Geophysical Research Abstracts
Vol. 12, EGU2010-3407, 2010
EGU General Assembly 2010


# Long-term water exchange evolution across Gibraltar Strait

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Mediterranean Sea waters outflow to the Atlantic Ocean and inflow of Atlantics waters to the Mediterranean in 1958-2006 is investigated on the basis of numerical experiments using Ocean Model (INMOM) of the Institute of Numerical Mathematics. Realization of the ocean fields prepared for the North Atlantic (with the Arctic Ocean) and the Mediterranean basin. The spatial resolution is 0.25° and 27 levels in a sigma-coordinate grid. Realistic CORE atmospheric forcing provided by GFDL (6hr for turbulent and 24hr for radiative fluxes) is used. The Bottom Gibraltar Current (BGC) with high density and salinity veered by the Coriolis force to the northern slope of the strait was well simulated by the model. The velocities in the core of the flow (without the tidal component) oscillated from 10-15 to 25-30 cm/s. Mean of the BGC water mass transport (WMT) from January 1958 to December 2006 is 1.47 Sverdrups (Sv) with root mean square (RMS) deviation 0.42 Sv and varied from 0.2 to 3.5 Sv. These estimate correlate with the observations and calculations using other models. Mean and RMS deviation of the Atlantic current WMT (into the Mediterranean Sea) are 0.66 and 0.16 Sv. The BGC WMT permanently dominated and the total mean outflow from the Mediterranean to the Atlantic was 1.04 (with RMS deviation 0.36 Sv). The outflow of salty waters from the Mediterranean Sea caused intense Atlantic waters inflow (quasi- linear correlation). Velocities of both currents either increase or decrease practically without changes in the squares of their transversal sections (balance principle). The BGC WMT has seasonal cycle with a winter maximum (January-March) caused by winter convection (salinification and heat losses due to strong winds) in the Western Mediterranean. Long-time variability is characterized by episodes of strong increase in the BGC WMT during 1974-1979 and 1990-1996. The period from 1959 to 1975 is characterized as relatively small transport of the WMT by the BGC. High WMT was observed in the 1980s and especially in the 2000s. Common long-period trend of mass transport increase by the Bottom Gibraltar Current was revealed since mid-1970s until present. Two time scales in the BGC WMT dominate: oscillations with periods of 4.5 and 12.3 years. This work is supported by RFBR grants 09-05-00266a and 10-05-00144a .