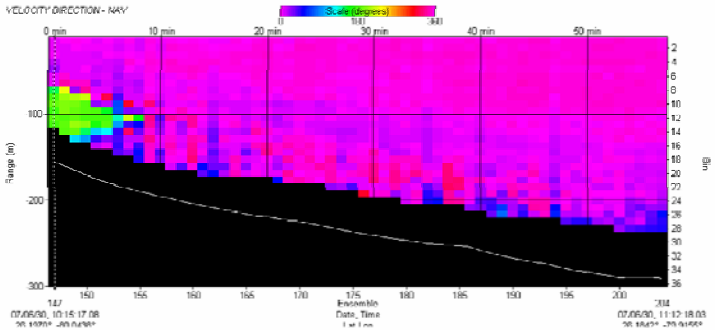
May 1



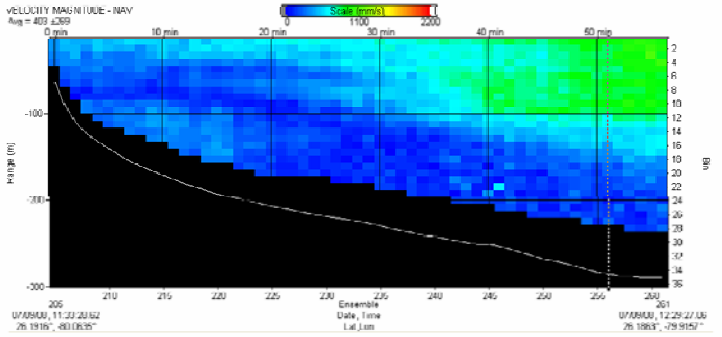


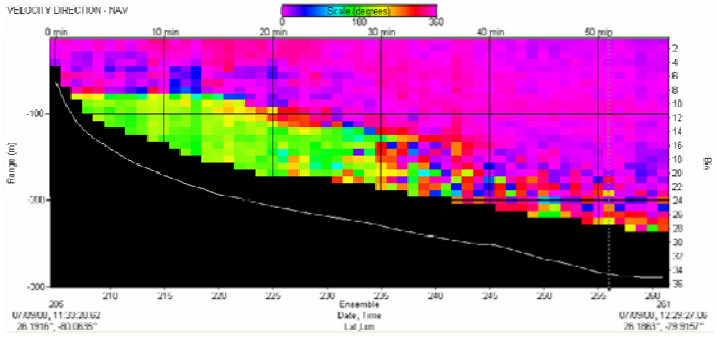
June 30





September 8

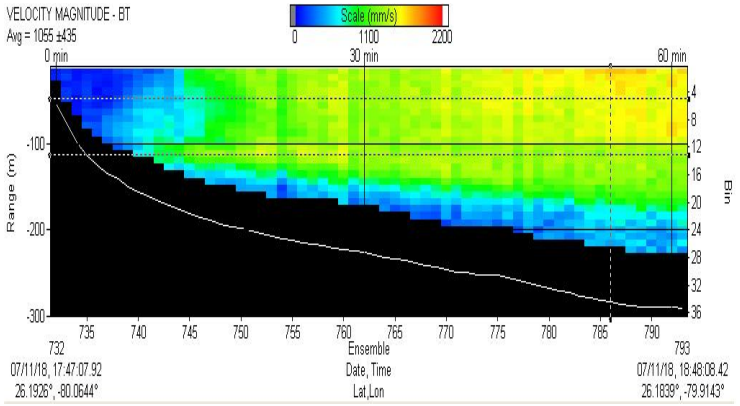




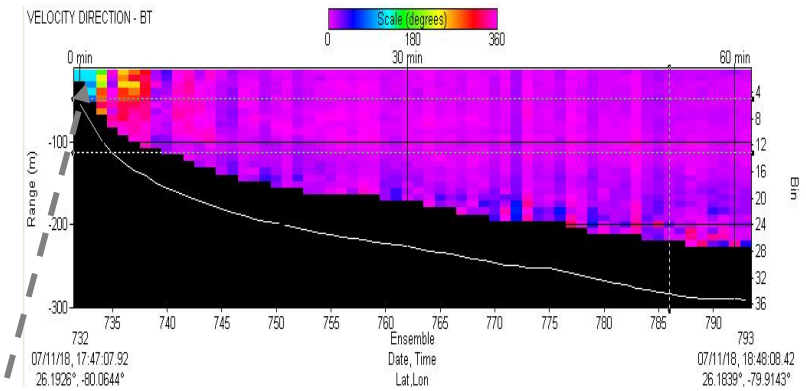
Fall: the southward flow weakened and migrated to the surface

