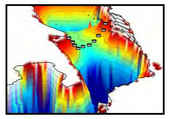
Observations of the Western Adriatic Current as a Summertime Mixed-Layer System



DART

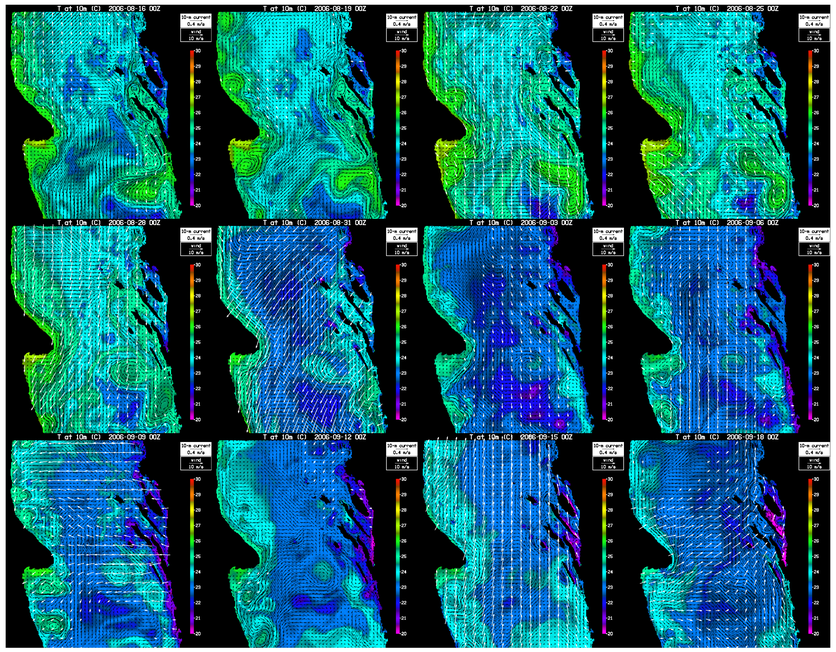
Jeffrey W. Book[1], Michel Rixen[2], Paul J. Martin[1], and Derek Burrage[1]

[1]U.S. Naval Research Laboratory

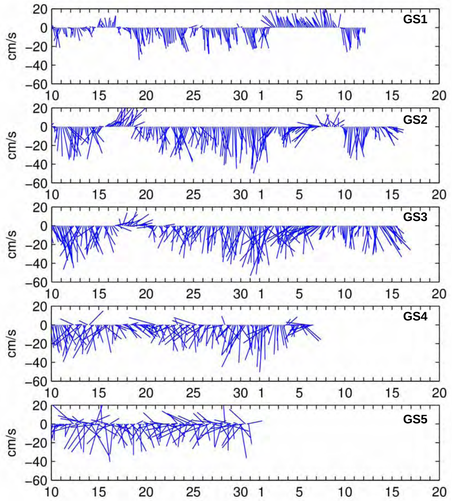
[2]NATO Undersea Research Center

Questions, Comments, Suggestions, Collaboration?
E-mail book@nrlssc.navy.mil

Navy Coastal Ocean Model (NCOM) simulated mesoscale eddies in the Western Adriatic Current (WAC), upstream and downstream of Cape Gargano, Italy

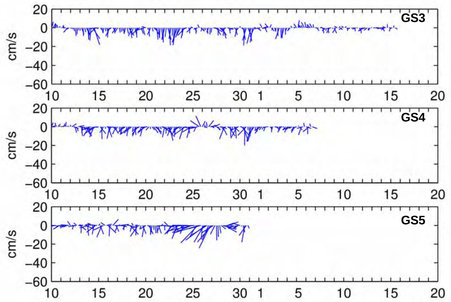


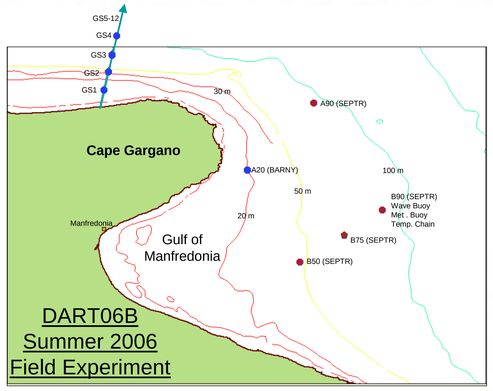
ADCP observed near-surface WAC currents
eastward flow (WAC) is downward



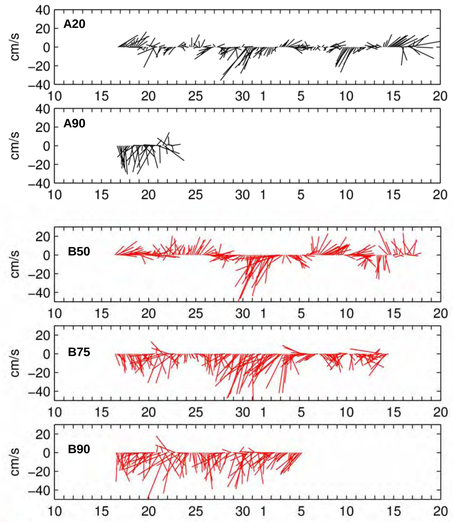
ADCP current observations show strong mixed layer currents and weaker lower layer currents. Mixed layer currents have considerable mesoscale variability including inshore current reversals (i.e. anti-cyclonic eddies)

