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The structure and circulation of intermediate, deep and bottom water masses of the North Atlantic

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Water mass is one of the basic concepts of oceanography. Changing the characteristics of the main water masses in the North Atlantic can be causes of climate variability.
The purpose of the present study is a quantitative assessment of the characteristics of water masses using the Optimum multiparameter (OMP) analysis. OMP analysis of water masses is a continuation of the thermohaline analysis. To study water mass mixing besides temperature and salinity such advanced features as concentration of nutrients, CFCs, isotopes, Redfield ratios and potential vorticity are used.
Mathematically the OMP analysis is a system of linear equations for each point of the observations. Using four parameters of the water masses one can find the ratio of five water masses in the volume of water being under investigation.
To study the structure of the North Atlantic Ocean we were identified eight major water masses:
1) ABW – Antarctic Bottom Water;
2) DSOW – Denmark Strait Overflow Water;
3) ISOW – Iceland-Scotland Overflow Water;
4) LSW – Labrador Sea Water;
5) MW – Mediterranean Water;
6) AIW – Antarctic Intermediate Water;
7) SPMW – Subpolar Mode Water;
8) STMW – Subtropical Mode Water.
Percentage of each water mass was calculated for each section. Upon solving equation systems a data array was performed using the algorithm written in Fortran. The calculations were performed for 12 oceanographic sections made in the North Atlantic (24-64°N) in 1980-2004. We investigated the water masses located deeper than 500 m where there are practically no seasonal changes.
On analysis of the water mass percentage in the vertical water sections pathways of intermediate and deep waters can be traced. Comparison of the percentage in the different sections gives an indication of the variability in the intermediate and deep circulation.
We calculated the volume of each water mass in the North Atlantic Ocean (24-64°N, 0-77°W) below 500 meters on the basis of data on the percentage of water masses on sections. The next phase of the study, we plan to evaluate the rate of formation of each water mass and its age.