

Long-term (1993-2016) variability of physical-chemical parameters in the South Adriatic under the different circulation regimes in the East Mediterranean

Iris Dupčić Radić, Marina Carić, Enis Hrustić, Stijepo Ljubimir, and Rade Garić

University of Dubrovnik, Institute for Marine and Coastal Research, Kneza Damjana Jude 12, POBox 83, HR-20000 Dubrovnik, Croatia

Long-term variability of temperature, salinity and nutrients (nitrates, phosphates and silicates), collected between 1993 and 2016 in the open South Adriatic from 0 to 1200 m depth, are presented here. South Adriatic (SA) extends from the Palagruža Sill to the Otrant Sill and it's the deepest part of the Adriatic Sea (about 1250 m). SA ecosystem is a true pelagic, with low terrestrial inputs and impact of the coastal waters on the nutrient budget. Notable influence is regular exchange of water with the Eastern Mediterranean through the Strait of Otranto. SA is an entry point for water masses originating from the Ionian Sea (IS) and a place of dense water formation for the eastern Mediterranean deep circulation cell. Water masses, entering the SA in larger amount during the winter, show decadal variability explained by different circulating regimes (cyclonic and anticyclonic) in the IS, referred to as "Bimodal Oscillating System" (BiOS). Considering temperature and salinity values, years 1993-1996 and 2007-2012 were anticyclonic (lower temperature /less saline) and years 1997-2006 and 2013-2016 were cyclonic (higher temperature/more saline). The highest temperature and salinity values during the research period were observed in 2016. During 23 years of research significant variations in the nutrient concentrations are found. Annual medians of nutrients of the whole water column were as follows: nitrates from 0.2 μM (2000) to 3.7 μM (1995), phosphates from 0.03 μM (2004) to 0.21 μM (2014) and silicates from 1.7 μM (2002) to 6.2 μM (1995). Nutrients reached rather high levels of concentrations in 1990s, especially in 1995. These high nutrient levels in mid-1990s, coupled with low temperature and salinity values, are related to the inflow of the nutrient richer Western Mediterranean waters, which enter to the Adriatic during the anticyclonic phase of the BiOS and was strengthened by the Eastern Mediterranean Transient (EMT) occurring in the early 1990s. Anticyclonic circulation is changed to cyclonic in 1997, accompanied by a decrease in nutrient concentrations which last till 2005. Nitrate and phosphate concentration increased again in 2006 and silicate concentration increased in 2007. During both years the BiOS reversal from cyclonic to anticyclonic was slower and did not completely change the Adriatic water mass properties in a short time as during the BiOS regime shift in the 1990s. Nitrate and silicate values were increased till 2009 and phosphates were increased only till 2007. The fall in concentrations of nitrate and silicate in 2010 and phosphate in 2008, during anticyclonic years, as well as increased concentrations of nitrate in 2013, phosphate in 2014-2015 and silicates in 2015-2016, during cyclonic years, indicate that nutrients concentration are not exclusively related to the BiOS but also by other biological (phytoplankton activity), biogeochemical and physical processes (vertical mixing).