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Predicted and observed variability in sound speed in the oceanic littoral

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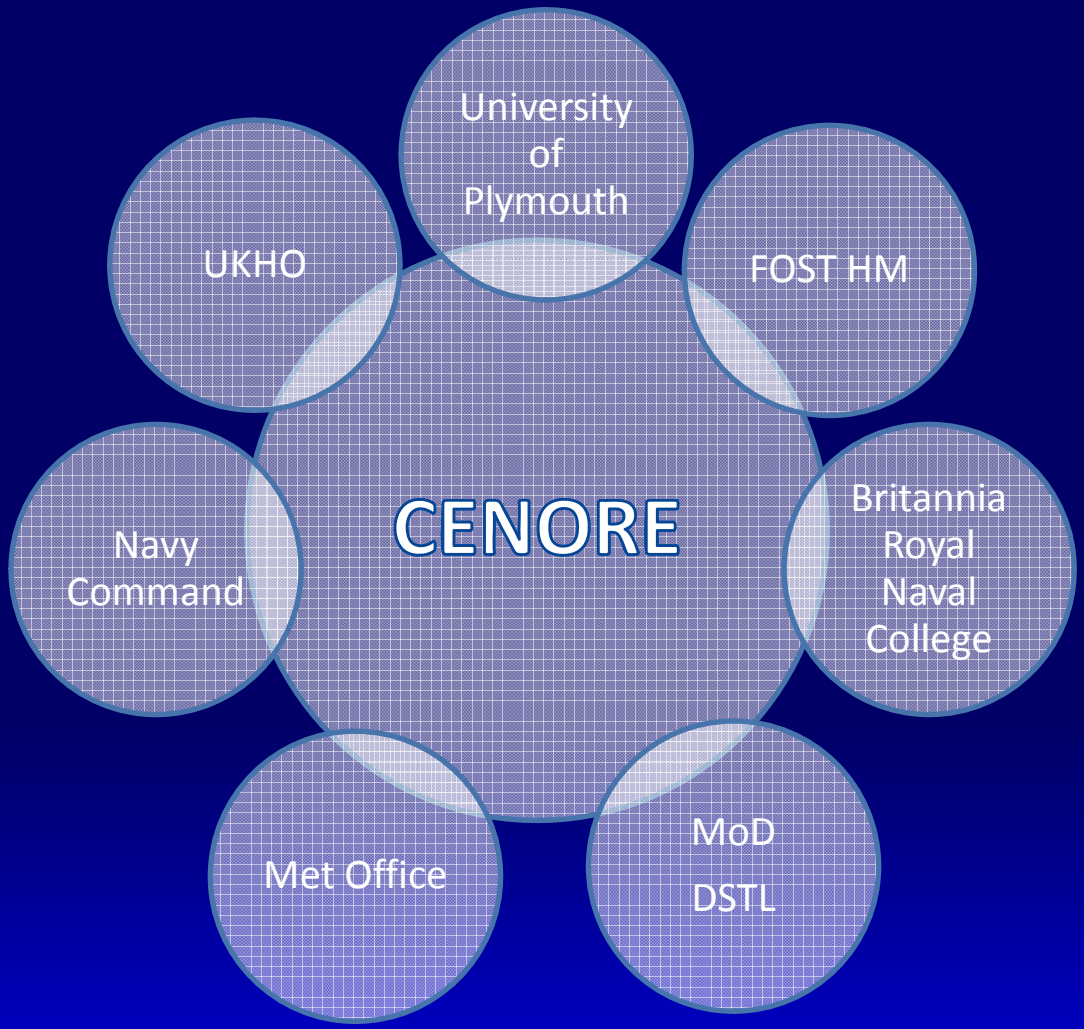
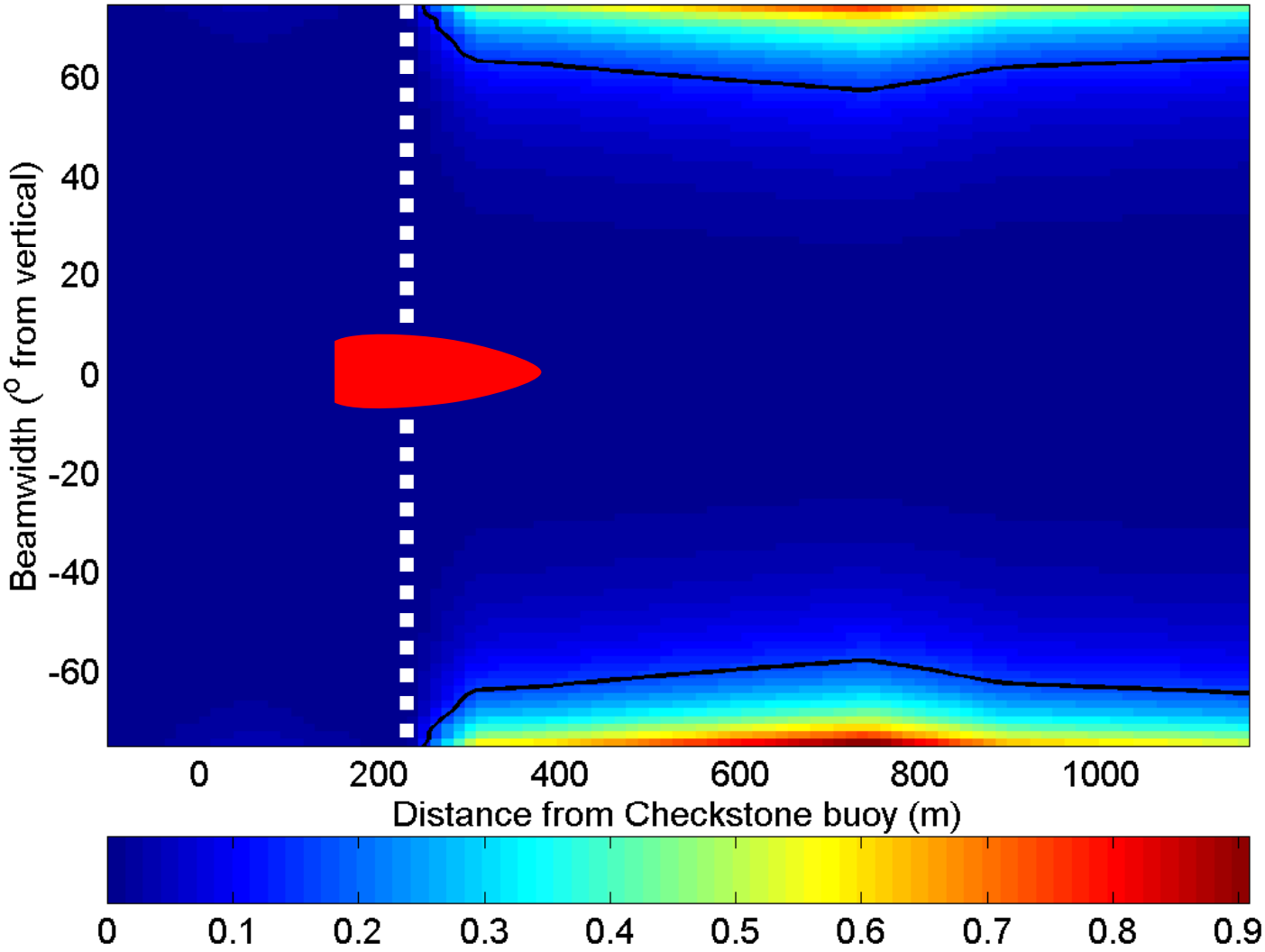


