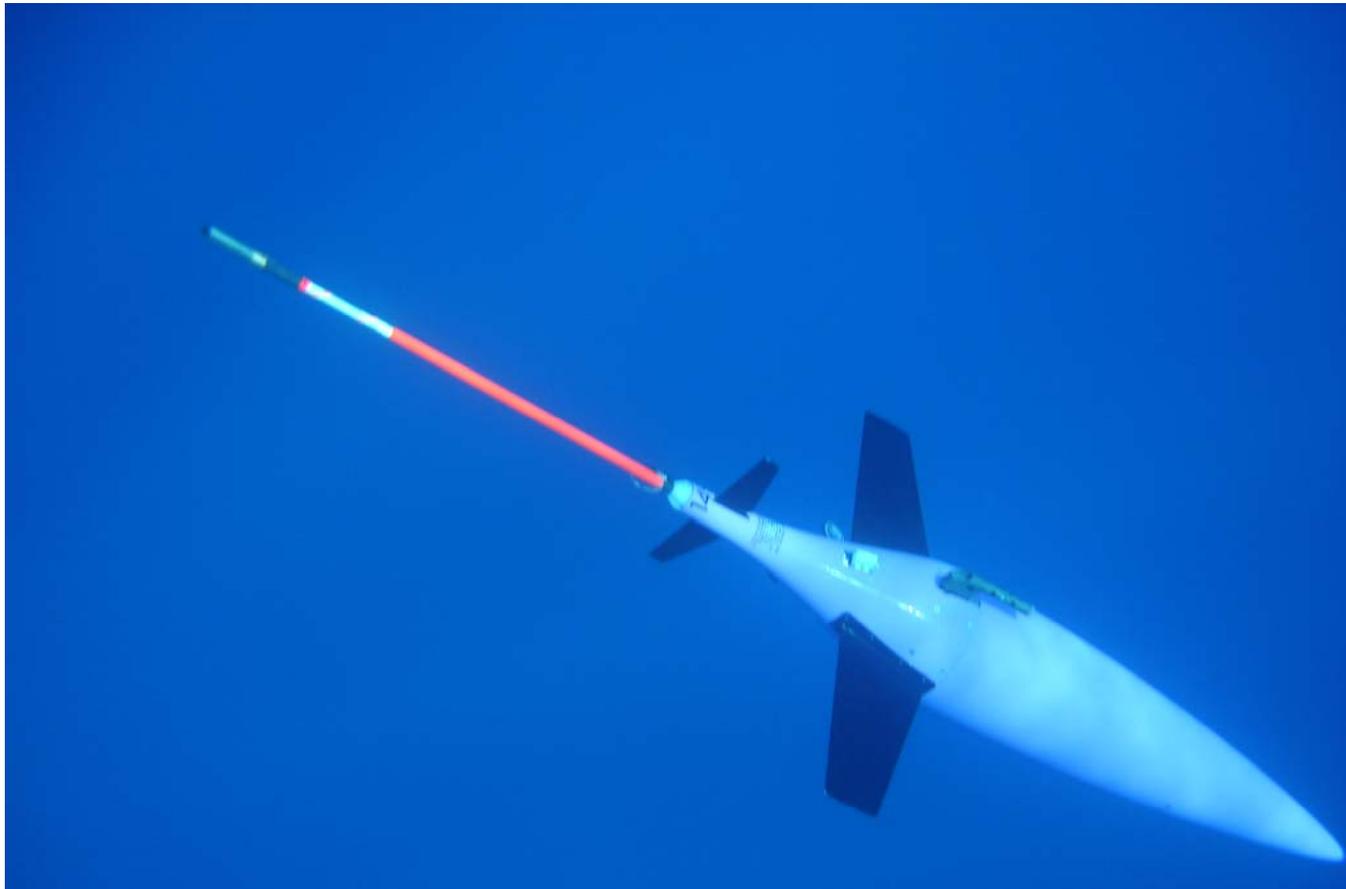




A Study of the Warm Core Cyprus Eddy with Gliders (and Data Assimilation)



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Outline

Gliders and Oceanography

Cyprus monitoring plan and status

EYE project

EGO COST Action

Glider description

- Battery-powered, buoyancy-driven
- 25-50 cm/s, 16-45° slope
- CTD, oxygen, fluorescence, optical backscatter, currents
- surface transmit/receive for data and instructions every ~7h.
- 1000 m dive capability

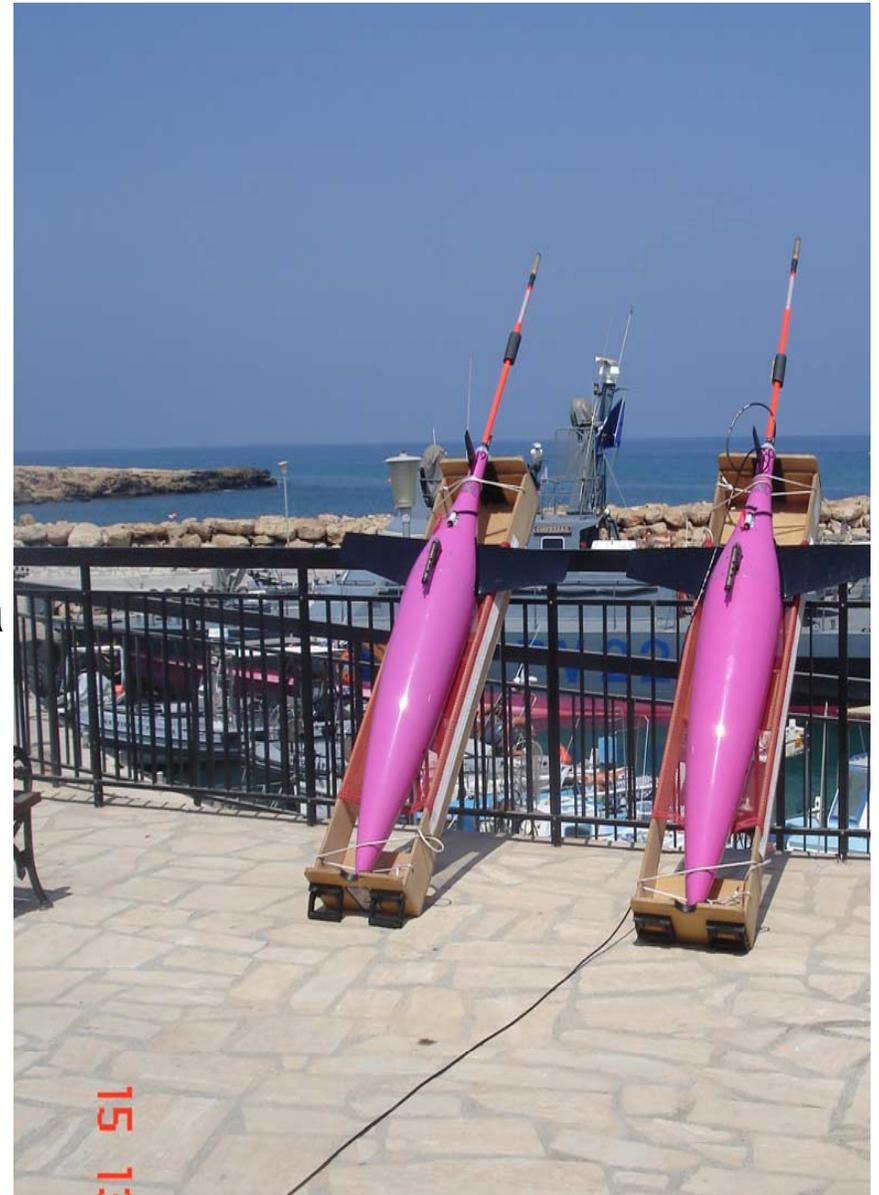
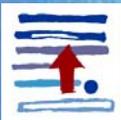
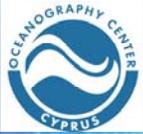


Photo: A. Hannides

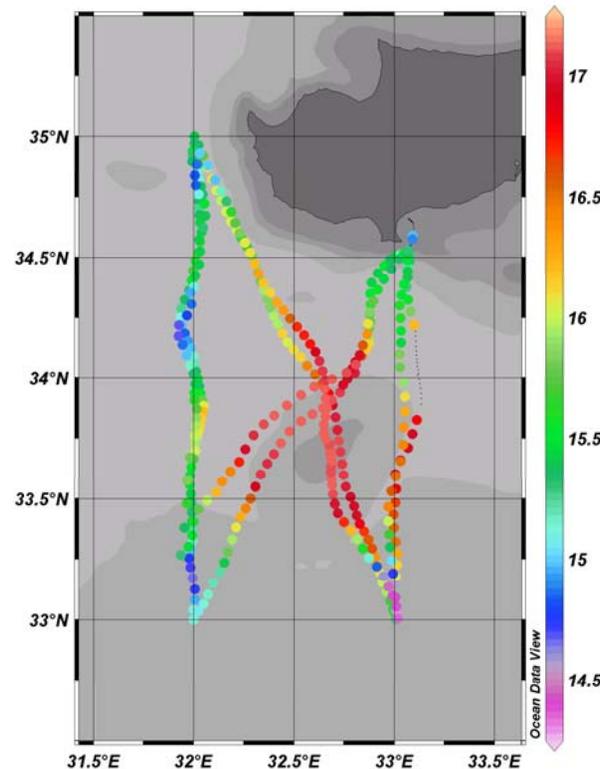




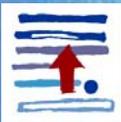
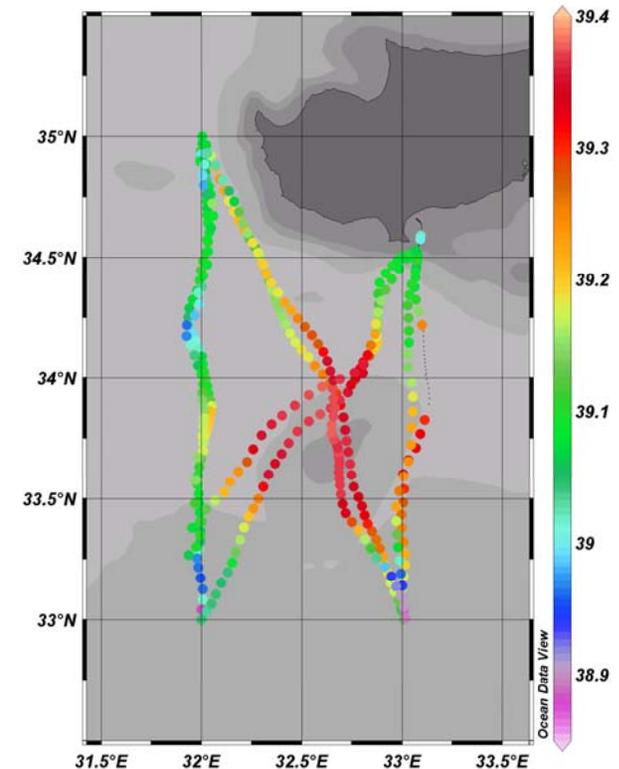
Cyprus Glider Program

