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Variations of Hypoxia of the Black Sea on the time scale of decades (1958-2002)

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Suboxic zone in the Black Sea (a layer between oxic surface and anoxic water), which is also known as the "C-layer" was discovered by Murray et al. 1989. Climate change and variations in anthropogenic eutrophication are cansideres as important drivers for variation of biogeochemical processes in this semienclosed basin. According to Oguz (2005) physical and ecological systems respond synchronously to climatic forcing at the decadal time scale. Furthermore, Konovalov et al. (2005) described the undulating structure of the suboxic zone and suggest that there was the during the periods of large eutrophication in the 1970s and 1980s the load of inorganic nitrogen supported higher primary production and consumption of silicates in excess of the load of silicates to the sea.
No doubt that the climatic change and anthropogenic eutrophication both are long-term factors effecting oxygen depletion, however it is still uncertain which one is the more important factor. Numerical model has not been enough used to simulate the biogeochemical system responce to anthropogenic and climate forcing in isolation or conjointly.
During the first 9 months a coupled 1D hydrophysical-biogeochemical model (GOTM plus ROLM) was set up to study the main elements in redox layer in the Black Sea. The model incorporates parameterization of major biogeochemical process for 24 components, including oxygen, sulfide, nitrate, nitrite, ammonium, elemental sulfur, phytoplankton, zooplankton, bacteria, particulate and dissolved organic nitrogen, and particulate and dissolved form of Mn and Fe (Yakushev et al. 2006). The basic model simulations of the suboxic layer development under 40-yearly changes forcing and 40-year averaged forcing for the Black Sea hydrophysical-biogeochemical scenario were carried out.

The vertical distribution of some variables for summer period are carried out. The profiles show that (1) the maximum of NO3 is at the same depth where O2 decreases to zero; (2) the onset of Mn2 occurs simultaneously with the depletion of O2, similar to the NH4 and the minimum of PO4; (3) when H2S increases, the gradient of PO4 has its maximum. All the results are similar to the observation data (Yakushev, 2006). Furthermore the analysis of the difference between interannual and perpetuasl year run during 40-years makes clear that the impacts of the NAO on the ecological dynamics seems to be well pronounced. The concentration of oxygen and NAO index tend to have quasi-synchronous oscillations in study period, and O2 looks much sensitive to the NAO index than that of NO3 and H2S. The 1970s and 1990s were dominated primarily by negative NAO index and positive index, separately, the concentration of oxygen fluctuated relatively higher, while in the 1980s the positive and negative NAO index occurred altemately, the concentration of oxygen became stable. It looks that nitrate has also close relationship with the NAO index. The increasing H2S concentration reflects the overall tendency of the NAO index in the last decades. Furthermore, the specific process how NAO index affect the biochemical variables in the Black Sea will be presented.