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ROFI of the Elbe river during flood event, unstructured-mesh model study.

Ivan Kuznetsov (1), Alexey Androsov (2,3), Vera Fofonova (2), Sergey Danilov (2,4,5), Natalja Rakowsky (2), Sven Harig (2), Mayya Gogina (6), and Holger Brix (1)

(1) Institute of Coastal Research, Helmholtz-Zentrum Geesthacht, Germany, (2) Alfred Wegener Institute for Polar and Marine Research, (3) P.P. Shirshov Institute of Oceanology, St. Petersburg, Russia, (4) A. M. Obukhov Institute of Atmospheric Physics, Moscow, Russia, (5) Jacobs University, Bremen, (6) Leibniz Institute for Baltic Sea Research, Warnemünde, Germany

Regional models help to significantly improve our understanding of the global and regional cycles of, for example, carbon and nutrients. However, regional models often poorly resolve estuarine dynamics and are rather controlled by open boundary conditions. To investigate ecosystem processes in the south-eastern North Sea and Elbe estuary while avoiding the problems associated with nesting solutions we developed and applied an unstructured-mesh physical ocean model (FESOM-C). The FESOM-C model employs mixed unstructured-mesh methods and a finite - volume discretization. It is based on three-dimensional primitive equations for momentum, continuity, and density constituents. Vertically, the model uses a σ-coordinate system. The unstructured grid consists of quads and triangles zooming into the estuary, its vicinity and the coastline. Decrease in horizontal resolution provides a better numerical representation of coastal processes like asymmetries in tidal and residual flows, and periodic stratification. The lower resolution in the open sea allows conducting comparatively large regional studies. We developed a construction methodology for model setups in regions with complex coastal lines, including mixed mesh and bathymetry generation, open boundary and initial conditions and rivers distribution formation. The newly developed FESOM-C model could reproduce both barotropic and baroclinic dynamics of the coastal and estuary regions reasonably well. An Elbe summer flood event was well captured by the physical model. Investigation of flood event on ROFI of Elbe River were conducted with developed model by introduction of passive tracers in river outflow.