- Equipment funded by Cyprus Research Promotion Foundation
- Repeated transects south of Cyprus (4-yr program)
- Contribute *real time in situ NRT data* to MOON
- 3 long missions completed, May-August '09 show Cyprus Eddy

Temperature [degrees Celsius] @ Pressure [decibar]=300



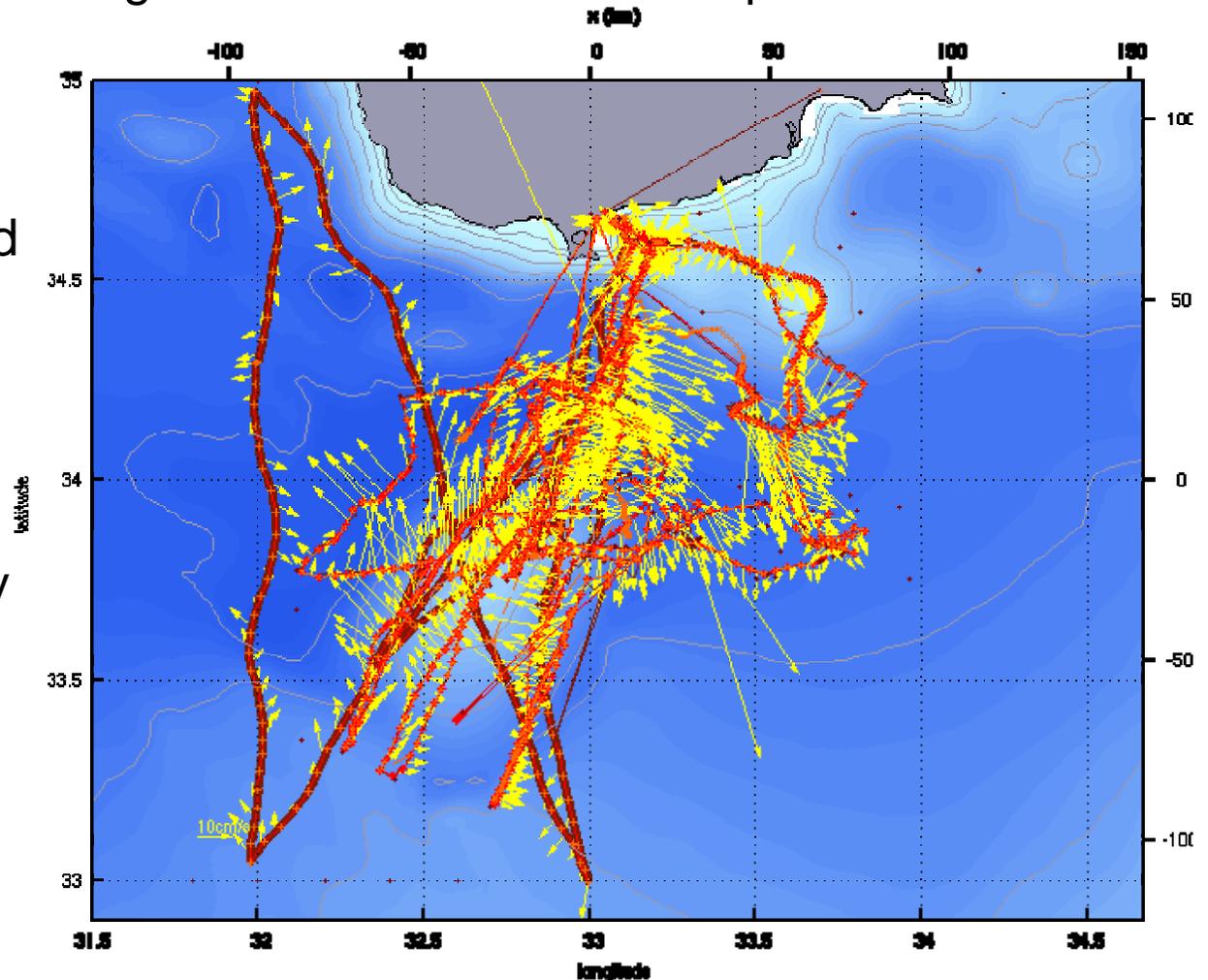
Salinity [psu] @ Pressure [decibar]=300



EYE of the Levantine (12/2009)

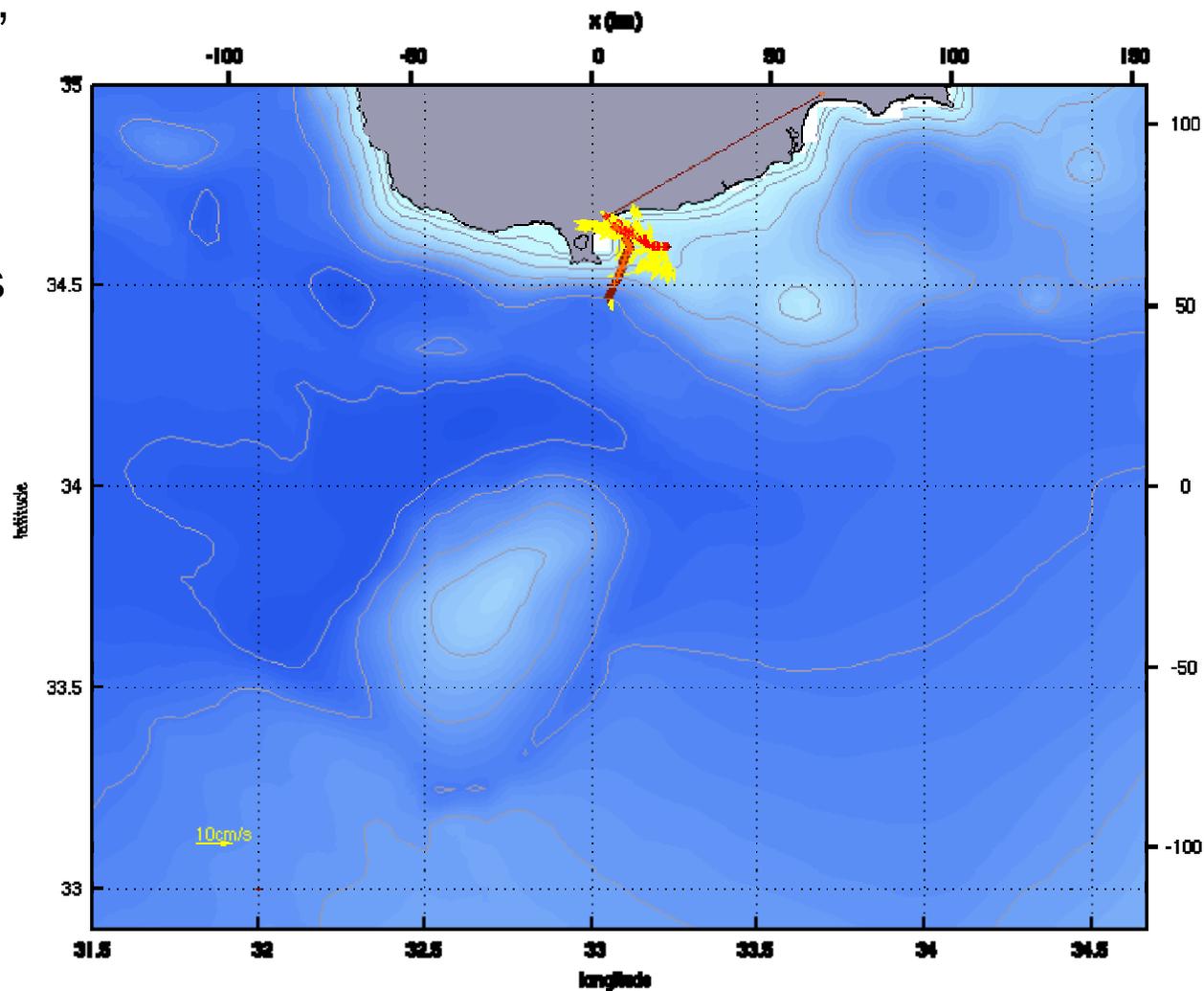
- **Sampling the warm core Cyprus Eddy**
- **Labs:** LOCEAN, LOV (fr), OGS (it), ULB (be), UCY-OC (cy)
- **Gliders:** physical and biogeochemical context for shipborne measurements

- 6 gliders deployed from Limassol
- 2 profiling floats
- 4 surface drifters
- ship borne measurements by CYBO (Cyprus), TARA (French), Merian (German)