Early work – Observational
Estuaries, beaches and shelf seas.
Analysis of frontal systems in shallow water

Tidal intrusion fronts…

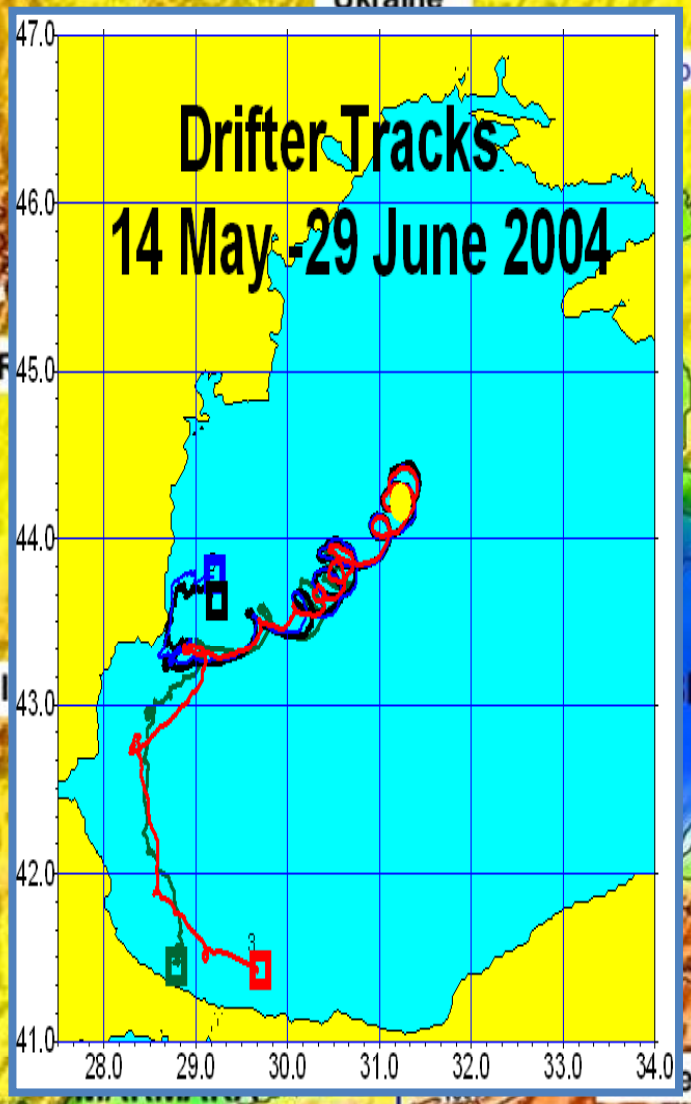
Thain, R. H. and Priestley, A. D. 2010. Scales of sound velocity variability in estuaries and shallow water, littoral areas.

Multibeam sonar errors



Priestley, A. D. and R. H. Thain. 2003. Water column variability at an estuarine mouth: implications for multibeam sonar surveys. *Third international conference on high resolution surveys in shallow water, Sydney, Australia*, 17-21 November 2003.

Why the Black Sea ?



