Cite abstracts as **Author(s) (2008), Title, *Eos Trans. AGU, 89*(53), Fall Meet. Suppl., Abstract xxxxx-xx**

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Tracing the Influence of Mediterranean Outflow Waters on the Mid-depth Portuguese Margin Between Marine Isotope Stages 9 and 13

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Calypso piston core MD03-2699 was retrieved from the Estremadura promontory north of Lisbon from a water depth of 1895 m. Nowadays, this site is bathed by Northeast Atlantic Deep Water (NEADW), whose physical properties are modified by diffusive mixing with the overlying Mediterranean Outflow Water (MOW; 700-1400 m). During the last glacial maximum the MOW became denser and settled deeper in the water column and its lower core's flow strength increased on millennial time scales during the Greenland stadials of the last 50 ka. In order to reconstruct deep-water variations on the mid-depth Portuguese margin during the mid-Brunhes we generated benthic stable isotope and trace element records and measured the mean grain size <63µm for the interval from 300 to 510 ka. Because of the strong MOW derived salinity overprint on the benthic Mg/ Ca data we currently use the western Mediterranean equation (Cacho et al., 2006) to calculate bottom water temperatures (BWT). During the MIS 10 glacial inception, BWT and grain size records reveal millennial-scale oscillation in deep-water conditions with warmer MOW waters (8-10°C) bathing the site during stadials and NEADW (5-7°C) during interstadials. The lower MOW core was the dominant water mass throughout glacial MIS 10 and 12 and NEADW during interglacial MIS 9.5 and 11.31. During MIS 13.1, on the other hand, strong MOW influence on the BWT is observed nearly throughout with NEADW-level BWT occurring only between 493 and 497 ka. During termination IV the MOW/ NEADW boundary shifted upwards right at the onset of the termination, but during termination V the lower MOW core settled further up in the water column only after 408 ka. The Cd/ Ca data indicates that the glacial and stadial MOW was enriched in nutrients either by exporting nutrients from the Mediterranean Sea or by mixing with southern source waters. Overall, our records reveal that deep-water dynamics on the mid-depth Portuguese margin were very variable during the mid-Brunhes, experienced millennial-scale oscillations similar to the last glacial cycle and are driven by the density and thus settling depth of the MOW.

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