Geophysical Research Abstracts
Vol. 18, EGU2016-9320, 2016
EGU General Assembly 2016

Water masses along the OVIDE 2010 section as identified by oxygen and hydrogen stable isotope values

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The OVIDE transect between the western Iberian Peninsula and the southern tip of Greenland is one of the hydrographic sections in the North Atlantic that is measured regularly to identify changes in water mass formation and transport and thus to evaluate the state of the Atlantic Meridional Overturning Circulation (Mercier et al., 2015; García-Ibáñez et al., 2015; both in Progr. in Oceanography). During the OVIDE 2010 campaign seawater samples covering the complete water column were collected on the section between Portugal and the Reykjanes ridge for stable isotope analyses. Oxygen (δ18O) and hydrogen (δD) stable isotope values were measured simultaneously by cavity ring-down laser spectroscopy using a L1102-i Picarro water isotope analyser at the Godwin Laboratory for Paleoclimate Research (Univ. Cambridge, UK).

Within the upper water column the stable isotope values clearly mark the positions of the Portugal Current (40.3°N 11°W), the North Atlantic Drift (46.2°N 19.4°W) and of the subarctic front (51°N 23.5°W). Up to Station 36 (47.7°N 20.6°W) an upper (around 600 m) and lower (around 1000 m) branch of the Mediterranean Outflow water (MOW) can clearly be distinguished by high oxygen (0.5-0.7‰ and hydrogen (3-5‰ values. At Station 28 (42.3°N 15.1°W) strong MOW influence is also indicated between 1400 and 1600 m. In the west European Basin, lower oxygen isotope values reveal the presence of Labrador Sea Water (LSW) below the MOW (down to 2200 m). Close to and west of the subarctic front this water mass shallows and occupies the complete interval between 1000 and 2000 m water depth. In the Iceland basin, two additional levels with lower oxygen isotope values are observed. The deeper level (2200-3500 m) marks Iceland Scotland Overflow Water (ISOW) that based on its distinct isotopic signature (δ18O $\leq$ 0.25‰ can be traced as far east as 18.5°W (down to at least 3500 m). Close to the Reykjanes ridge both, the ISOW and LSW, are also associated with local maxima in δD, a signal that appears to get “diluted” towards the east. The third plume of low oxygen and slightly increased hydrogen isotope values occupies the upper 700 m in the Iceland basin and is related to the Subpolar Mode Water formed locally. Overall, the stable isotope signatures along the OVIDE 2010 section agree very well with the water mass analysis of García-Ibáñez et al. (2015), but enable distinguishing between the upper and lower MOW cores in the open ocean.