Ukraine

Russia

SEA OF AZOV

LACK SEA

Georgia

Kizilirmak

Yesilirmak

Sakarya

SEA

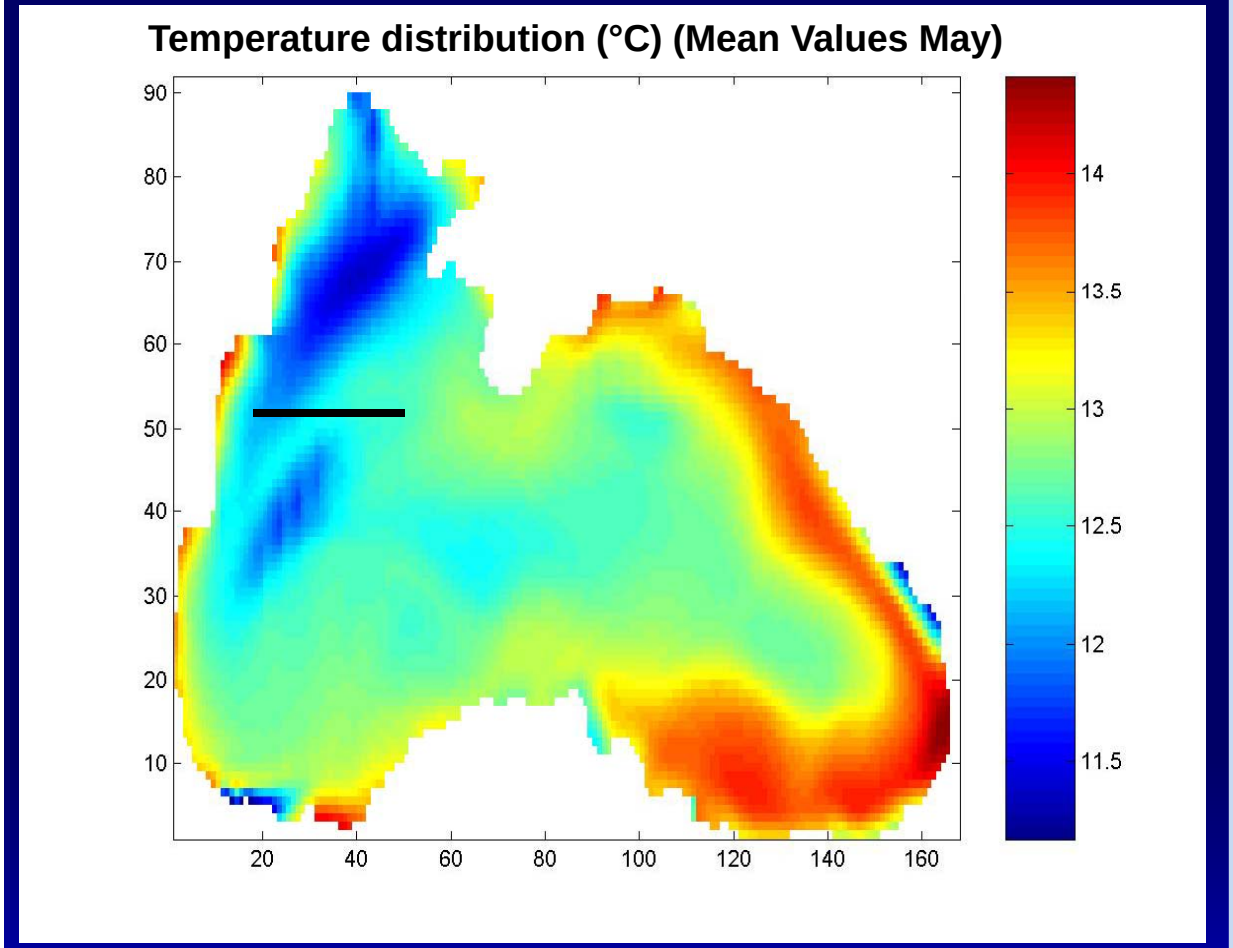
1000

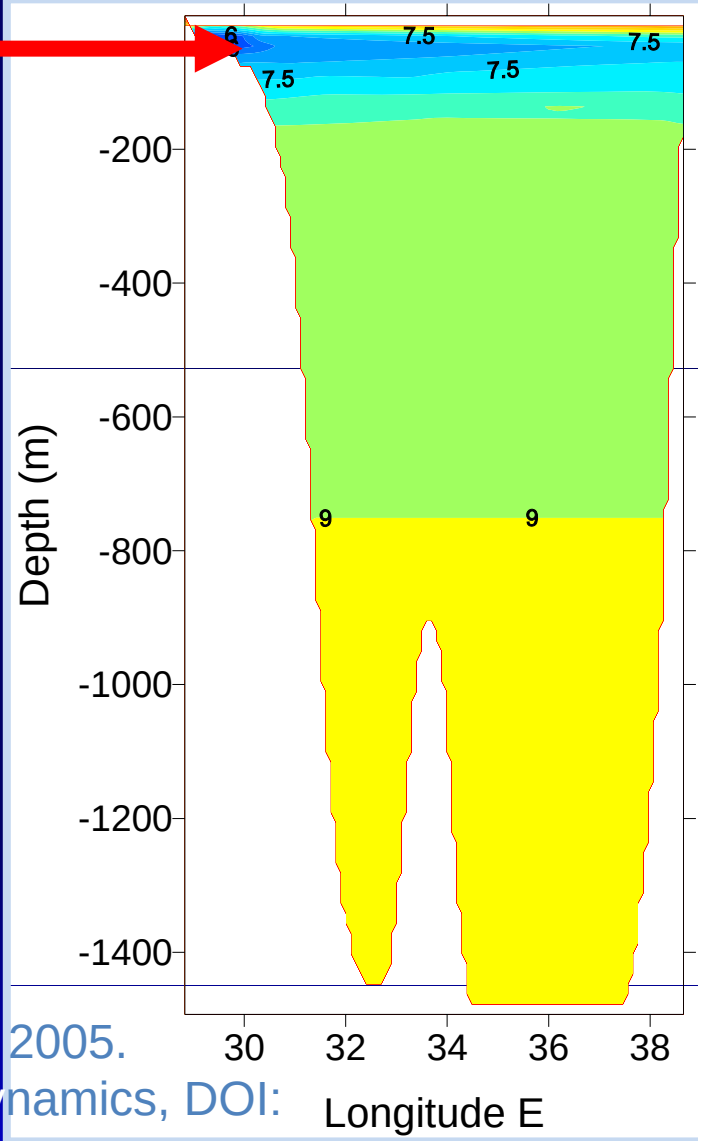
2000

myOcean

Initial temperature distribution (May)