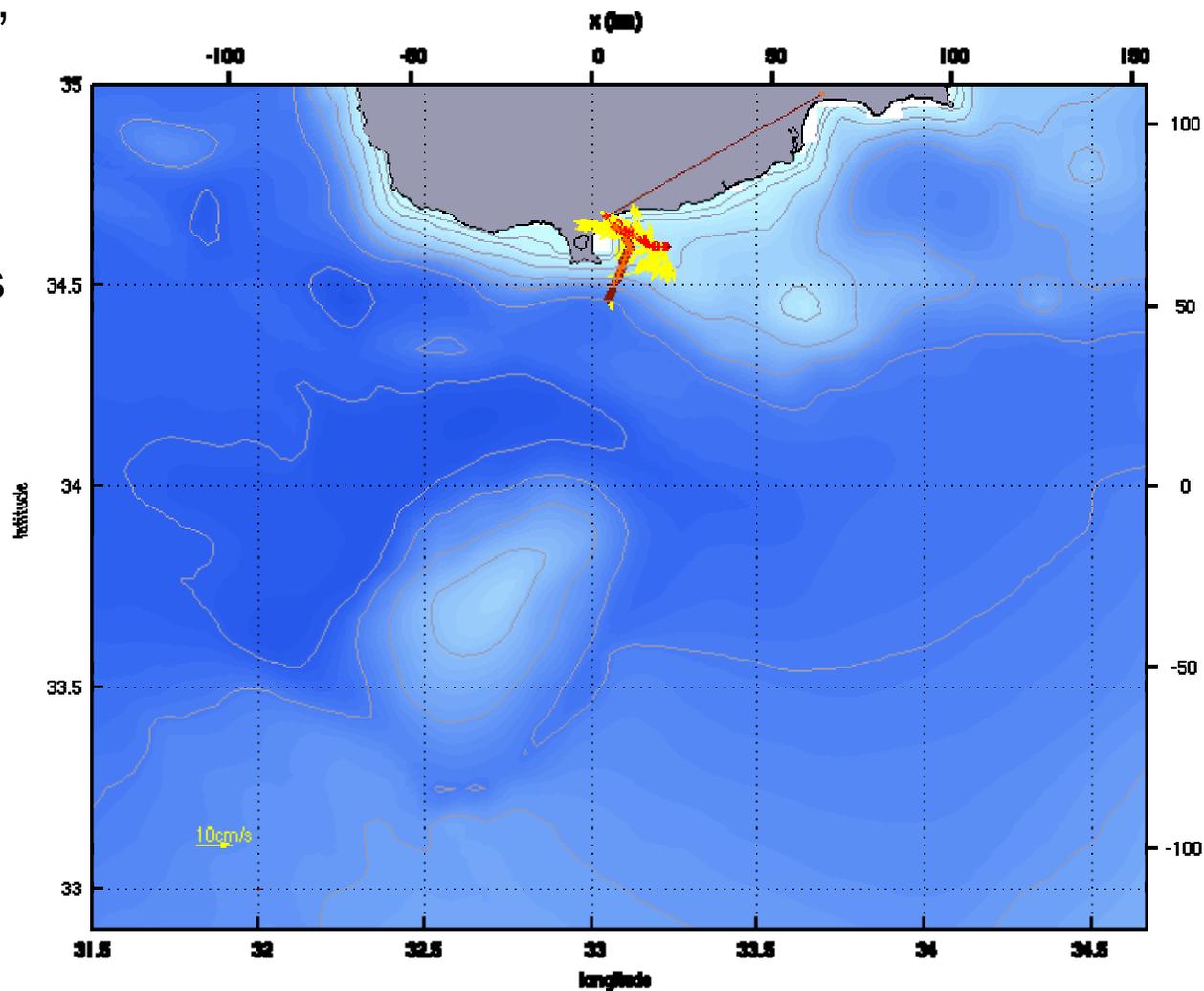
EYE of the Levantine Glider fleet

- Depth-ave velocity, Max 30 cm/s
- Anti-cyclonic
- Radius ~40km
- Near Eratosthenes Seamount



EYE of the Levantine Glider fleet

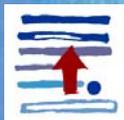
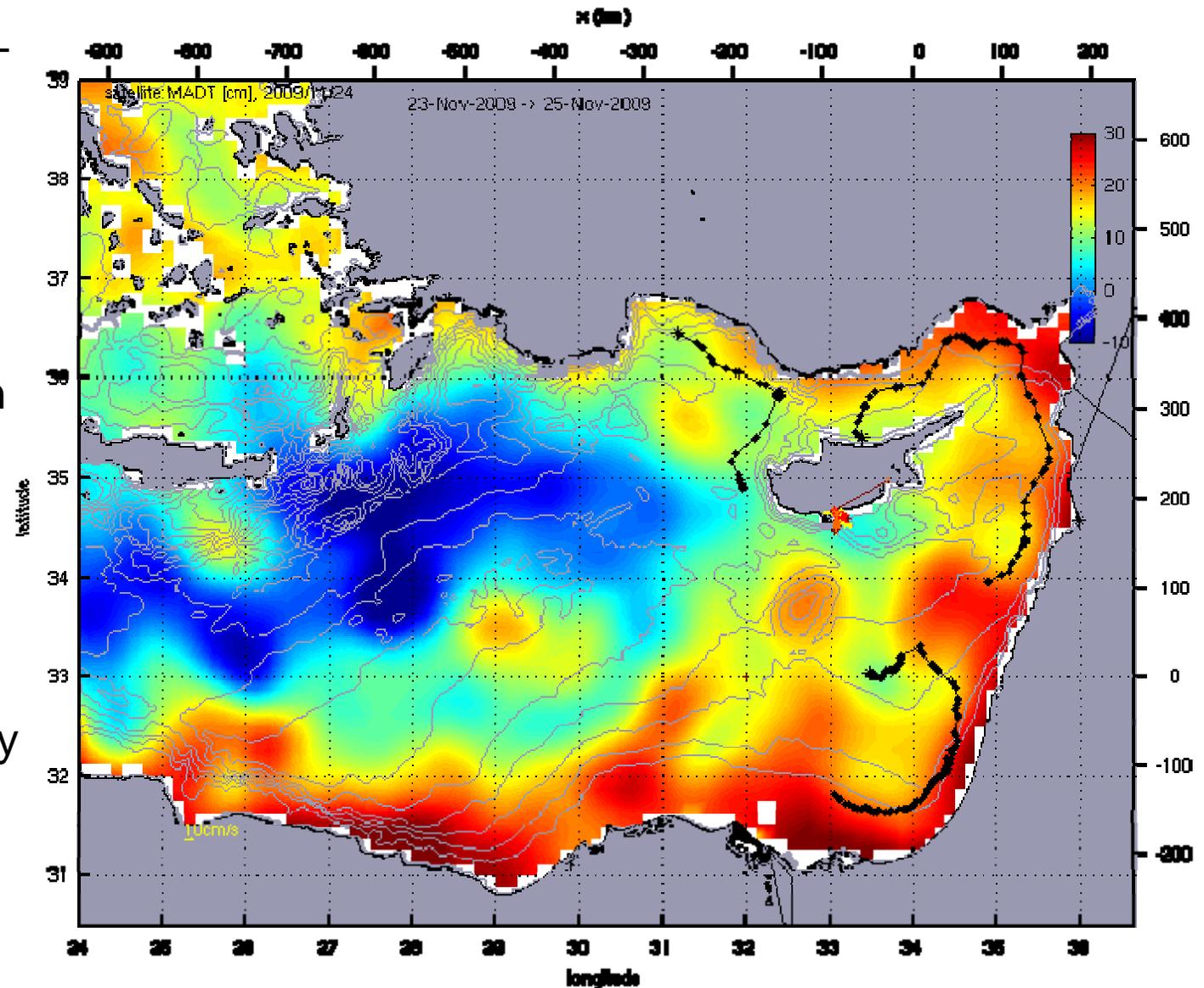
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EYE of the Levantine

Drifter and Dynamic Topography

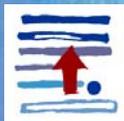
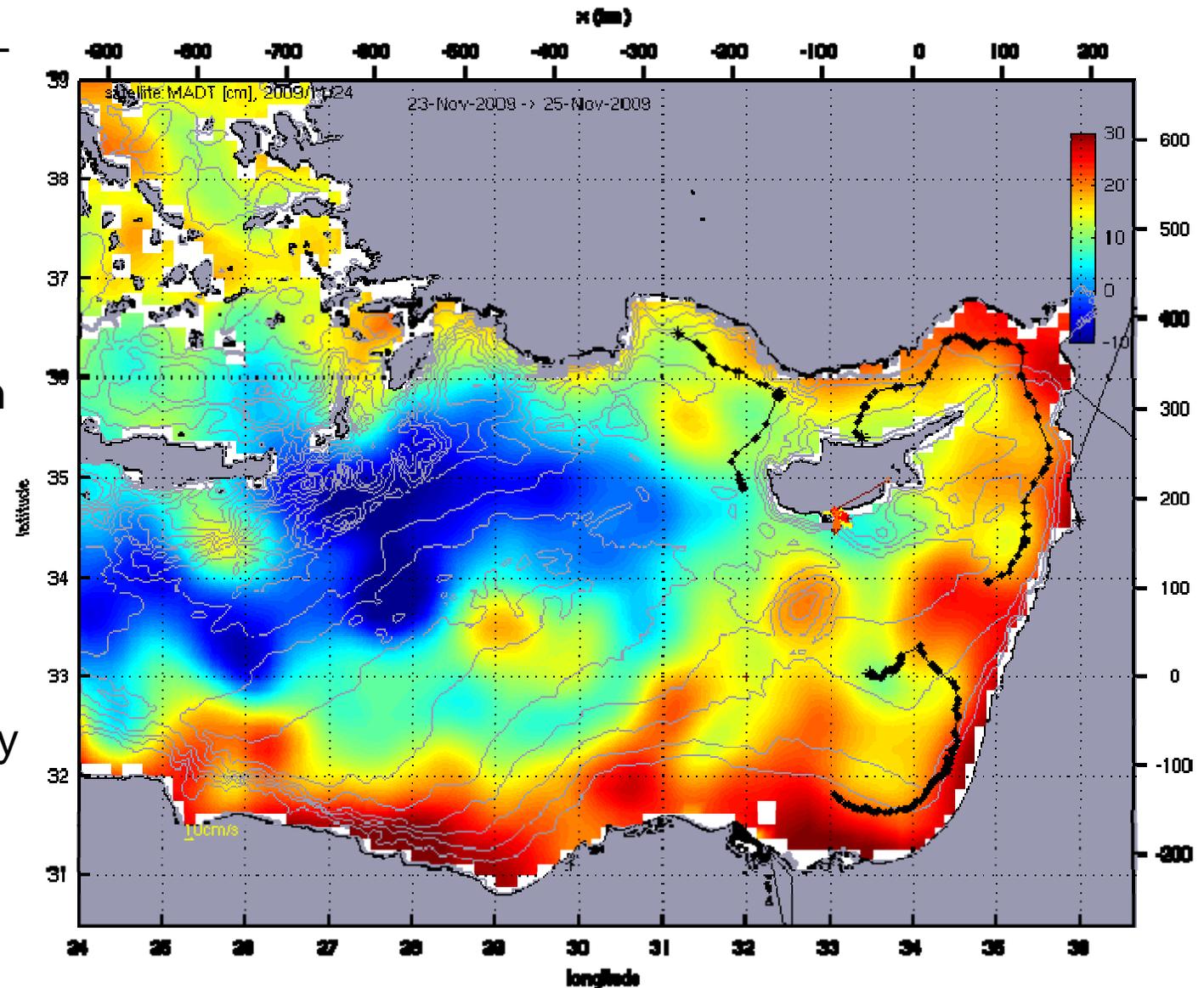
- 23 Nov '09 – 13 Jan '10
- Surface drifters and MADT
- General AC circulation in seamount region
- Stagnation near eddy center
- Second eddy to East (Shikmona Eddy)