November 18

Current speed



Current Direction

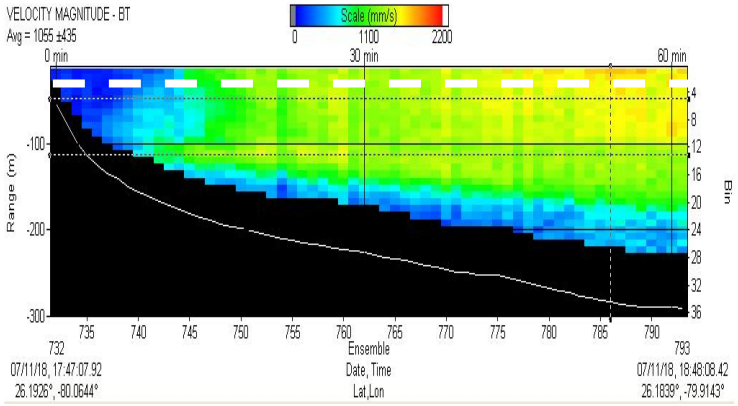


Southward jet

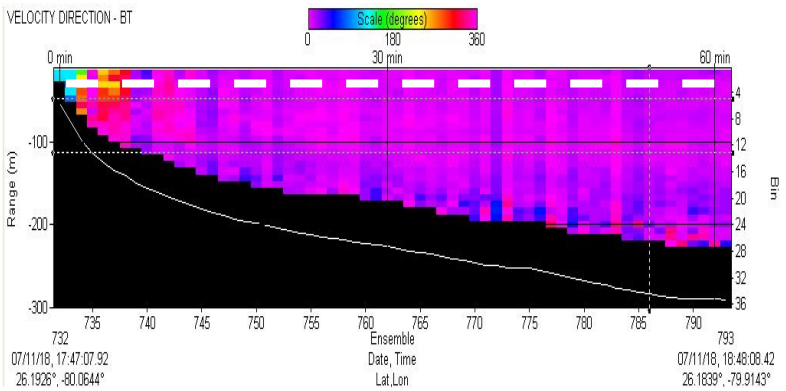
Fall: the southward flow weakened and migrated to the surface