Cold
Intermediate
Layer



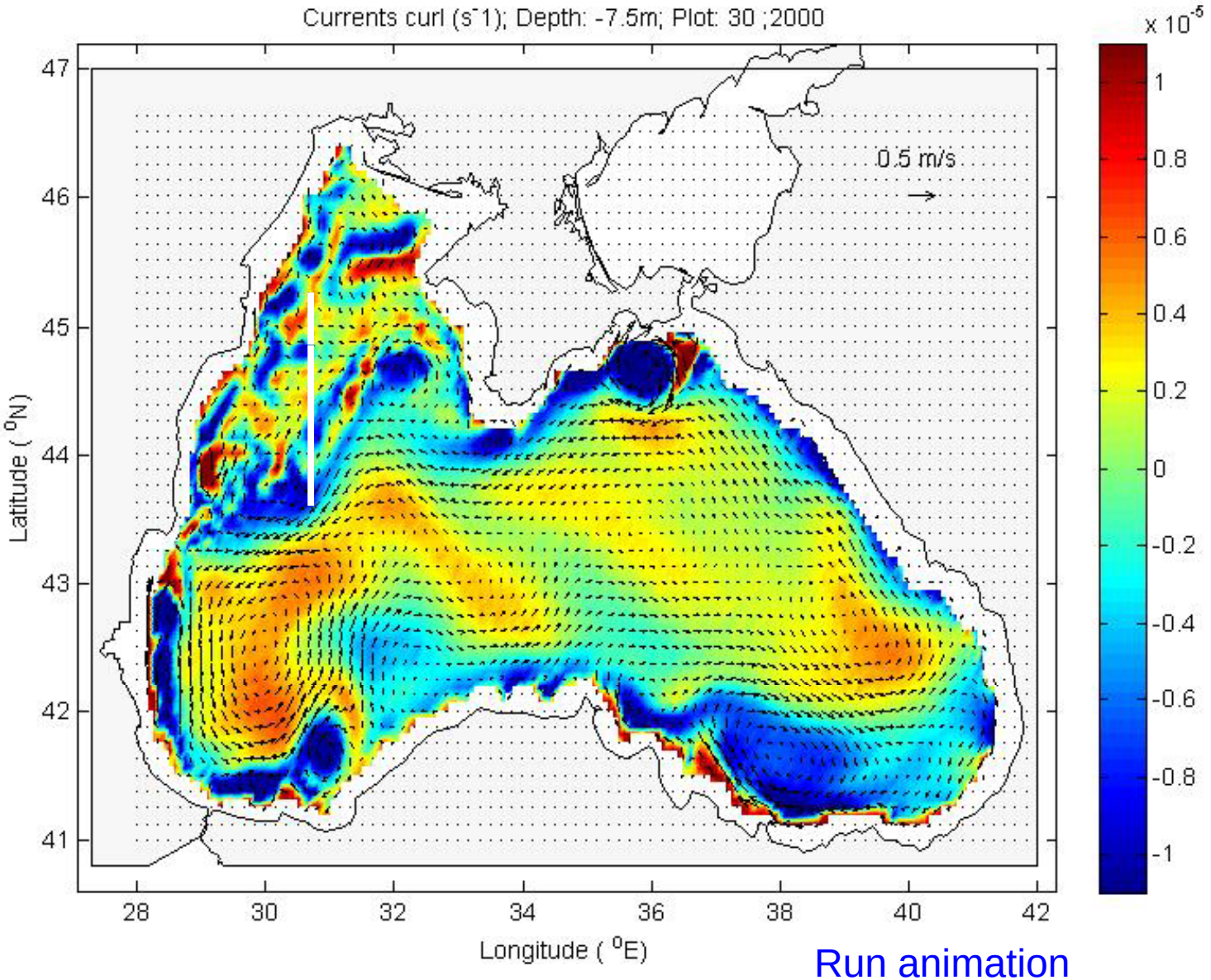


Enriquez, C. E., G.I. Shapiro, A. J.Souza, A. G.Zatsepin. 2005. Hydrodynamic modelling of mesoscale eddies. Ocean Dynamics, DOI: 10.1007/s10236-005-0031-4

POLCOMS-Black Sea

- 3-D, Baroclinic ocean circulation model
- Horizontal Resolution: ~6km (92 x 170)
- Vertical resolution: 30 “S” vertical levels, 2.5 m in the upper layer, increases with depth
- Horizontal boundaries: rivers and Bosphorous (in-out)
- Forcing: 6h re-analysis data (8 parameters) , Wind (U,V), SL pressure, SL air temperature, SL rel humidity, precipitation, cloudiness, solar radiation

