Investigation of ecosystem dynamics in frontal zones of the North Sea by a 3-D coupled bio-physical model HAMSOM-ECO.

Irina Alekseeva[1] , Corinna Schrum[2] and Michael St.John[3].

A 3-D coupled bio-physical model HAMSOM-ECO (HAMburg Shelf Ocean ECOsystem Model) was developed to investigate the influence of hydrographic fronts on the meso-scale ecosystem dynamics and recruitment success of fish stocks in the North Sea. The biological model block was coupled to a primitive non-linear equation corresponding to a 3-D baroclinic model (HAMSOM) and simulates low trophic level interactions including differenced by species phyto- and zooplankton functioning limited by nitrogen nutrients, phosphates and silicates.

The model has a primary coarse horizontal resolution of 10km and was applied to a system of the North Sea and the Baltic. A nested frontally resolving model modification with 1.8km resolution supported with all liquid boundary conditions from the coarse version was designed to be focused on the frontal regions of the North Sea: the Dogger bank tidal mixing front, Skagerrak shelf brake front and the river plume front off the Jutland coast.

The model runs were carried out with 6-hourly ECMWF atmospheric forcing for years with extreme water column stratification to investigate the ecosystem response to the hydrodynamics. The results show that the model is able to successfully reproduce yearly variability of both the frontal hydrodynamics and the frontal ecosystem processes. It was

[1]Institute of Oceanography, Hamburg University, Troplowitzstr. 7, D-22529 Hamburg, Germany. (e-mail: alexeeva@ifm.uni-hamburg.de).

[2]Institute of Oceanography, Hamburg University, Troplowitzstr. 7, D-22529 Hamburg, Germany. (e-mail: schrum@dkrz.de).

[3]Institute for Hydrobiology and Fisheries Science, Hamburg University, Olbersweg 24, 22767 Hamburg, Germany. (e-mail: michael.st.john@uni-hamburg.de).

shown that frontal features enhance phytoplankton primary production and biomass basically due to strong vertical mixing and intensive upward nutrient fluxes.