ADCP observed 50 m WAC currents
eastward flow (WAC) is downward



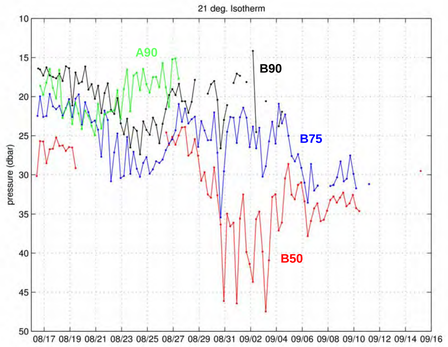


ADCP observed near-surface WAC currents
southeastward flow (135°T) is downward

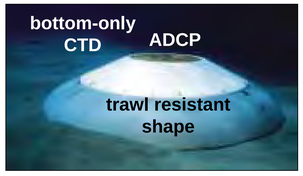


Mixed-Layer System

The combined ADCP and synoptic CTD time-series from the SEPTR shows the WAC during August-September 2006 as a mixed-layer system with strong mesoscale variability. From Aug. 17-29 winds were weak and variable, and currents at B50 in general flowed opposed to the WAC forming anti-cyclones. Then strong offshore winds (SW) on Aug. 29-30 turning to bora winds (NE) on Aug. 31-Sep. 1 both deepened the mixed layer at B50 and greatly increased the mixed-layer WAC currents. Thus the anti-cyclone recirculation was suppressed but the mixed layer slope increased maintaining the WAC as mixed-layer flow overtop sluggish deep flow. After the winds relaxed following the storm period, the previous system of anti-cyclonic circulation at B50-B75 was reestablished with a weak mixed-layer slope between them.



BARNY ADCP Mooring



Field Experiments

Reliable and innovative observational tools were used for monitoring the circulation and heat and salt changes of these mesoscale structures.

BARNY moorings hold bottom-mounted, upward-looking Acoustic Doppler Current Profilers (ADCP) and have a well established record (> 8 years of use, > 100 deployments) of surviving multiple trawl strikes without loss of data.

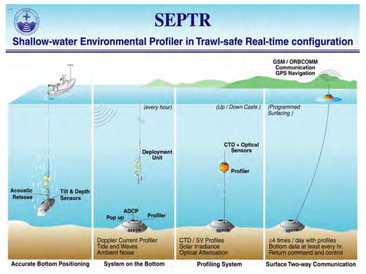
New Shallow-water Environmental Profiler in Trawl-resistant Real-time configuration (**SEPTR**) **moorings** added a profiling CTD and real-time communication while maintaining the trawl protection of BARNY.

SEPTR technology enabled **near-real-time monitoring** of **waves** and **profiles** of **ocean velocity**, **temperature**, **salinity**, and **optics** in a **heavily-fished**, **frontal zone.**

Conclusions

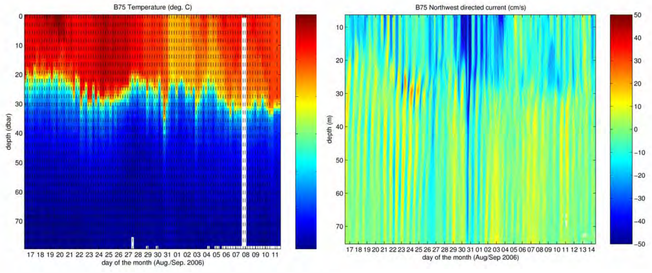
The observations show that NCOM is qualitatively accurate in reproducing the mixed-layer dynamics of the WAC system near Cape Gargano and can predict generation of mesoscale eddies. DART showed the utility of monitoring time-series of temperature, salinity, and velocities simultaneously across a coastal current as advective and thermohaline structures are important and both must be monitored for accurate rapid environmental assessment.

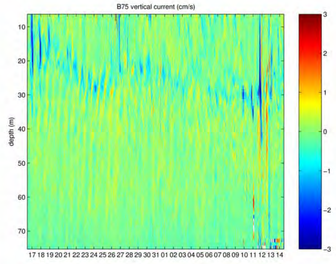
SEPTR Concept



SEPTR Realization

SEPTR Data



Future Work

We will conduct analysis of the WAC system and mesoscale eddies in a vorticity framework. This analysis will require consideration of even smaller scale process as direct measurements of vertical velocities show near-inertial oscillations are generating internal waves along the thermocline. This produces significant downward flux from the mixed layer to the lower layer. The importance of this process in vorticity and mixing terms will be examined.