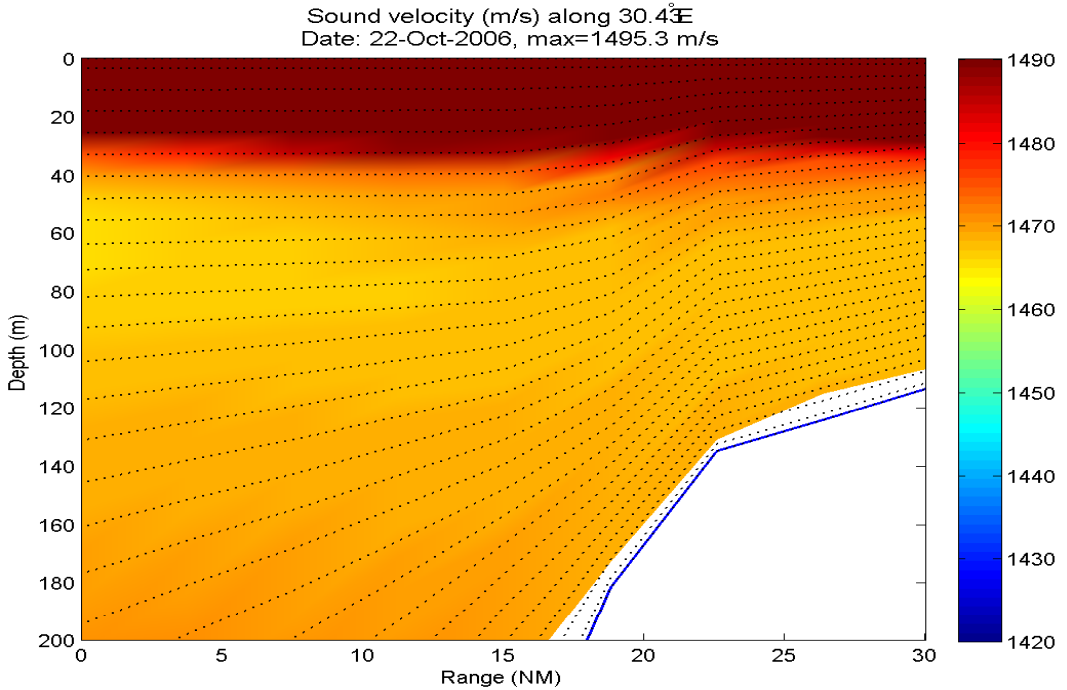
Mesoscale circulation-POLCOMS-Black Sea

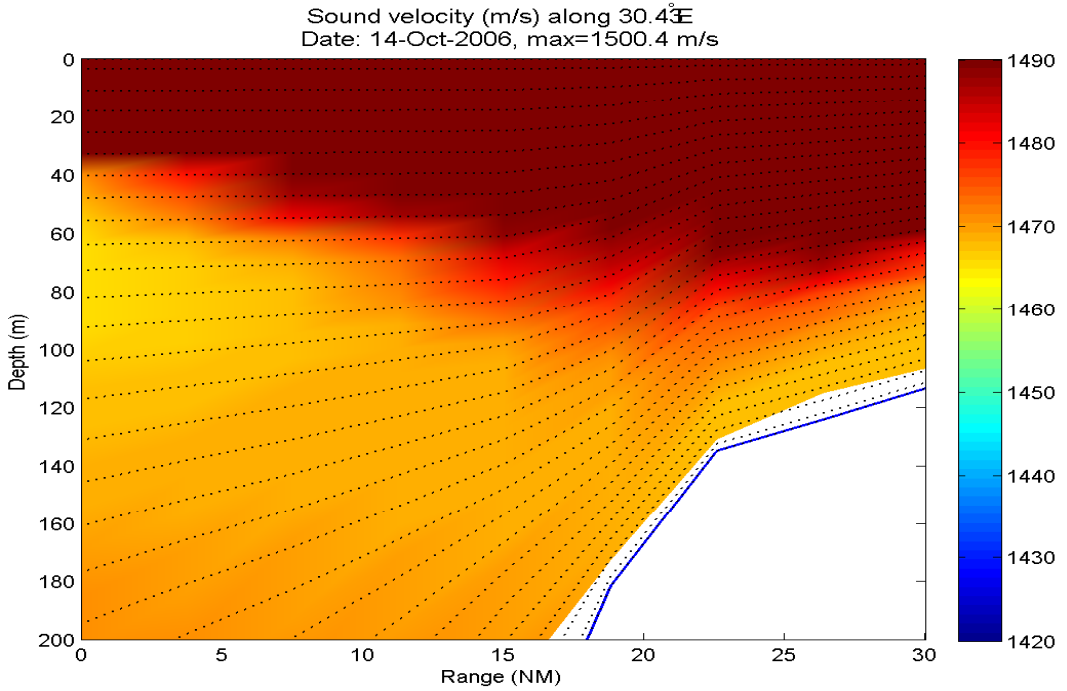


Run animation

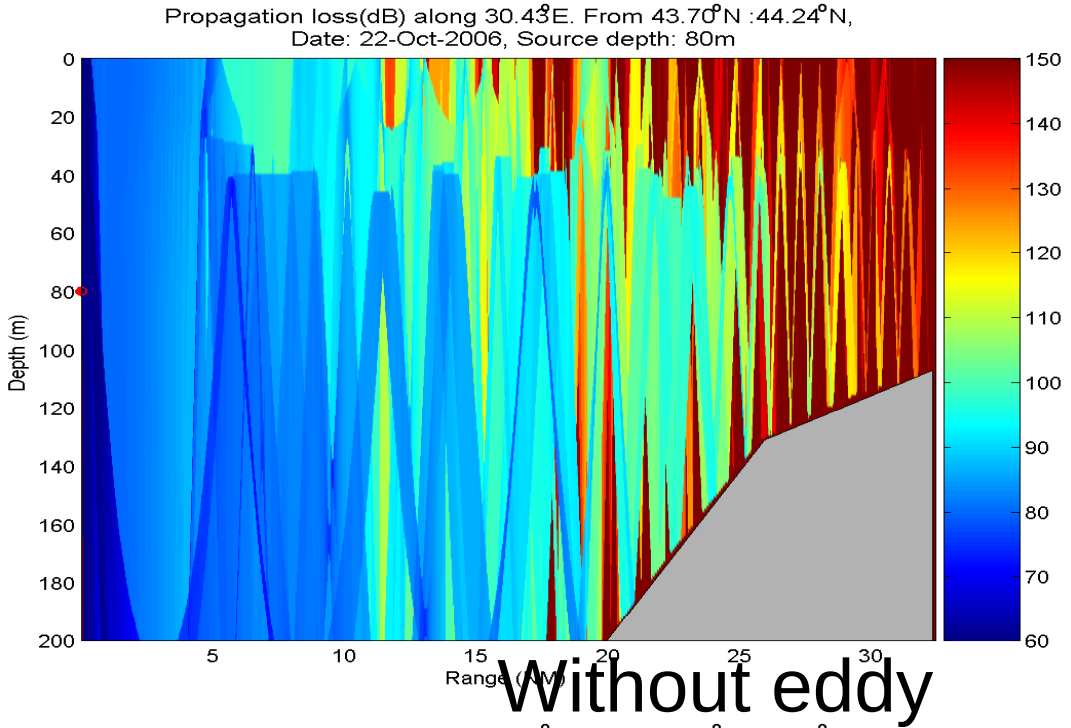
22 Oct 2006 - no eddy present

8 Days previously - mesoscale eddy present

