Understanding the oceanic variability in the Lofoten basin: an overview of the glider activity of the ProVoLo project

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Objectives

The Lofoten basin is one of the world's most energetic area regarding the ocean dynamics. Understanding the physical processes controlling the water masses transformation of this very productive area is crucial in a climate perspective and for fisheries. The ProVoLo project aims at quantifying the energy pathways in this region from the large-scale circulation to the (sub-)mesoscale and eventually to the dissipation scale.

Gliders deployments

Two Seagliders (Sg560 and Sg561) have been deployed in May and June 2016 (see figure). We present preliminary results from the first 3–4 months of data.

	period	# profiles
sg560 – MR	June 9 → Sept 19, 2016	626
sg561 – LBE	May 4 → Sept 19, 2016	886

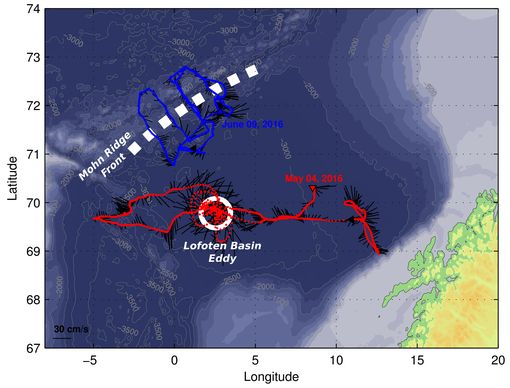


Figure 1: Map of the two ongoing deployments with depth average currents (DAC) estimated by the gliders.

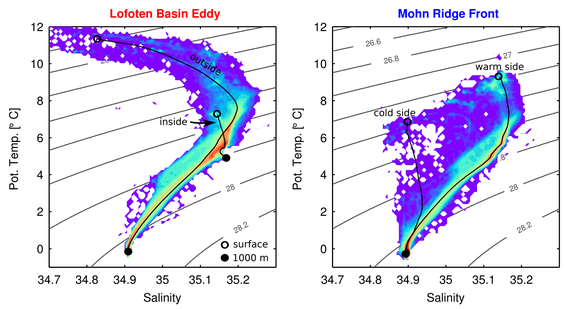


Figure 2: Volumetric θ/S diagrams for the two deployments: *(left)* Mean θ/S profiles inside and outside the Lofoten Basin Eddy are represented in black; *(right)* A mean θ/S profile is represented for both sides of the front.

The Lofoten Basin Eddy

⇒ Eddy centers were detected using DAC like in [1].

- 126 (211) profiles collected <15 km (<50 km) from the center.
- Two low stratified cores with $N \sim 5f$.
- Peak velocities of 60 cm s^{-1} @ 15 km–850 m ⇒ **Ro∼-0.6**.
- barotropic vel (60 cm s^{-1}) ≫ baroclinic vel O(5 cm s^{-1})

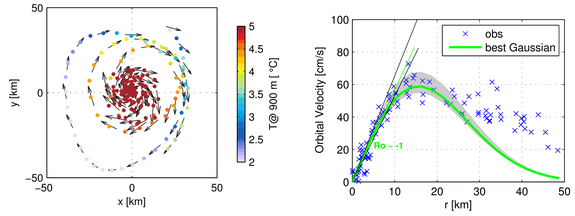


Figure 3: *(left)* Pot. Temp. around 900 m and glider DAC; *(right)* DAC magnitude vs distance to the eddy center. Parameter for the best Gaussian fit are: r = 15.6 km and V_m = 0.59 m s^{-1}.

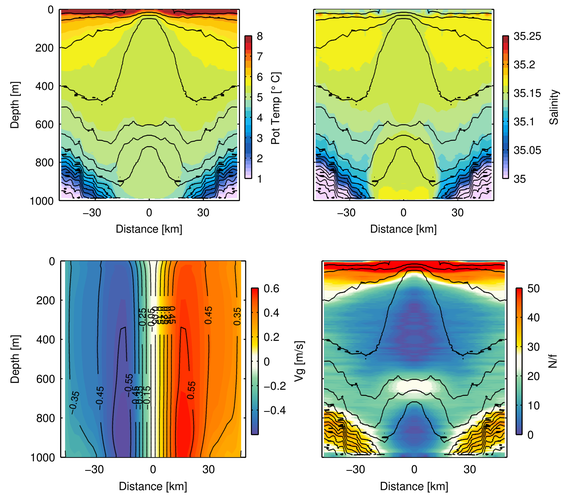


Figure 4: Mean radial structure of Pot. Temp., Salinity (with pot. dens. contours), geostrophic velocities, stratification of the LBE.

