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Correlating structures in seismic reflection data and mesoscale to fine-scale oceanographic structures related to the Mediterranean Outflow Water: a preliminary analysis of joint data acquired during the GO cruise

E. Quentel (1,2), M.-A. Gutscher (1,2), X. Carton (1,3), R. Hobbs (4), L. Geli (5), E. Cosquer (5), L. Hua (5), E. Vsemirnova (4)

(1) Université Européenne de Bretagne, Brest, France, (2) Laboratoire Domaines Océaniques, UMR 6538 UBO-CNRS-IUEM, Plouzané, France, (3) Laboratoire de Physique des Océans, UMR 6523 UBO-CNRS-IFREMER, France, (4) University of Durham, United Kingdom, (5) IFREMER - Centre de Brest - Technopole Brest-Iroise - B.P. 70 - 29280 Plouzané, France

During the GO cruise (HMS Discovery) in April 2007, 2000 km of seismic reflection profiles were acquired synchronously with collocated oceanographic data in the Gulf of Cadiz as part of the EU funded project GO (www.dur.ac.uk/eu.go). In order to investigate the seismic response of water boundary layers related to the warm, saline Mediterranean Outflow Water (MOW), three types of seismic sources were used: a high-resolution (HR), low-resolution (LR) and medium resolution source (MR). The characteristics of each source are: HR (117 cu in, 15-350 Hz), LR (2000 cu in, 10-60 Hz), and the intermediate source MR (10-60 Hz and 20-120 Hz). The expected vertical resolution is 2.5, 15 and 7.5 m respectively.

The MOW along the Portuguese continental slope (zone of Meddy detachment) was imaged by the HR and LR source. Highly similar structures are observed at the boundaries between these water masses with these different sources at a high spatial resolution. A homogeneous band of horizontal clear and strong reflectors in the water column are imaged in the depth range 750-2000 m. A Meddy seen in the LR and MR profiles presents strong, laterally continuous (about 10 km) reflectors above, and prominent reflections below, surrounding a transparent body. Using the HR source, the

reflectors at 750 m depth reveal more fine structure. However, the deeper reflectors at 1500-2000 m depth are weaker than on the LR profile. The higher energy of the low frequencies source offers better images of the deep boundary.

The lower frequencies capture the gross structure and present reflection events with a wide range of amplitudes related to tuning caused by reflections from various layer thicknesses and impedance contrasts. The seismic profiles using the low-frequency source can be easily correlated with structures observed in the oceanographic data. We correlate structures from the LR seismic profiles to the mesoscale oceanographic structures. Meddies and Mediterranean currents in the water column have length scales of 20-50km and a total thickness of 500-1000m. High frequency data are more difficult to interpret and are more sensititive to the fine-scale structure. We compare these to the oceanographic fine-scale structures. Typical length scales are on the order of 10 km, with a thickness of 20 m. We analyse the fine-scale structures above a Meddy. We examine the spectra of reflectivity and of oceanographic profiles and analyse histograms to determine the characteristic vertical and horizontal scales of the structures imaged by both methods.