EYE of the Levantine

Drifter and MADT

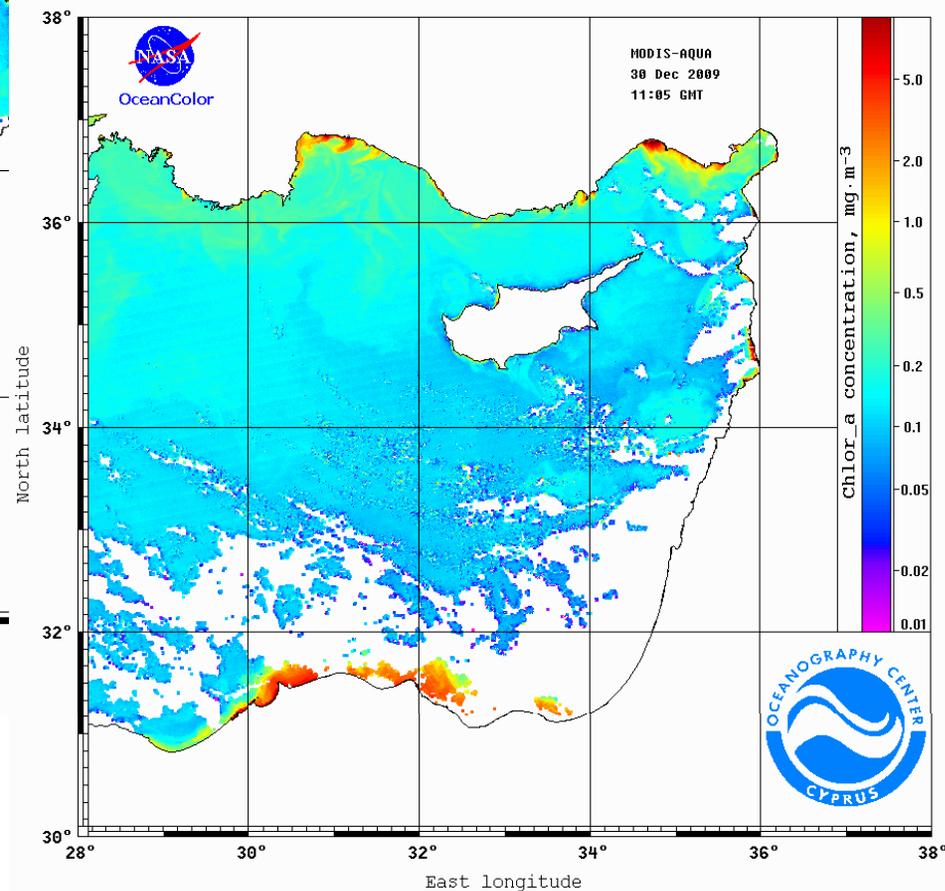
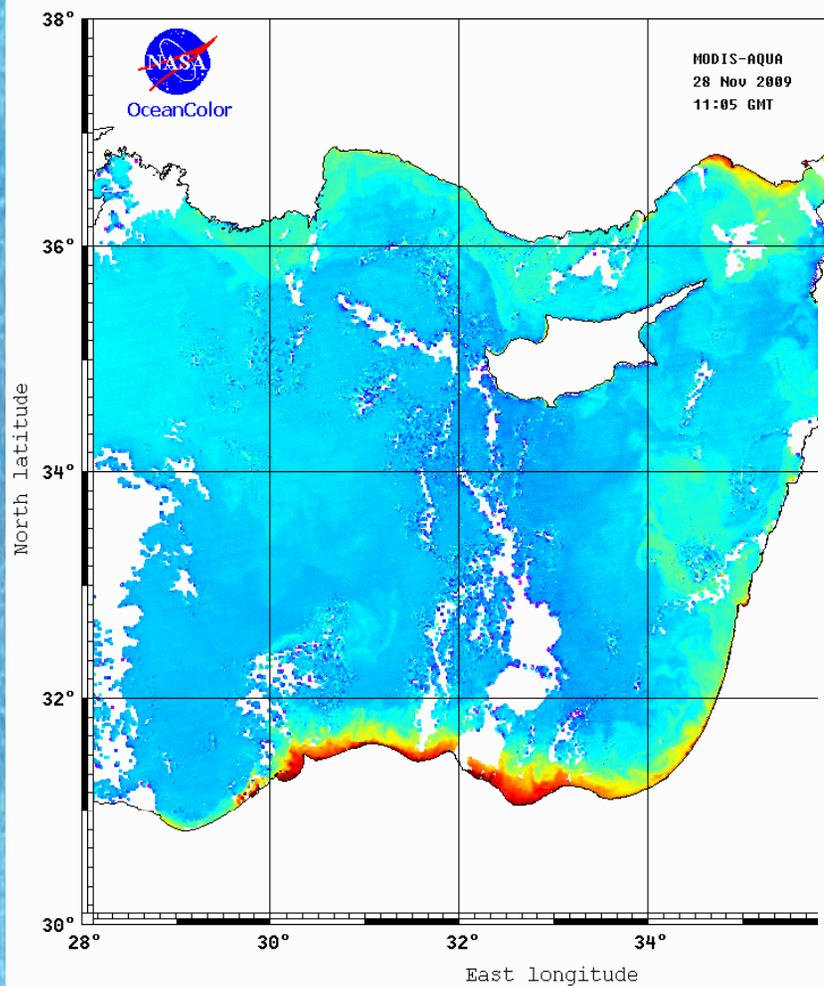
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EYE of the Levantine

Remote Sensing - Chlorophyll

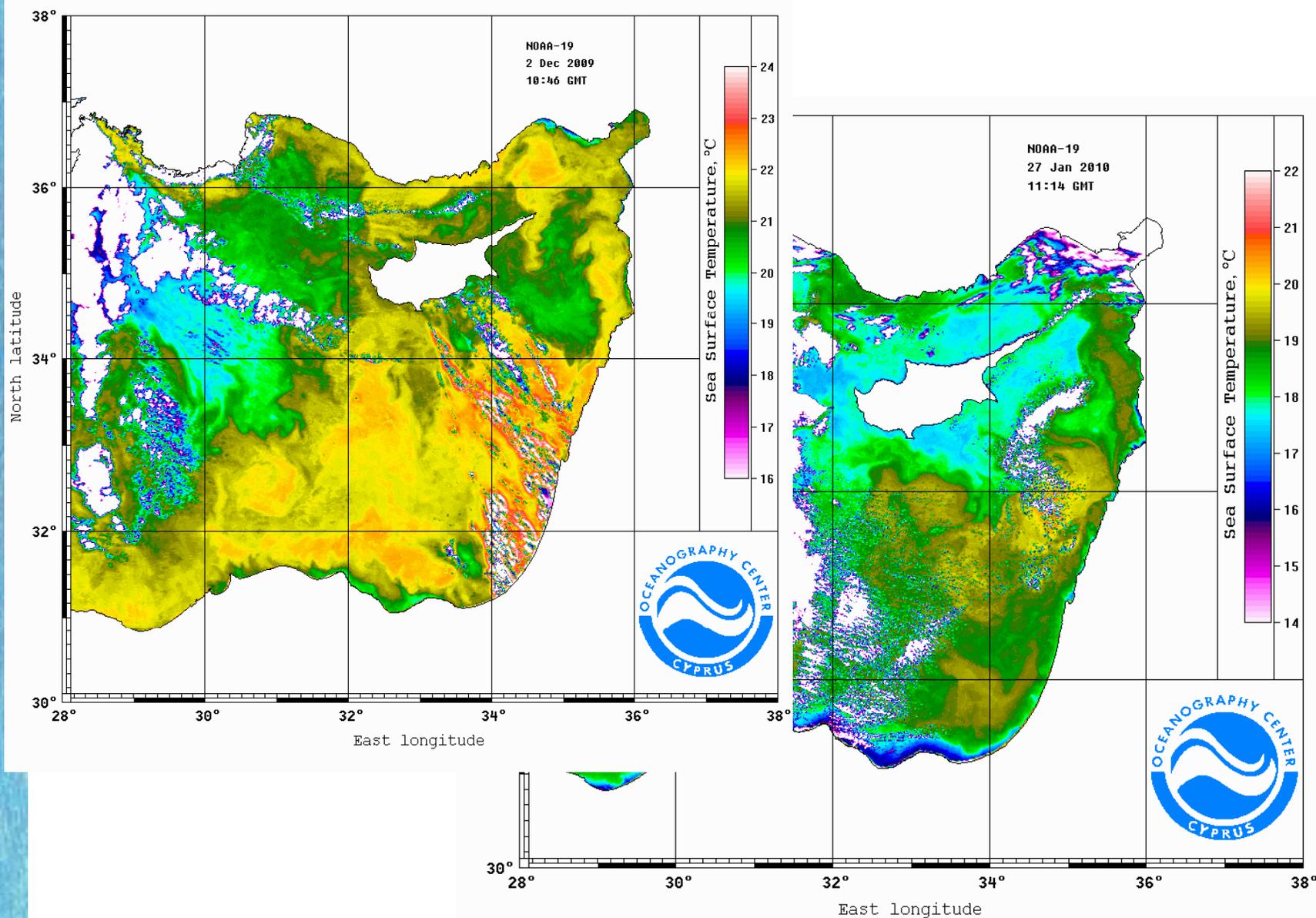
- Where is Cyprus Eddy?
- Shikmona Eddy is clear.