Important Results

The Lofoten Basin Eddy:

- very barotropic (∼ 90% of the total velocities)
- extreme vorticity approaching $-f$ at the center [2]

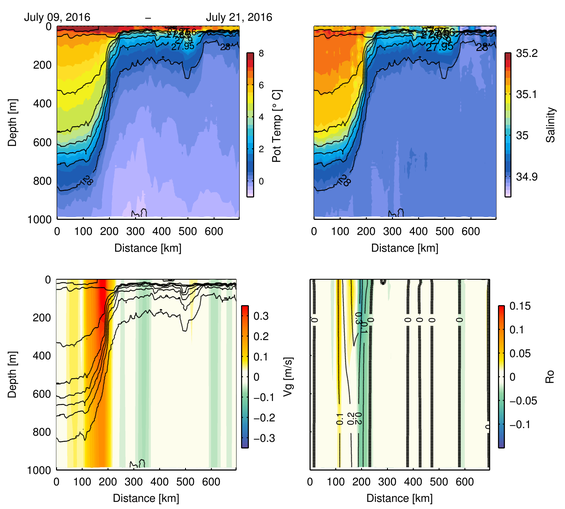
The Mohn Ridge Front:

- baroclinic structure (∼30–50% of total the velocities)
- exhibits a high mesoscale variability

The Mohn Ridge Front

⇒ Geostrophic velocities computed from cross-front pot. density section, referenced by DAC and geometrically corrected [3].

- Frontal flow seems to be balanced, Ro = 0(0.1).
- Important mesoscale activity/meandering of the front.



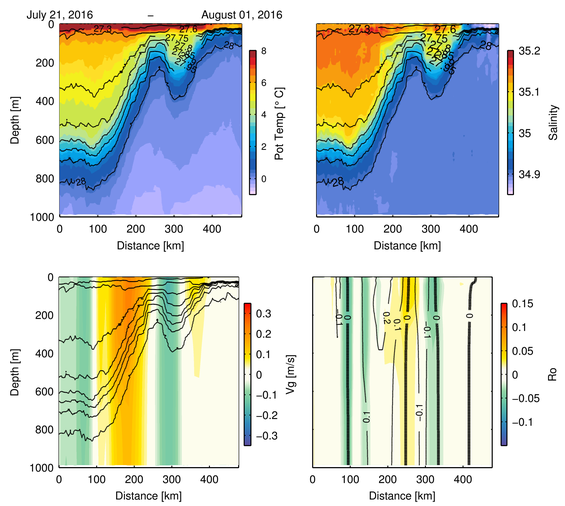


Figure 5: Cross-front section of the Mohn Ridge Front: *(upper left)* Pot. Temp and *(upper right)* Salinity with pot. density contours; *(lower left)* Cross-section geostrophic velocities and *(lower right)* Relative vorticity (normalized by f) with velocity contours.

Perspectives

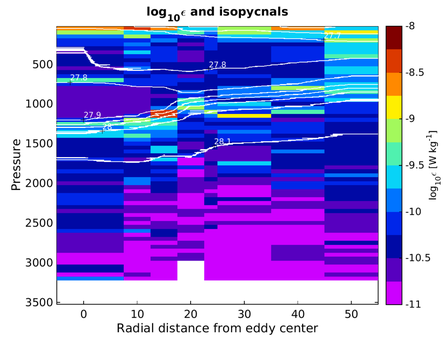


Figure 6: Dissipation rate within the Lofoten Basin Eddy measured by a VMP6000 during the ProVoLo cruise in June.

To investigate the finescale modulation of the energy dissipation thanks to a glider equipped with a microrider (first attempt in June has failed due to a leak...).

References

[1] A. Bosse, P. Testor, L. Mortier, L. Prieur, V. Taillandier, F. D'Ortenzio, and L. Coppola.
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[2] H. Søiland, Léon Chafik, and T. Rossby.
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Journal of Geophysical Research: Oceans, pages 1–14, 2016.

[3] Anthony Bosse.
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