November 18

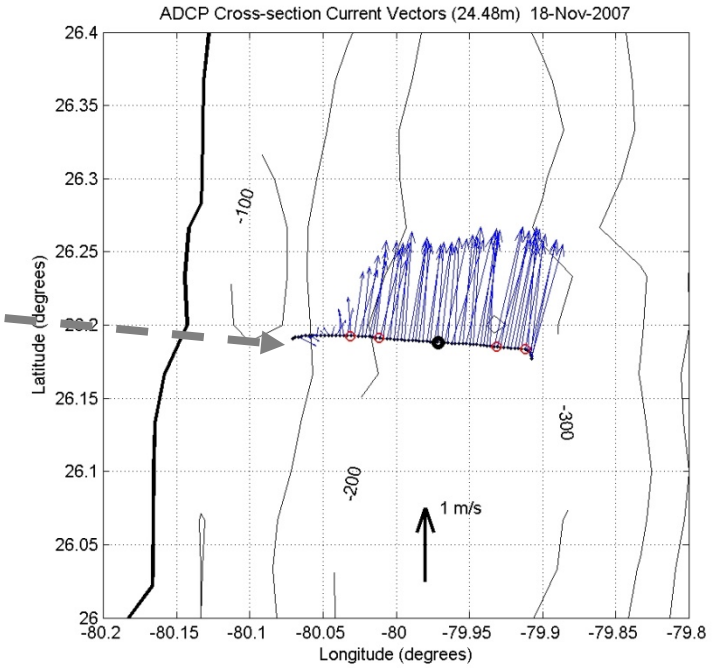
Current speed



Current Direction

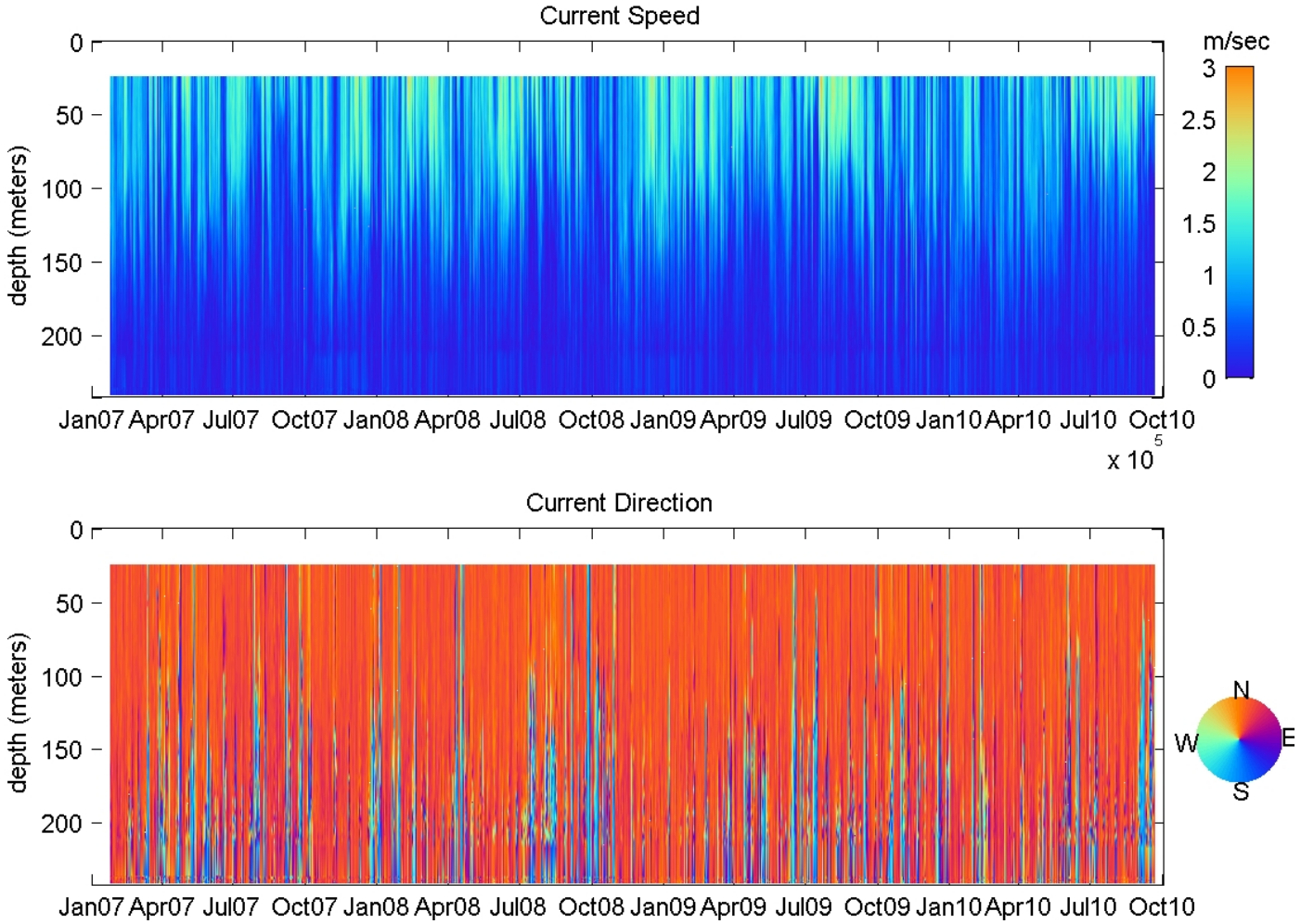


Coastal current reversal during winter months



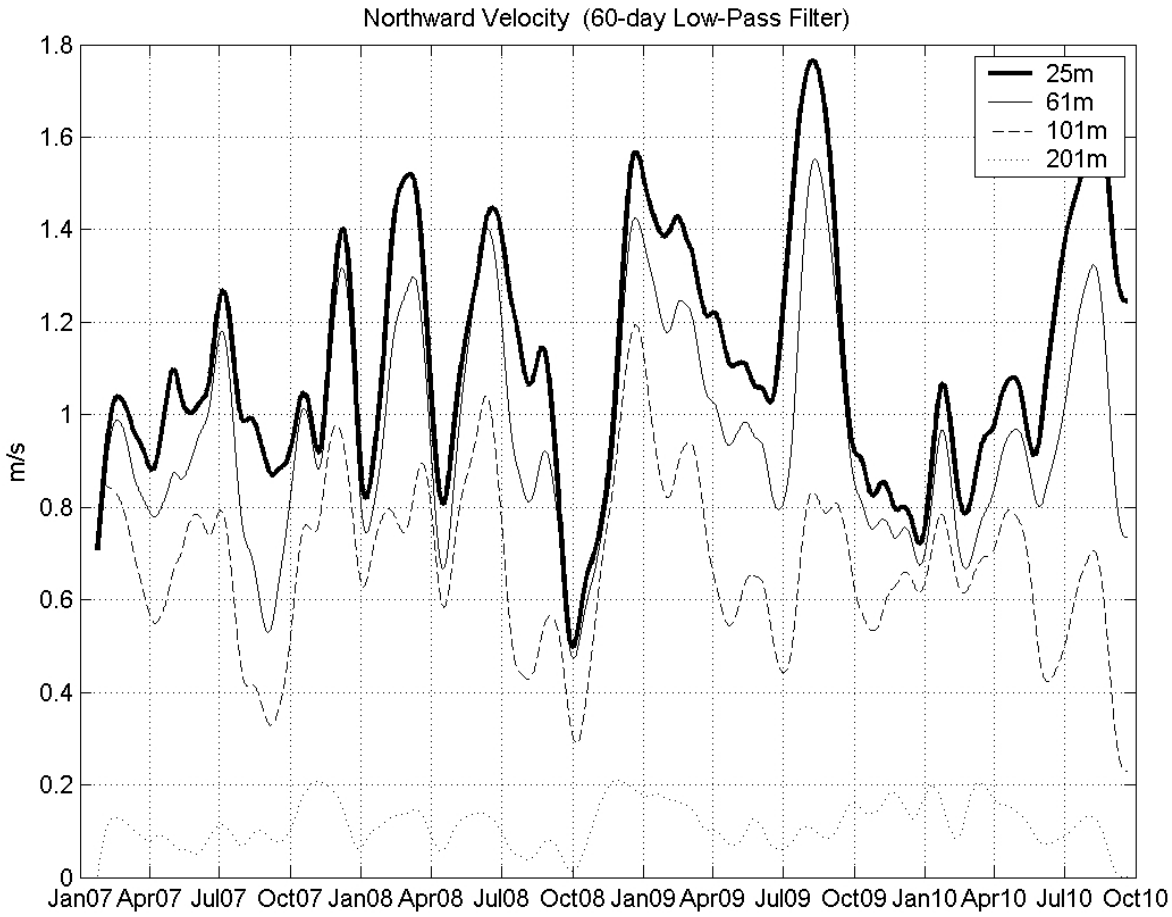
