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River plume dynamics in the Kara and Black Sea from altimetry-based lagrangian model, satellite salinity and chlorophyll data

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The largest fresh water inflow to the Arctic Ocean occurs in the Kara Sea basin, where two biggest Siberian rivers – Ob and Yenisei enter the open sea. Dynamics of the river plumes in the Kara Sea is characterized by large interannual variability with significantly different observed types of brackish water propagation. In this work, we, firstly, use satellite salinity and optical measurements together with hydrological observations in order to identify areas, covered by plume for different years, and validate satellite data. Then, we introduce lagrangian transport model, based only on satellite altimetry and meteorological wind data, to calculate the pathways of the brackish waters in the basin. For this purpose, we use MODIS, Aquarius, MERRA and merged altimetry data from AVISO. The model is parameterized and validated, using estimates, obtained from in-situ and satellite optical and salinity data. This simple model allows to qualitatively reproduce observed plume dynamics and it's interannual variability in the Kara Sea for twenty years period from 1993 to 2013. The shapes of reproduced plume are in good agreement with satellite optical data for the whole period of time. The reasons of the interannual variability and mechanisms of the plume propagation are discussed.

Proposed method was applied also for analyzing long-term variability of the plume dynamics of the Danube in the Black Sea. The pathways calculations of the Danube waters were done for 1993-2012 years. Fresh water propagation can be classified on three major types: 1) "western", when brackish waters are propagated along the western coast and moves to the southwest; 2) "northern", when Danube waters moves to the north and are blocked on the north-eastern shelf and 3) "Eddy-type", when plume propagation is significantly affected by the mesoscale anticyclones. Reasons for differences in observed types are discussed.