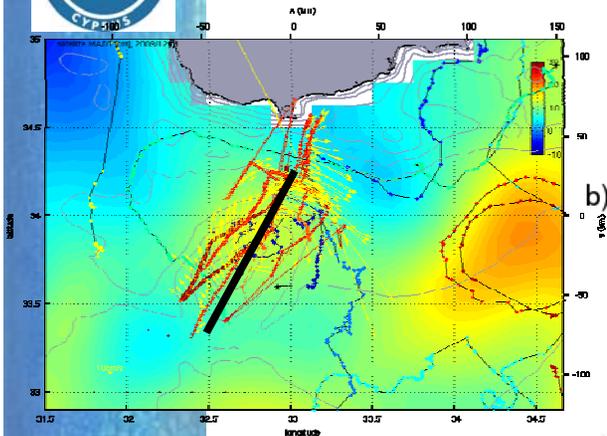
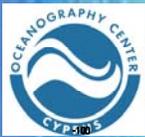




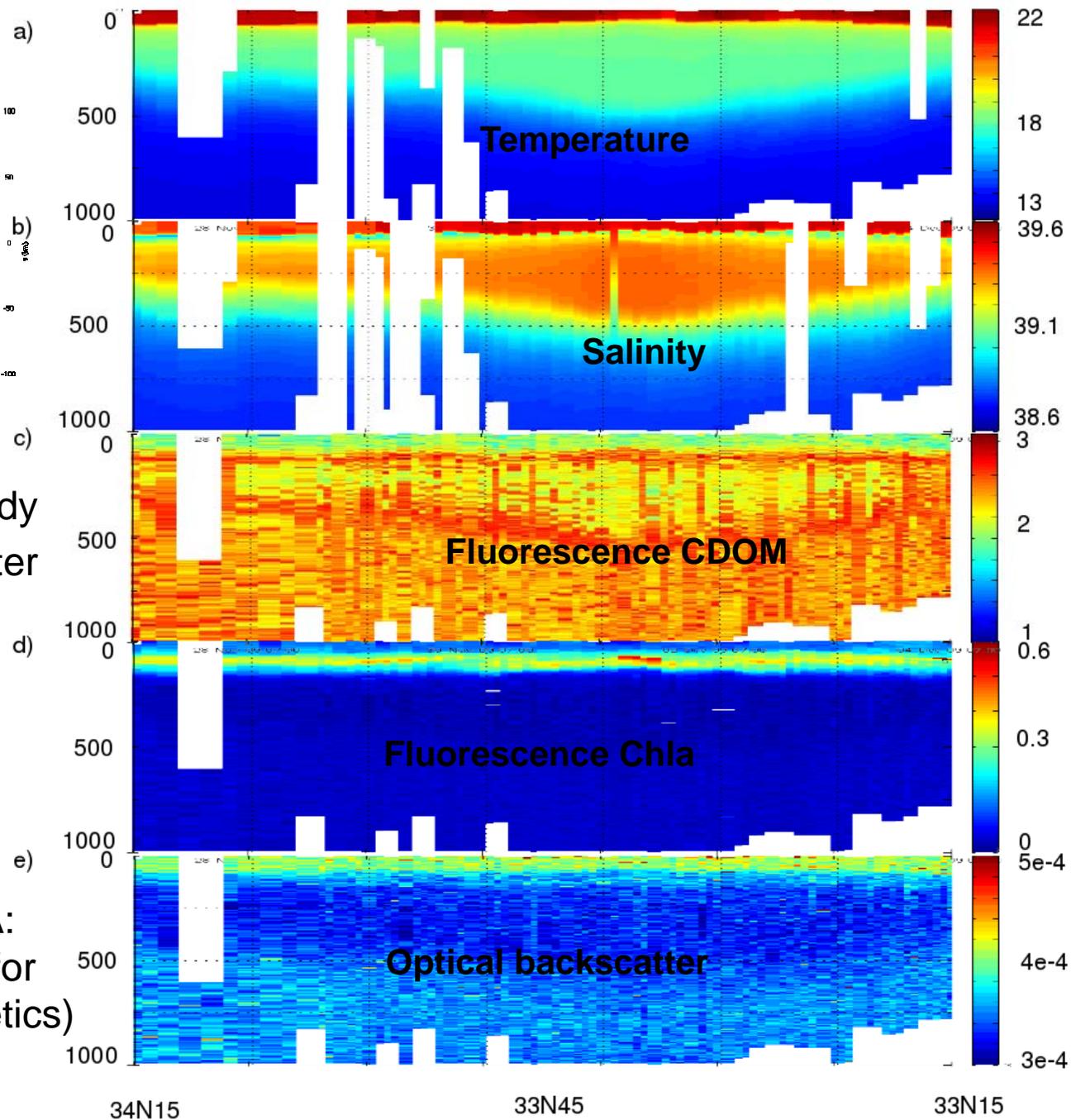
EYE of the Levantine

Remote Sensing - SST



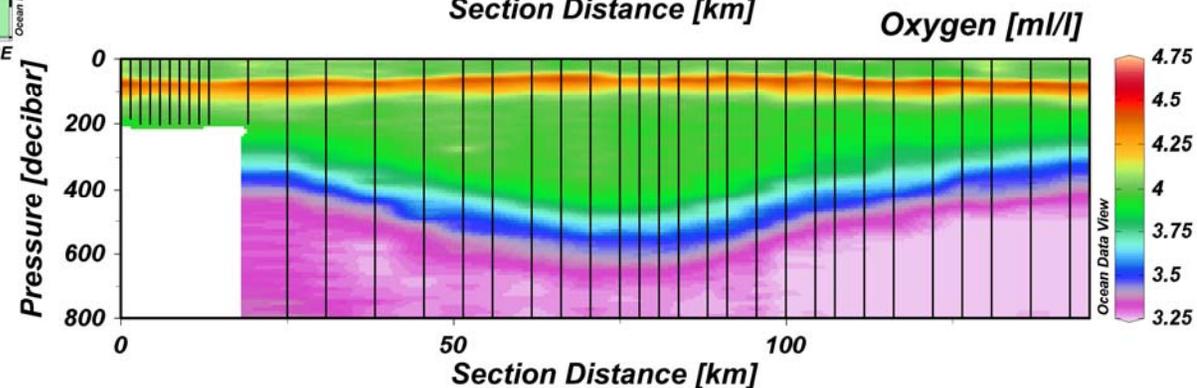
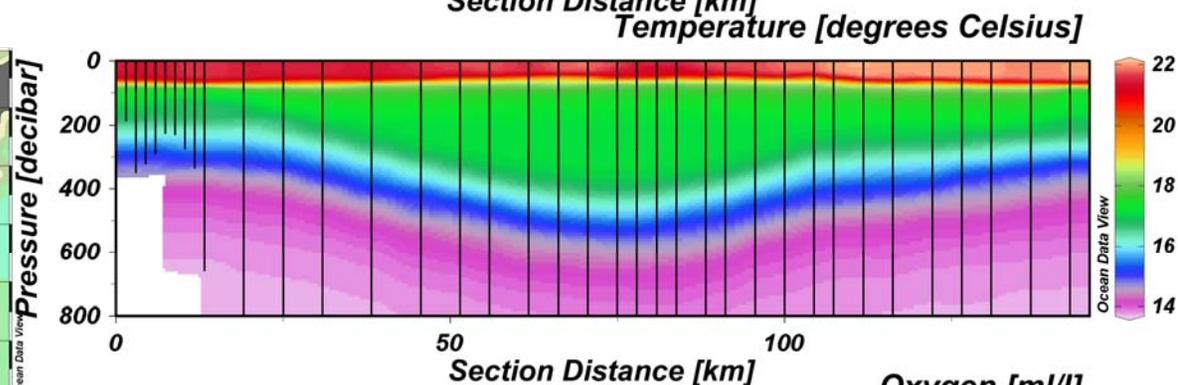
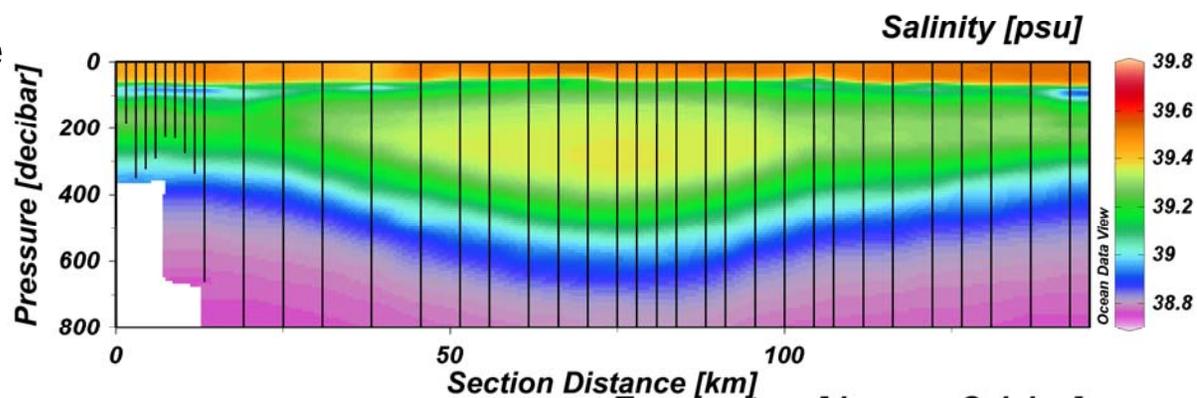
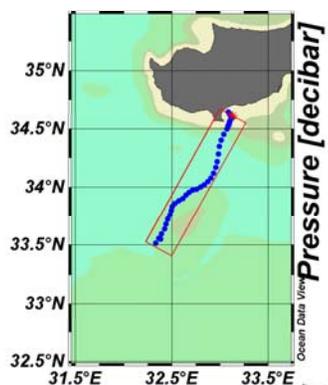


- Distribution of properties in eddy
- Location of center and edges
- Guide for measurements:
 1. Biogeochemical (nutrients, pigments).
 2. Biological (TARA: water samples for taxonomy, genetics)



EYE of the Levantine Glider (Atalanta)