Interannual Variability

Current Speed and Direction (26.188 ºN, 79.971ºW)
January 2007 - October 2010

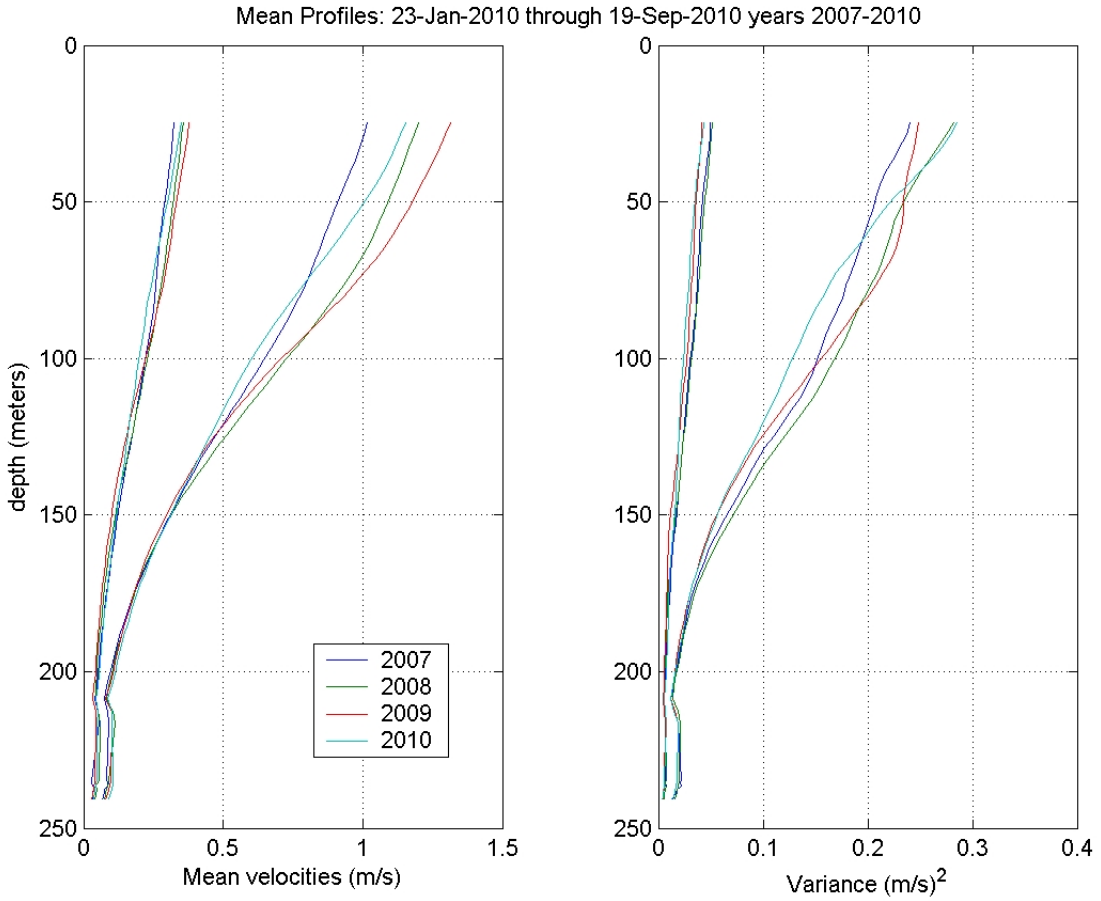


Orange colors in the top plot indicate strong flow (3 meters/sec), blue colors represent weaker flow. Red colors in the bottom plot indicate northward flow; blue colors indicate southward flow.

Northward Velocity Component (60-day Low-Pass Filter)

