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50-year Of Biogeochemical Model Simulations In The Mediterranean Sea

Adolf Konrad Stips [1] and Garcia-Gorriz Elisa [1,2]

(1) EC Joint Research Centre, 21027 Ispra, Italy
Telephone: +390332789876 Email: adolf.stips@jrc.ec.europa.eu
(2) Telephone: +390332786268 Email: elisa.garcia-gorriz@jrc.ec.europa.eu

We test if we can detect trends and regime shifts in our model results from several sub-basins of the Mediterranean Sea that are corresponding to those detected in the experimental data. The selected sub-basins differ in the meteorological forcing and in the nutrient inputs. Abrupt changes (also called regime shifts) are typically caused by positive feedback in the system resulting in a non-linear response of the system. We carry out a detailed statistical analysis and basin-comparison of the results from 50-year physical-biogeochemical simulations. The model results are generated by the 3-D General Estuarine Transport Model - GETM for the hydrodynamic fields and by the ERGOM biogeochemical model for nutrients and chlorophyll. This coupled model is mainly forced with ECMWF atmospheric data, realistic bathymetry, and discharges plus nutrient inputs from rivers. The horizontal resolution of the model output is 5'x5' and the multi-annual runs cover the period from 1960 to 2011. The model results and the available observations are analyzed with respect to autocorrelation, linear trends, non-linear functional forms and the occurrence of breakpoints in the time series. The applied statistical methods include significance tests and confidence limits for the investigated characteristics. Most investigated physical and ecosystem variables are better described by a non-steady behavior than by steady linear functions. Therefore we examine in detail the regime shifts detectable approximately during the 1980ties within each Mediterranean sub-basin in the time period 1960-2011 for both the model results and the observations in the Mediterranean Sea. Finally we discuss the possible causes in the wider context of the changes in the Northern Hemisphere or even global climate change.