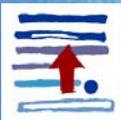
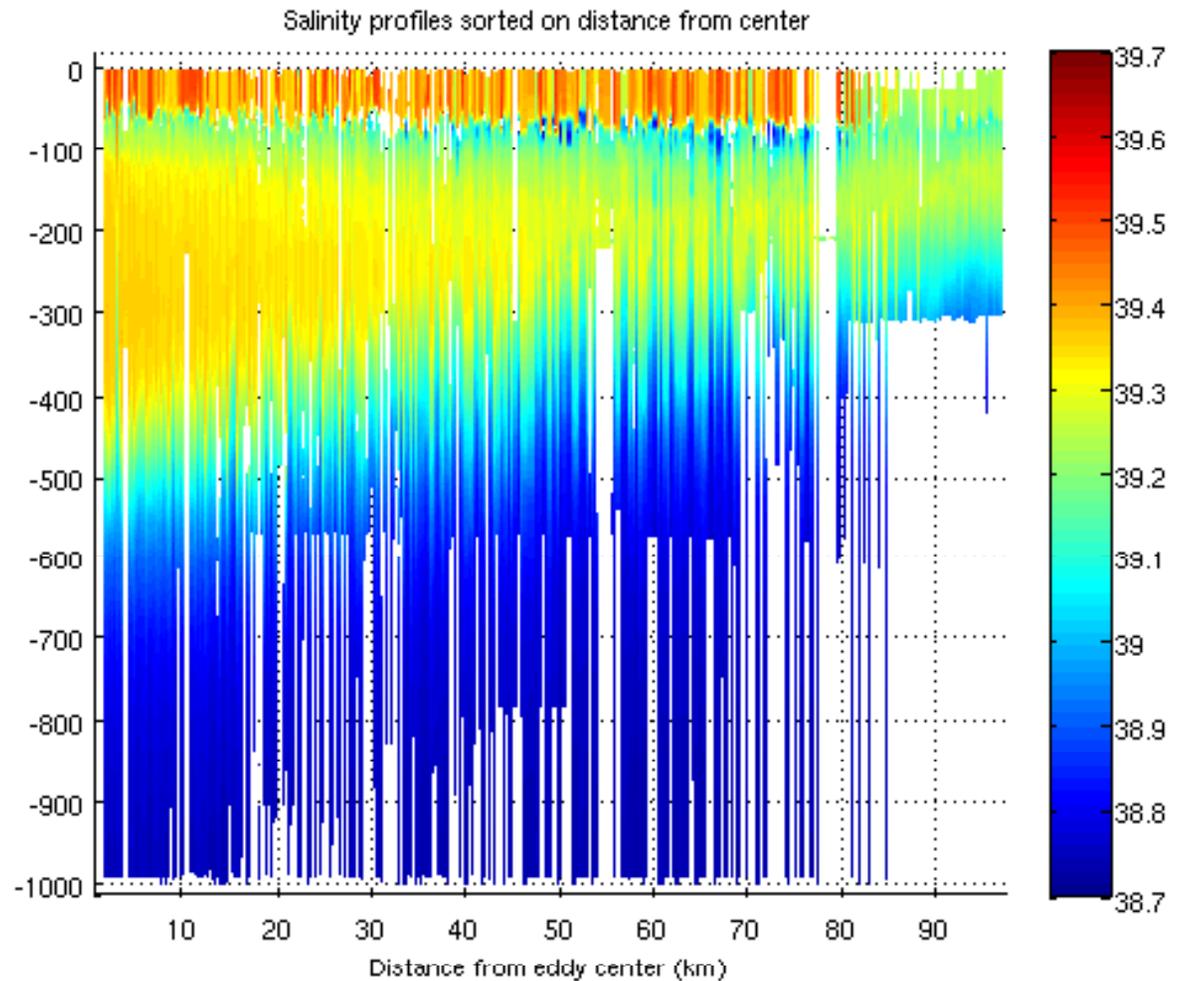
- N-S Section (10d)
- LIW to 500 m.
- Asymmetric shape
- Nov 2009- April 2010
- Autonomy: 567 dives, 2370 km, 143d.



EYE of the Levantine

Eddy Structure from fleet

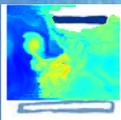
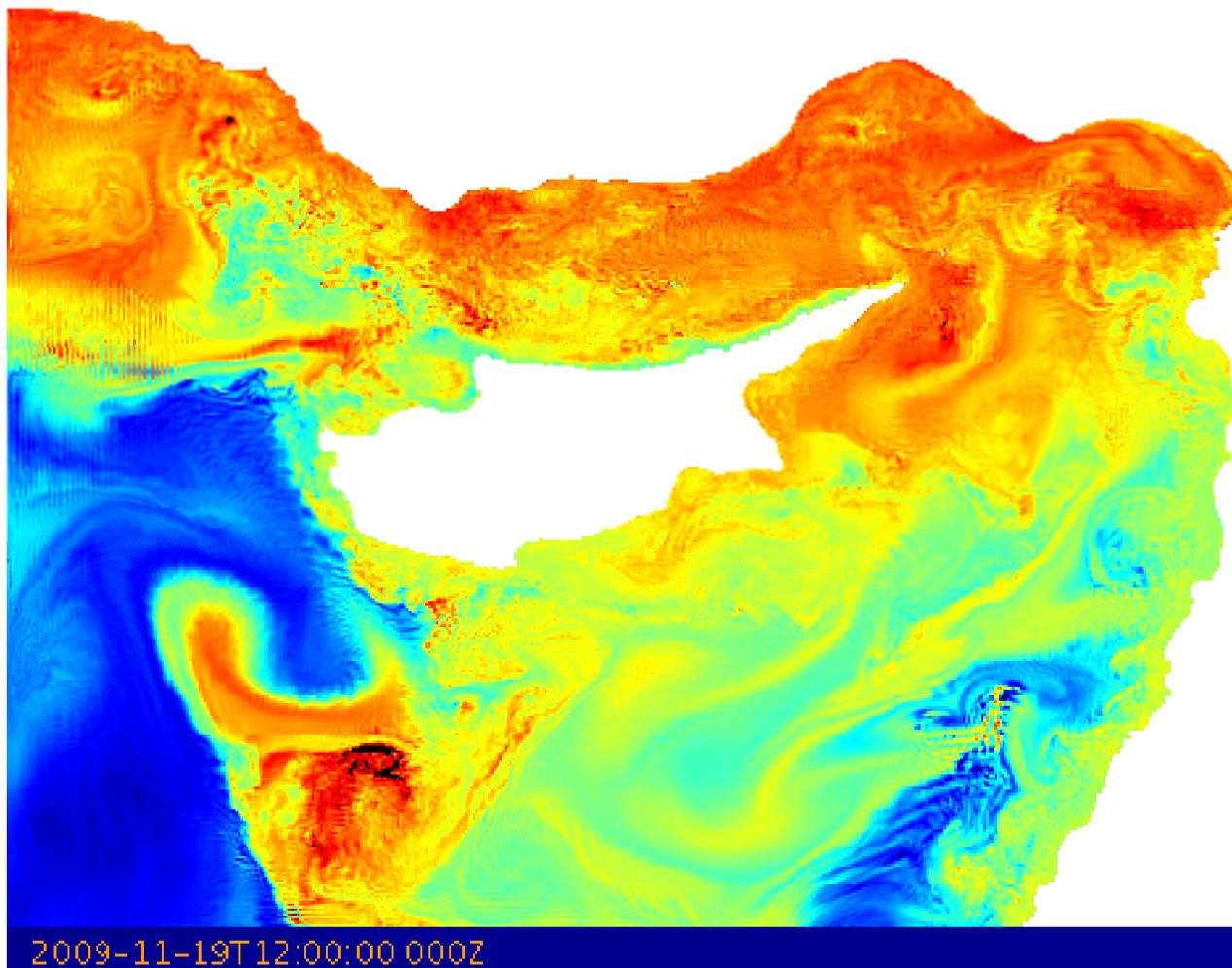
- Nov-Dec 2009
- Levantine IW core
- Atlantic Water at upper and outer edges



EYE of the Levantine

Numerical simulations (operational)

- Salinity at 120 m
- Shikmona Eddy strong
- Anti-cyclonic very weak near Eratosthenes Seamount
- Initial core disappears



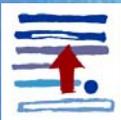
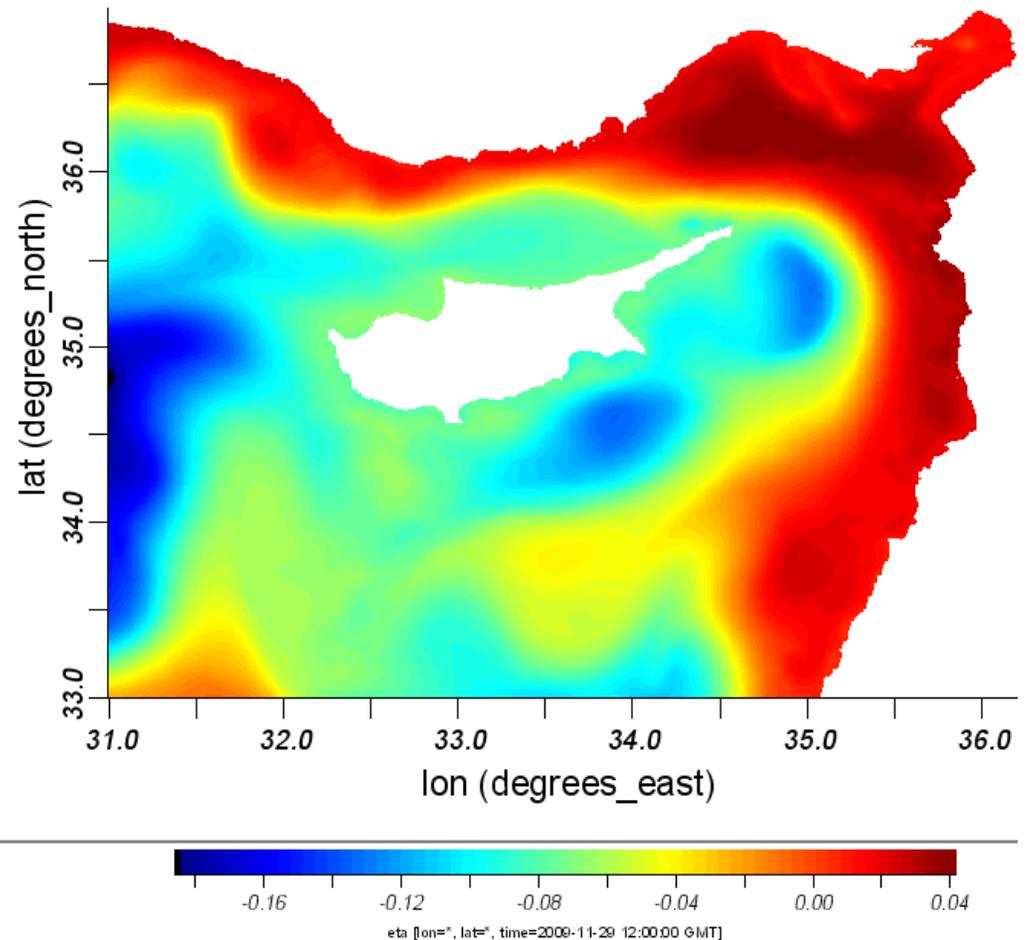


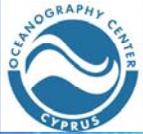
EYE of the Levantine

Data Assimilation (testing)

- 3DVar “OceanVar” (Dobricic and Pinardi, 2008)
- Glider T-S profiles every 5 km (2 m bin upcasts)
- POM, 1 km, forced by hourly 0.05° Skiron met forecast, Alermo ocean BC and IC
- Monthly vertical EOFs of deviations from mean from past forecast.
- Running.....

