Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05239, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05239
EGU General Assembly 2008

Hydrological Characteristics and Particulate Matter Dynamics in the NW Black Sea during October 2007

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The NW Black Sea is a sector of the world's largest semi-enclosed sea which receives freshwater from large rivers draining the European continent (Danube, Dniepr, Dniester, and others). The major sources of particles in the area are the rivers, the primary and secondary production, as well as aeolian inputs. This admixture of particulate matter (PM) is transferred and eventually settles on the extensive continental shelf, its movement controlled by the local hydrological conditions and circulation patterns.

The Southern European Seas: Assessing and Modelling Ecosystem changes (SESAME) Integrated Project is devoted to the study of the Mediterranean and the Black Seas as a coupled marine system, using existing and new observations and mathematical models. Within this framework, multidisciplinary oceanographic observations were carried out during October 2007 on board R/V Aegaeo. A series of 18 stations were occupied, including standard CTD measurements, optical measurements (two transmissometers emitting at 440 and 670 nm, and one fluorometer), in-situ particle size distribution, and water sampling. The particulate matter concentration was determined by on board water filtration.

The hydrology of the area is characterized by a sharp pycnocline, controlled mainly by temperature. Warm waters (17.97-20.15 ˚C) occupy the upper thermocline layer (20-30 m), with corresponding salinity in the range 8.12-17.51. The high variability of salinity is related with the distance from the Danube River mouths, and particularly the Saint George branch. The riverine waters move south-southwest, following the coastline due to Coriolis effect. Below the pycnocline, temperature decreases from $\sim$20 ˚C to 8.36 ˚C, whereas salinity ranges from 17 to 18.

Particulate matter concentration varies from 0.04 to 4.76 mg l^{-1}, the highest values appearing off the Saint George branch of the Danube River. Transmissometer readings were converted to beam attenuation coefficient c (m^{-1}). The marked correlation between PMC and c (R^2 = 0.863), yield the equation PMC = 0.685 * c + 0.164, which was used to convert all beam c data to PMC. The PMC spatial distribution at the surface (3 m depth) shows maxima in a narrow zone extending from Sulina to Saint George and then towards the southwest (water depths 10-20 m). The PMC field decreases rapidly as the distance from the coast increases, reaching minima at the outer stations (water depths 30-52 m).

The PMC distribution vs. depth shows a consistent pattern of maximum PMC at the surface waters, decreasing rapidly in the upper 8-10 m and then decreasing gently to lowest values towards the bottom. Increased PMCs near the bottom due to sediment resuspension were not evidenced, except for a single station SW of Saint George branch.

Particle size distributions (PSD) show great patchiness. In general, coastal stations exhibit relatively coarser particle populations (40-100 μm) at surface waters and finer near the bottom. At the pycnocline, small-scale density differences and subsequently small changes of the refractive index of water resulted in artifacts, recorded as large particles abundance.

Comparison of hydrological characteristics and particle distributions with previous observations (September 2002 and 2004) show considerable similarities, suggesting that at least during autumn most of particle-rich brackish waters originating primarily from the Danube River move towards the south, southwest, whereas offshore the influence of the river discharges decreases rapidly.