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Influence of runoff of small rivers on phytoplankton structure and photosynthetic activity in the north-eastern part of the Black Sea

Valentina Sergeeva (1) and Sergey Mosharov (1,2)

(1) Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, 117997, Russia, (2) Bauman Moscow State Technical University, Moscow, 105005, Russia

River runoff is an important source of nutrients and suspended organic matter that is a part of local production cycles in coastal and shelf marine ecosystems. Coastal areas influenced by freshwater discharge are characterized by large spatial gradients and significant temporal variability of salinity, temperature, and turbidity that affects phytoplankton communities. In this study we focus on influence of small river plumes off the northeastern part of the Black Sea on reaction of phytoplankton as one of the most sensitive components of marine ecosystems to variability of abiotic factors. We base on in situ data collected in May- June 2018 in coastal areas adjacent to the Tuapse, Ashe, Psezuapse, and Shakhe rivers. Characteristics of phytoplankton community structure (species composition, number, and biomass) were measured using epifluorescence microscopy. Phytoplankton photosynthetic activity was determined by radiocarbon method, extract method, and native water fluorescence method (Steemann-Nielsen, 1952; JGOFS, 1994; Holm-Hansen and Riemann, 1978; Pogosyan et al., 2009).
We show that species diversity and abundance of active autotrophs in phytoplankton were generally higher in the river plumes, as compared with ambient sea. On the other hand, dependence of spatial variability of biomass on influence of freshwater discharge was less pronounced. Influence of river runoff on abundance of phytoplankton in the considered coastal area of the Black Sea was caused by predominance of the marine diatom community in the river plumes. Large observed value of phytoplankton biomass in ambient sea was associated with the large-cell autotrophic dinoflagellates of the genus Ceratium in the phytoplankton community. Maximum quantum efficiency of PSII (Fv/Fm), which is indicative of potential photosynthetic activity of phytoplankton, was consistently high (0.57 ± 0.06 on average) in coastal sea and significantly lower in inflowing river water. Relative electron transport rate (rETR), which characterized realization of phytoplankton production potential, depends on adaptation of algae to local environmental conditions (light intensity, temperature, salinity, concentration of nutrients). Value of rETR in coastal area gradually decreased with a distance from river mouths with minimum in ambient sea. Phytoplankton biomass accumulated in river plumes can be subsequently involved to local production cycles in coastal sea as a result of mixing and dissipation of river plumes. In particular, areas of elevates surface turbidity associated with influence of river discharge at the study region visible at satellite imagery generally exceed areas of reduced salinity within river plumes. Thus, we presume that suspended matter detected in surface layer adjacent to river plumes can be composed from algae with relatively low terrigenous fraction.