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Sea Level





Conclusions

- Gliders and glider fleets are a vital component for near real time and long term **observation networks**.
- Support NRT forecasts and their application plus basic research.
- EYE experiment will provide more information about the Cyprus eddy (physical and biogeochemical).

Acknowledgements

- Funding: Cyprus RPF and UCY, TARA/Oceans.
- Launch/recovery support: Department of Fisheries and Marine Research.
- Colleagues.

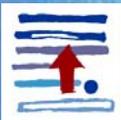
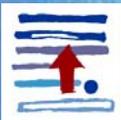


Photo: A. Hannides



Future

- EGO COST Action: Oct 2010-2013, ANY country can participate
- “Build cooperation at the *technological, scientific, and organizational* levels for a European capacity for *sustained* observations”
- Funding: for travel, workshops, and training for COST countries
- 5th Workshop and glider school: 14-18 March 2011 Gran Canary
- <http://www.ego-network.org>



Seaglider description

- Low-drag fairing over hull of compressibility \sim seawater
- Lithium batteries, \sim 6 mo life (4600 km or 650 dives to 1km)
- Iridium satellite phone for data, instruction transfer
- Controlled with file exchange (commands, waypoints, configuration)

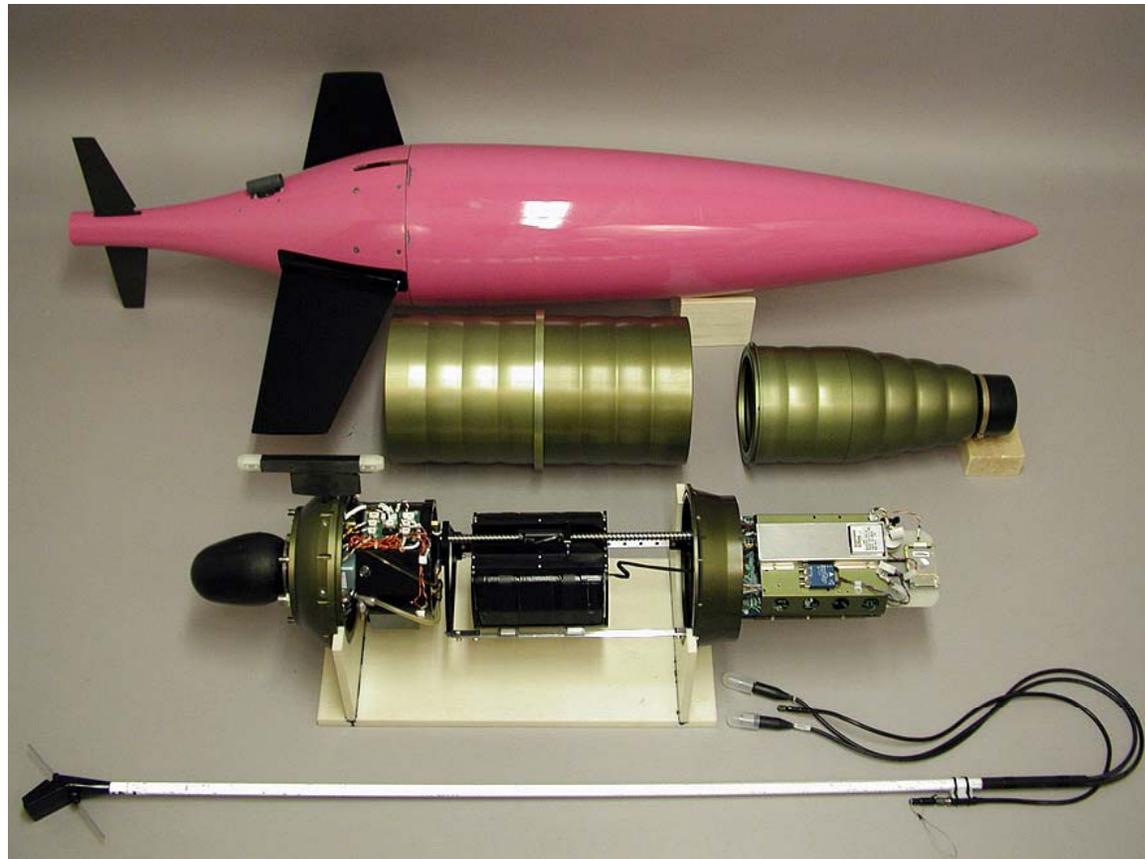


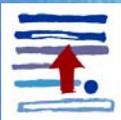
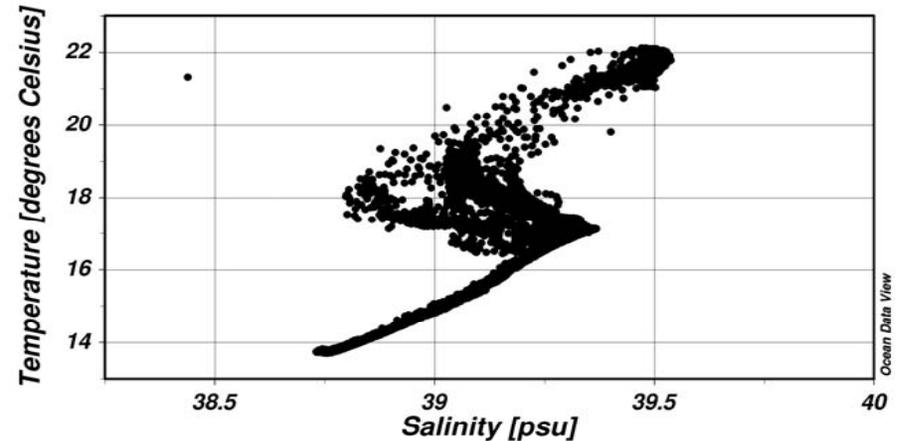
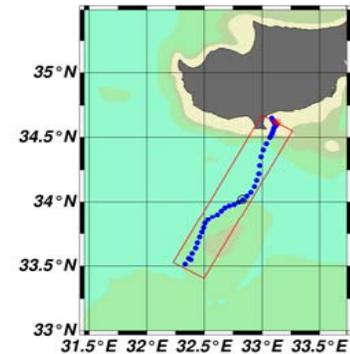
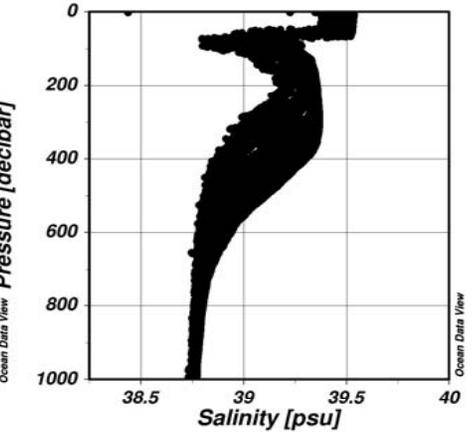
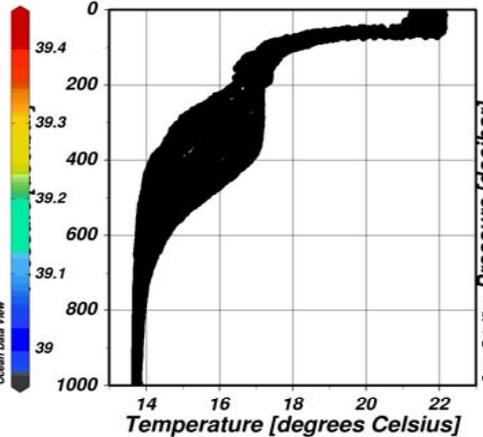
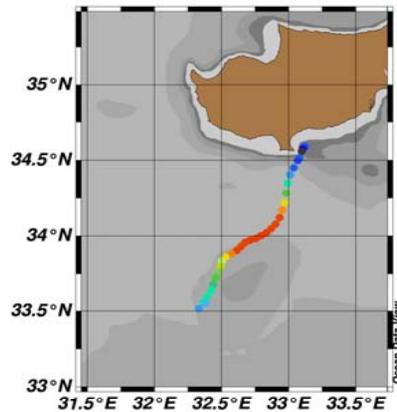
Photo: U of Washington