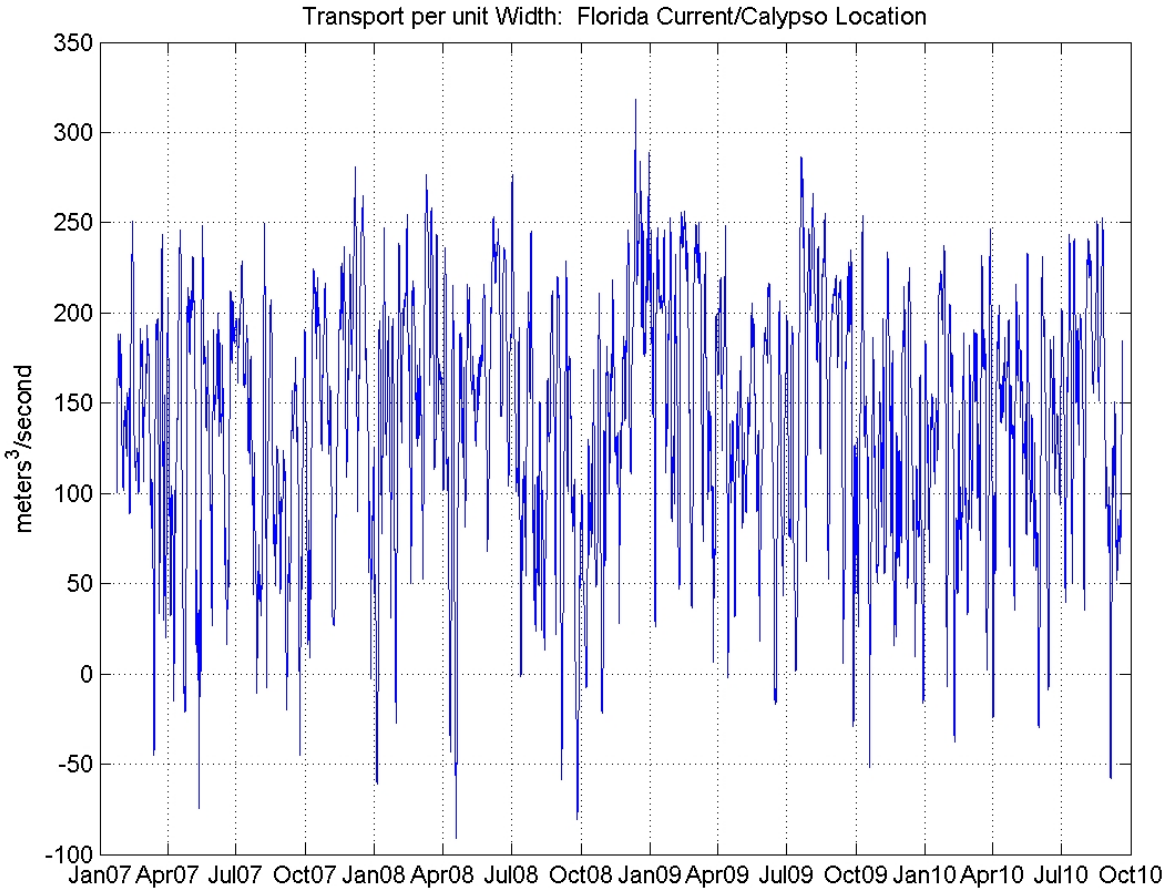


Mean Current Velocity Profiles



Mean velocity and variance profiles (both east and northward velocity components) for the time periods January through September for 4 years: 2007, 2008, 2009, and 2010. The year 2009 has the strongest mean flow during this time period. 2007 appeared to have the weakest flow.

Depth-Integrated Velocity Profile



Total transport (depth integrated) at the Calypso location from January 2007 to September 2010. The data were filtered with a 33-hour low-pass filter to remove tides and other higher frequency variability.

Mean Transport at the Mooring Location
(per unit meter width)

Time Period	2007	2008	2009	2010
Mean Transport January-September (m^3/s)	128.83	149.09	155.74	136.84

- **The year 2009 had the strongest mean transport**
- **The year 2007 had the weakest mean transport**

Conclusions

- During summer month, a transient southward flow in the form of a jet attached to the Florida shelf is observed below the Florida Current
- During winter months, the southward jet migrates to the surface, producing a coastal countercurrent
- This explains the seasonal pattern of the coastal circulation on the Southeast Florida shelf (mean transport northwards during summer months and mean transport southwards during winter months)
- Practical applications include costal pollution control, coral reef health, rescue and search operations, development of future ocean observing systems.

Acknowledgements

• The ocean observing system on the Southeast Florida shelf was established in 1999 as a cooperative agreement between the NSU Oceanographic Center and USF College of Marine Science, funded by ONR. We gratefully acknowledge Drs. R. Dodge and J. McCreary (NSU), M. Luther and R. Weisberg (USF) and W. Venezia (SFTF) for logistical support in the establishing of the observing system. Excellent technical support was provided by R. Cole and J. Donovan (USF), T. Thompson, L. Nemeth, and L. Robinson (NSU).

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