Modelling of river plume dynamics in Öre estuary (Baltic Sea) with Telemac-3D hydrodynamic model

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The main property of river plumes is their buoyancy, fresh water discharged by rivers is less dense than the receiving, saline waters. To study the processes of plume formation in case of river discharge into a brackish estuary where salinity is low (3.5 - 5 psu) a three dimensional hydrodynamic model was applied to the Öre estuary in the Baltic Sea. This estuary is a small fjord-like bay in the north part of the Baltic Sea. Size of the bay is about 8 by 8 km with maximum depth of 35 metres. River Öre has a small average freshwater discharge of 35 m3/s. But in spring during snowmelt the discharge can be many times higher. For example, in April 2015 the discharge increased from 8 m3/s to 160 m3/s in 18 days.

To study river plume dynamics a finite element based three dimensional baroclinic model TELEMAC - 3D is used. The TELEMAC modelling suite is developed by the National Laboratory of Hydraulics and Environment (LNHE) of Electricité de France (EDF). Modelling domain was approximated by an unstructured mesh with element size varies from 50 to 500 m. In vertical direction a sigma-coordinate with 20 layers was used. Open sea boundary conditions were obtained from the Baltic Sea model HIROMB-BOOS using COPERNICUS marine environment monitoring service.

Comparison of modelling results with observations obtained by BONUS COCOA project's field campaign in Öre estuary in 2015 shows that the model plausible simulate river plume dynamics. Modelling of age of freshwater is also discussed.