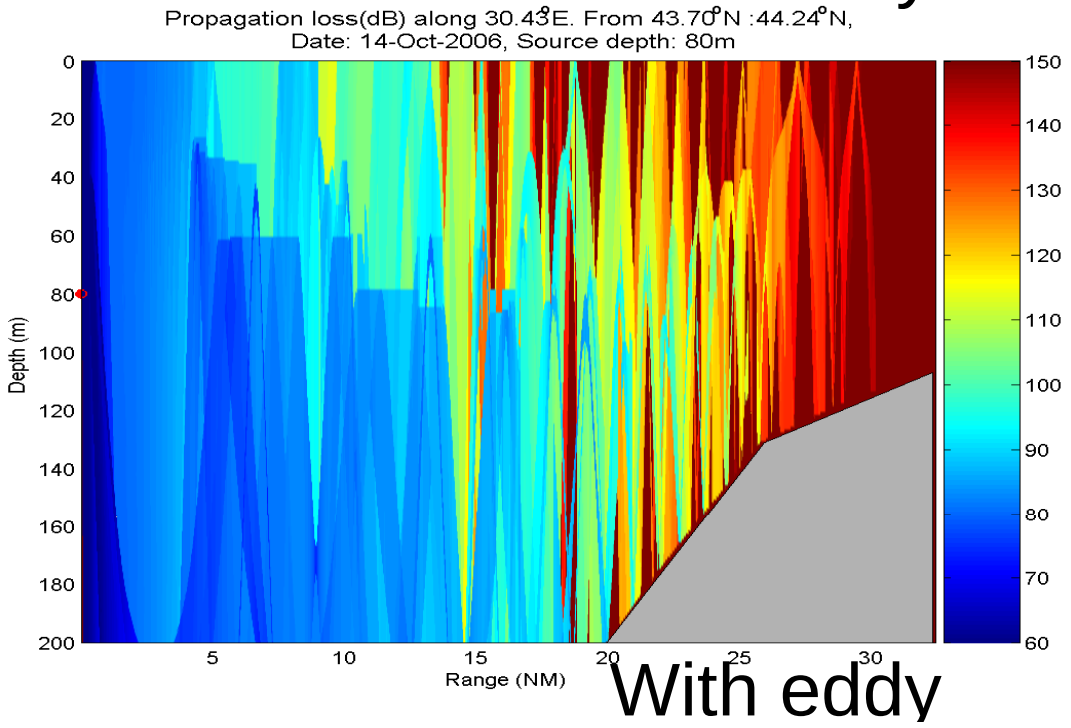




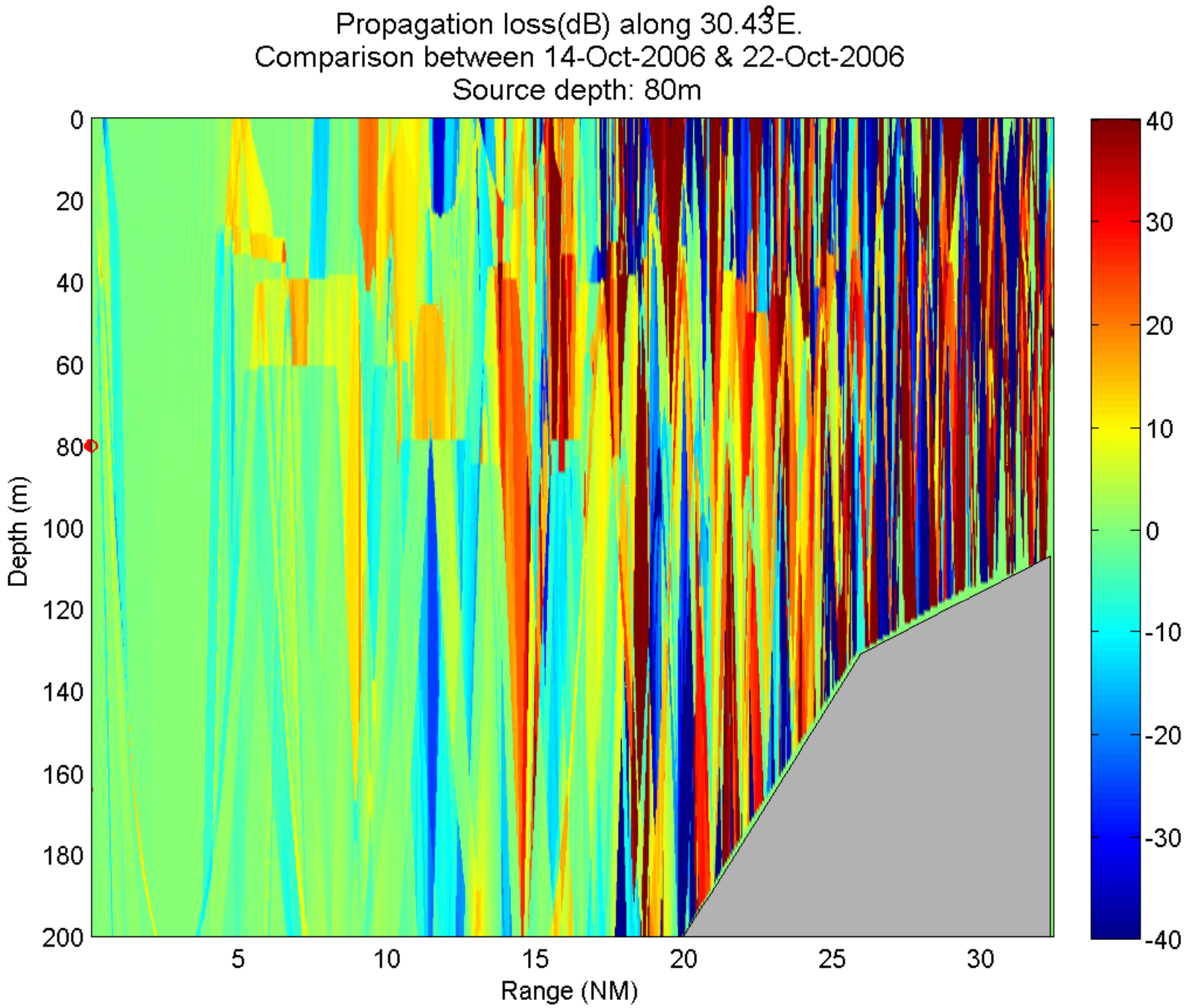
- Low Frequency Active Sonar Propagation - 1.6 KHz
- Deployment depth = 80m
- 'Hodgson' composite acoustic model
- Verified against UK MoD benchmarks