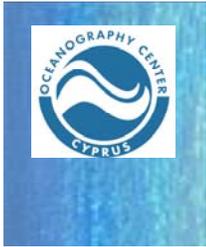
EYE of the Levantine

TS properties

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- Radius ~40km
- November 2009 to January 2010
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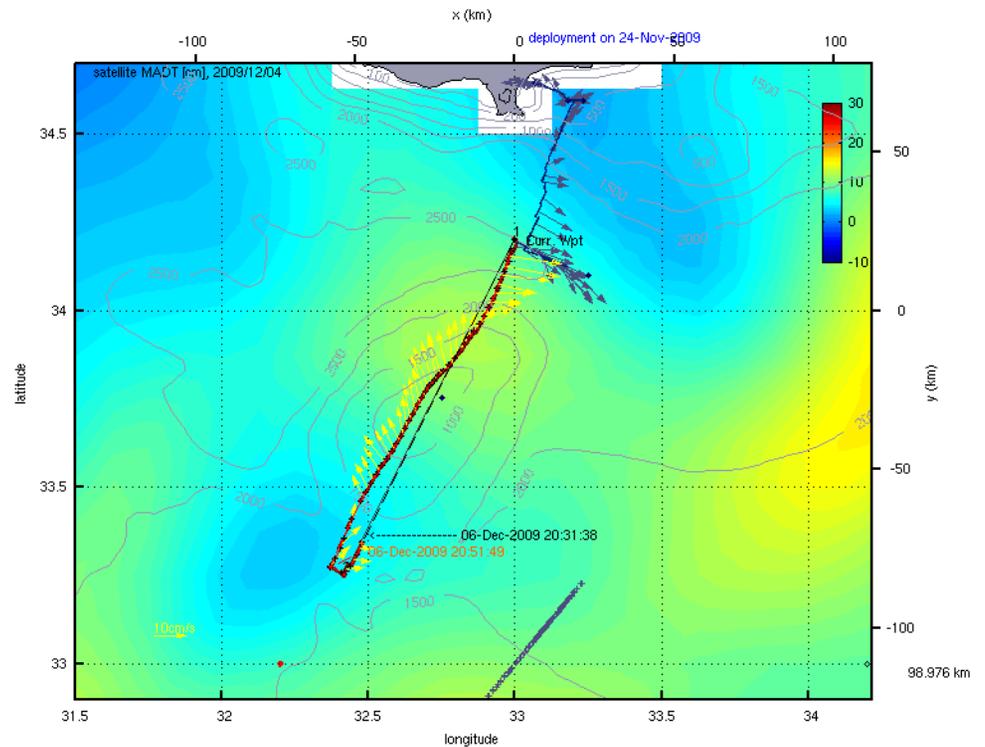
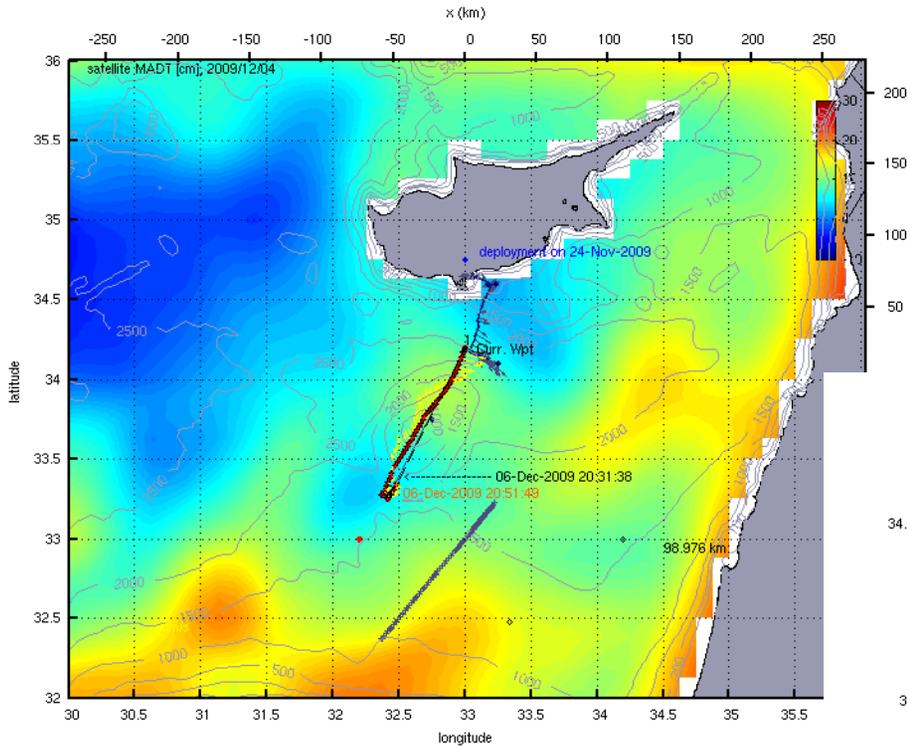




EYE of the Levantine

Remote Sensing - SLA

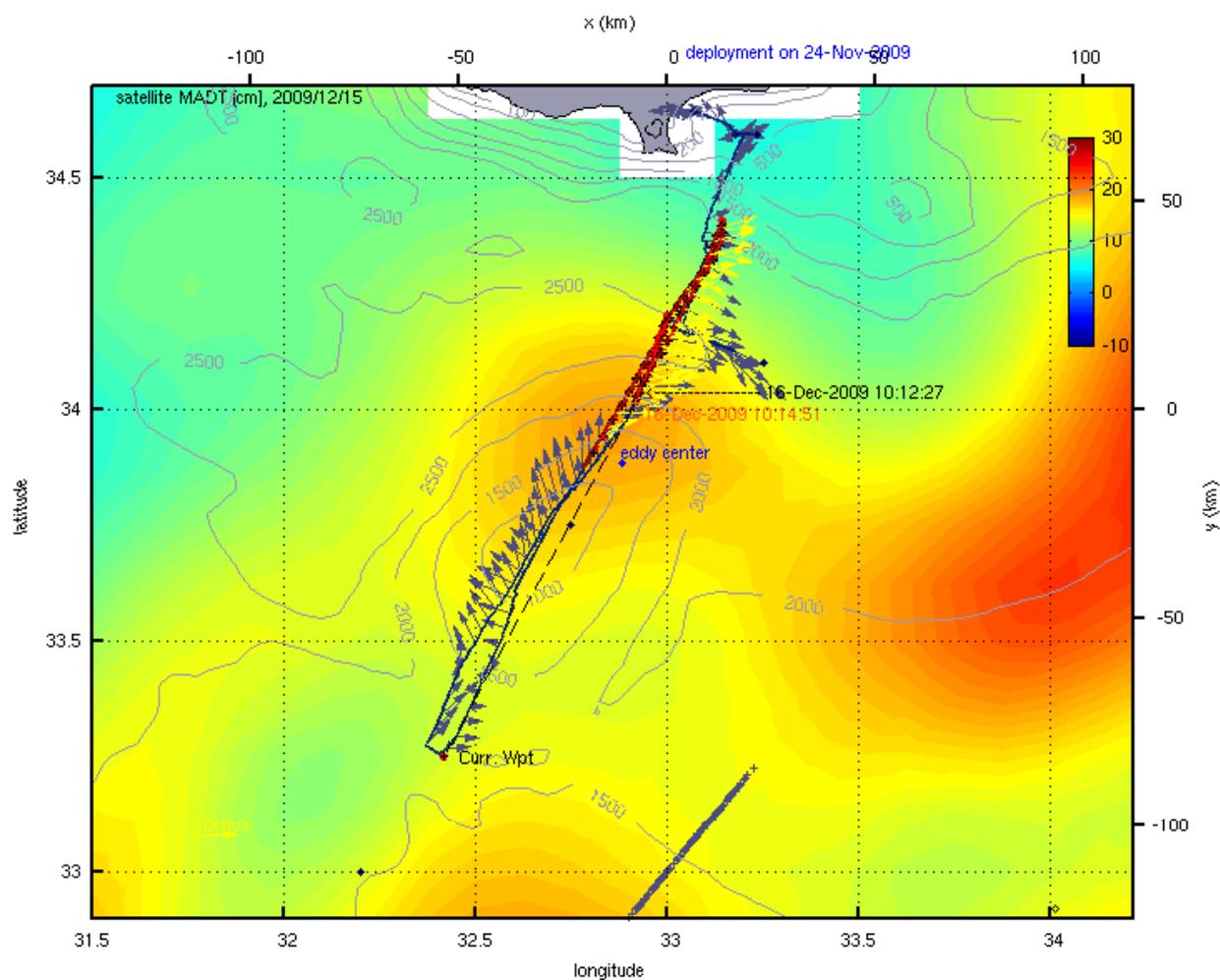
- Four gliders sampling the eddy
- Currents and sea level image show eddy position



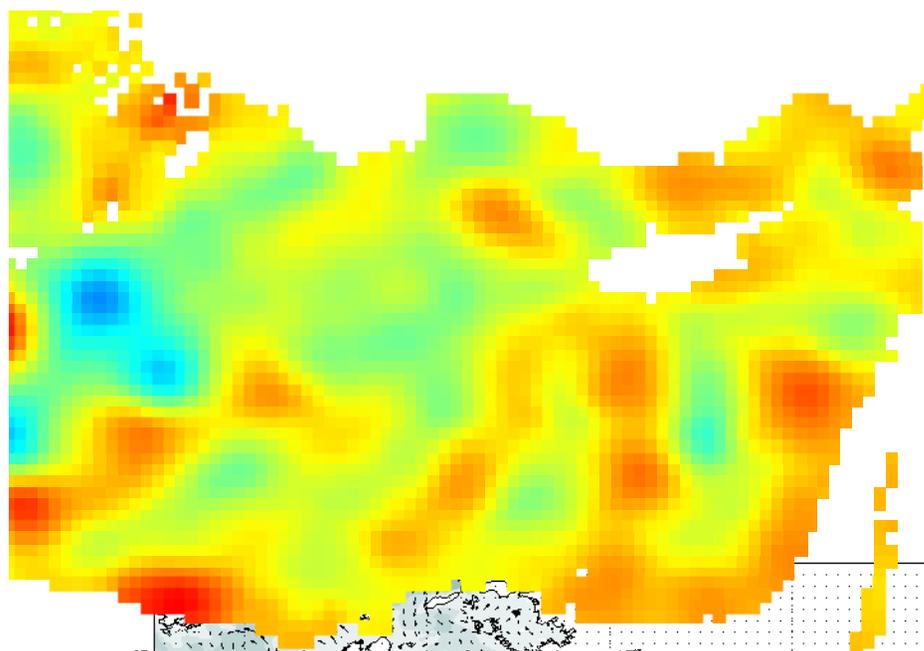
EYE of the Levantine

Remote Sensing - SLA

- Sea Level Anomaly
- December 2009 – Feb 2010
- Glider velocities co-located



SLA: velocity field



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