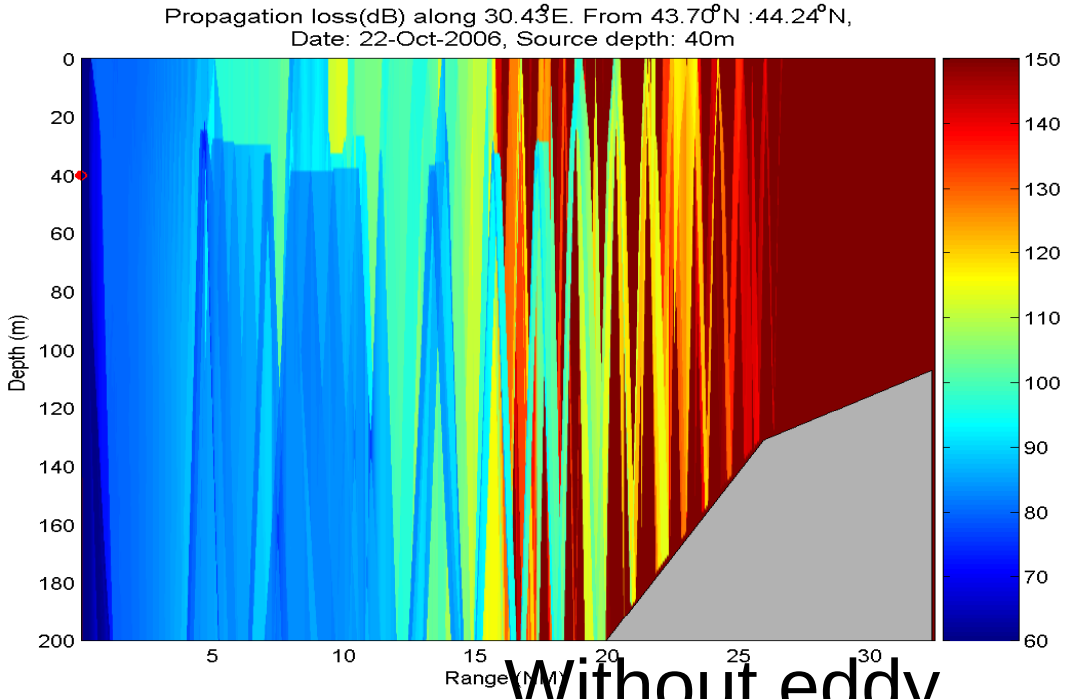
Without eddy



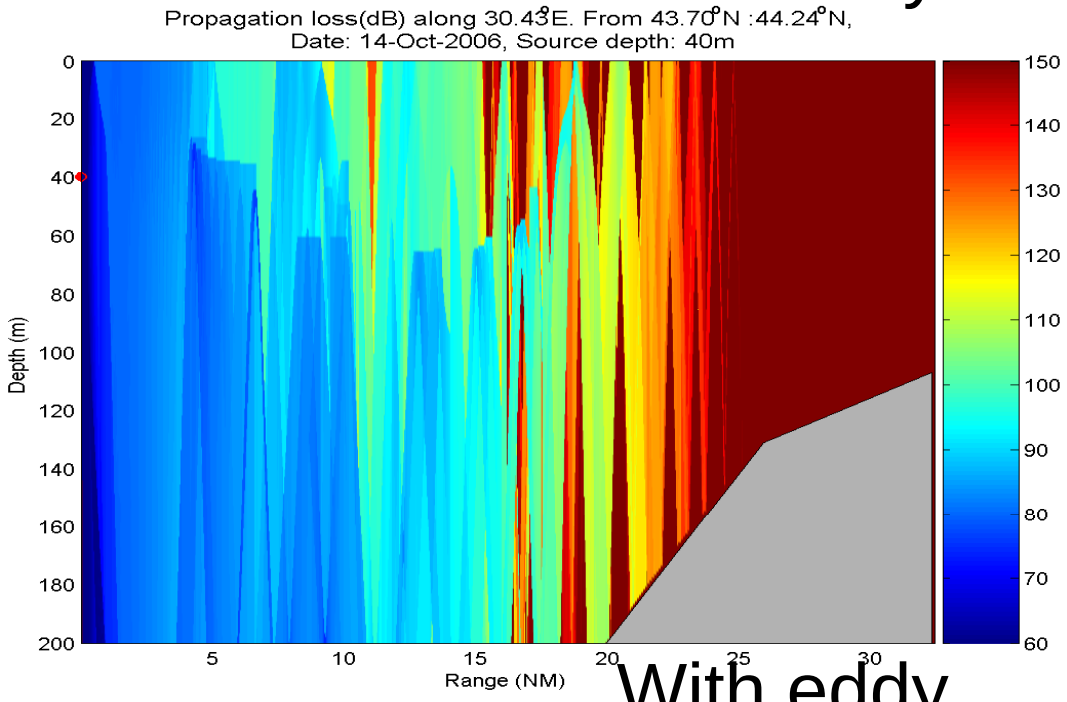
With eddy


Propagation loss(dB) along 30.43°E.
Comparison between 14-Oct-2006 & 22-Oct-2006
Source depth: 80m
Depth (m)
0
20
40
60
80
100
120
140
160
180
200
5
10
15
20
25
30
Range (NM)
40
30
20
10
0
-10
-20
-30
-40

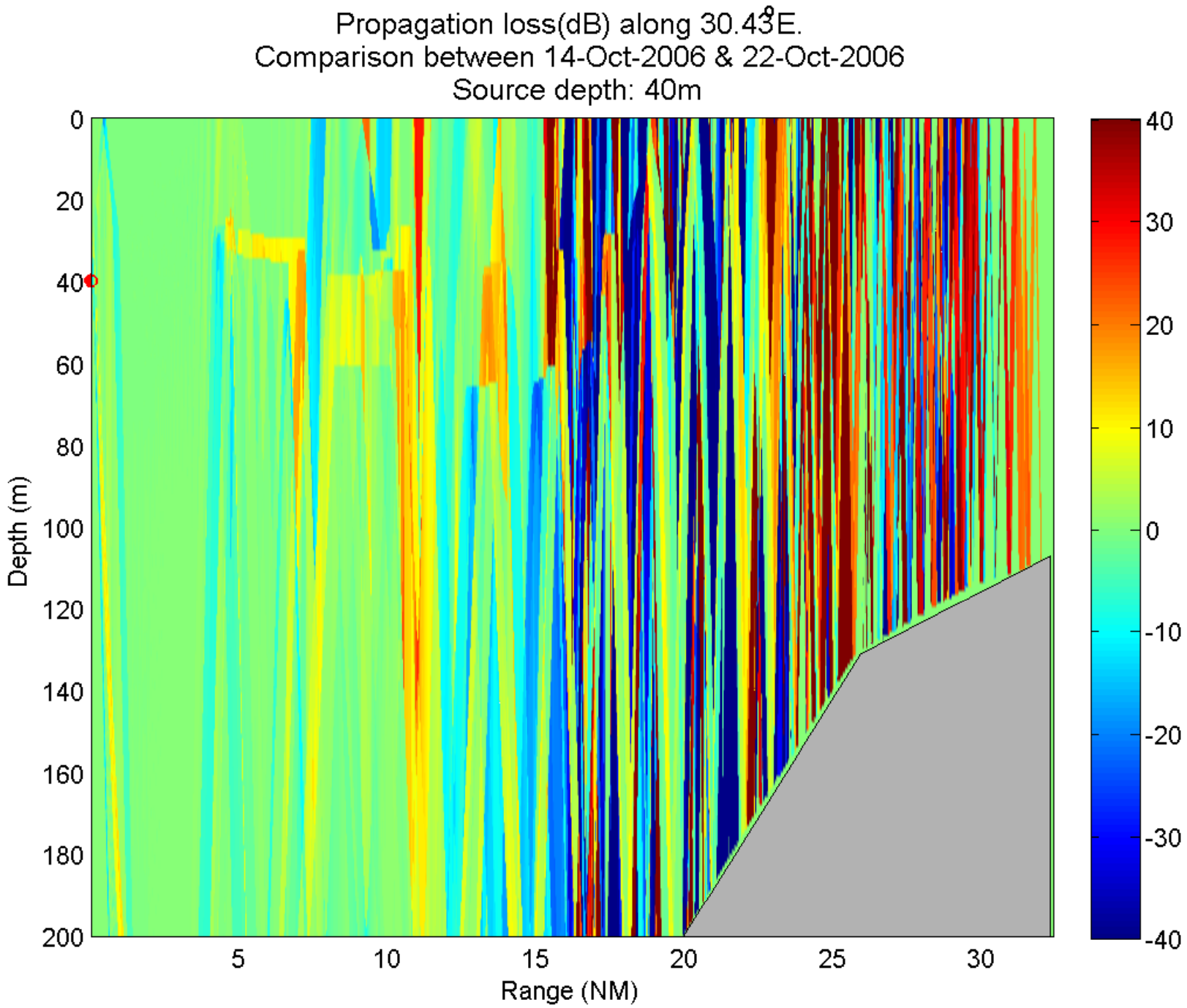
- Low Frequency Active Sonar Propagation - 1.6 KHz
- Deployment depth = 40m



Without eddy



With eddy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-20
-30
-40

What we can do...

1. Resolve eddies in 4D with high temporal resolution in complex shallow water environments
2. Prove that these are operationally significant oceanographic features from a LFAS perspective
3. Shallower water/greater temporal resolution?
4. Reduce operational uncertainty?
5. A scenario-based Atlas?

What we need to do...

1. Better model forcing
2. Adapting this work to other geographical areas
3. Model coupling, uncertainty transfer, validation
4. Operationally useful products....

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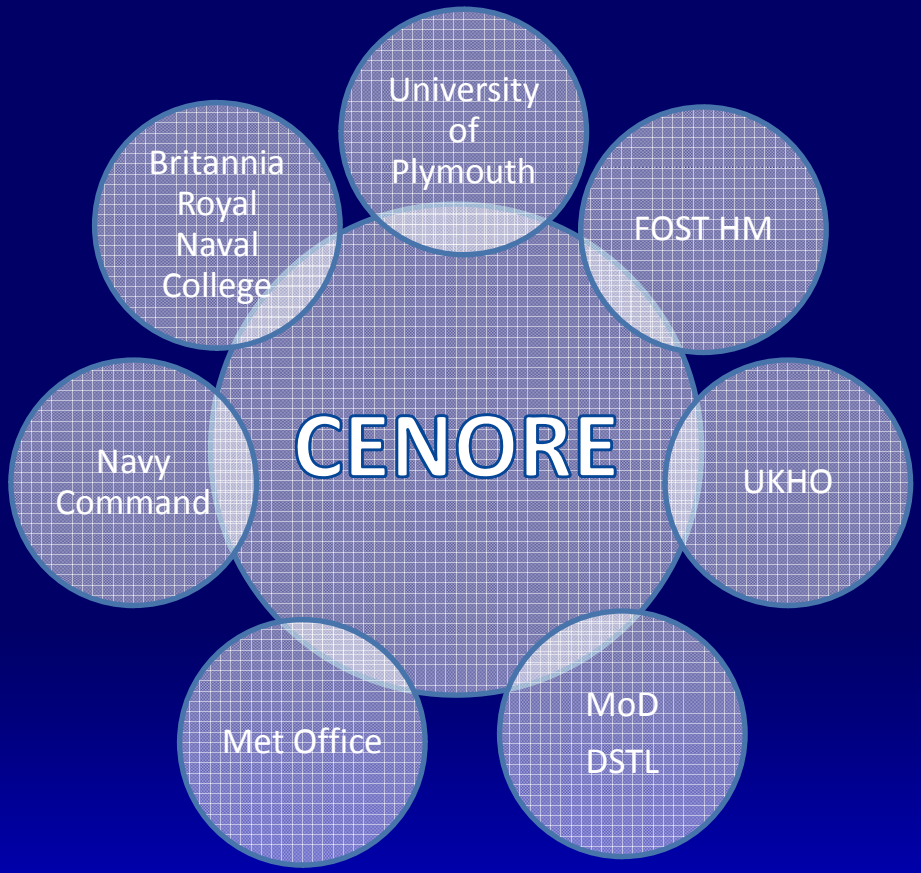
www.plymouth.ac.uk/marine/cenore



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- Priestley, A. D. and Thain, R. H. 2010. Sonar propagation in stratified waters. *Hydro-International,* 14 (2), 15-17

- Shapiro, G. I., S.V. Stanichny, R.R. Stanychna, 2010. Anatomy of shelf–deep sea exchanges by a mesoscale eddy in the North West Black Sea as derived from remotely sensed data. *Remote Sensing of Environment*, 114 , 867–875.

- Shapiro, G. I., D. L. Aleynik, and L. D. Mee, 2010. Long term trends in the sea surface temperature of the Black Sea. *Ocean Science*., 6, 491–501

- Thain, R. H. and Priestley, A. D. 2010. Scales of sound velocity variability in estuaries and shallow water, littoral areas. *Hydrographic Journal,* 131 & 132.

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