Geophysical Research Abstracts
Vol. 12, EGU2010-13557-1, 2010
EGU General Assembly 2010

Carbon dynamics in the Elbe land-ocean transition zone

Thorben Amann, Andreas Weiss, and Jens Hartmann
Institute for Biogeochemistry and Marine Chemistry, KlimaCampus, University of Hamburg, Germany

Recent model data reveal a discrepancy between the mobilisation of carbon from the terrestrial system into the fluvial system and the amount of carbon reaching the ocean. It is estimated that of 1.9 Pg C yr^{-1} total terrestrial input (Cole et al., 2007), 0.12-0.41 Pg C yr^{-1} are lost through CO_2-evasion from inner and outer estuaries to the atmosphere (Chen & Borges, 2009) while 0.9 Pg C yr^{-1} are exported to the ocean (Cole et al., 2007). Therefore estuaries can be considered as significant CO_2 sources.

To better understand temporal and spatial patterns of critical biogeochemical transformations in the land-ocean transition zone (LOTZ), an extensive historical hydrochemical dataset of the Elbe-river and –inner estuary system was analysed.

The LOTZ of the river Elbe can be distinguished into four zones with respect to changes in carbon species abundance: the non-tidal river zone, the tidal harbour zone, the maximum turbidity zone (MTZ) and the river mouth zone. The concentrations of suspended matter and POC decrease from the non-tidal river zone reaching their minima in the harbour zone. The MTZ is characterised by maximum SPM and POC values, while both parameters decrease to a further minimum in the river mouth.

Interestingly the POC concentration has nearly doubled in the period 1999-2007 if compared to the period 1985-1998. A possible cause may be the decrease in the general pollution of the river, despite of decreasing N and P loads in the past decades. This is supported by the observed reduction of DOC concentrations by 50% in the earlier period. In contrast the proportions of DOC and POC values within the four zones did not change. The doubling of POC concentrations between the two periods is not reflected in increasing SPM concentrations, resulting in higher POC (wt-% SPM) values.

A decrease of POC (wt-% SPM) from the non-tidal river zone to the river mouth indicates loss of organic carbon due to respiration processes. This is supported by an increase of nitrate and phosphate concentrations as well as dissolved inorganic carbon.

Presented analysis is used to develop a new spatial framework for quantification of carbon dynamics especially addressing sinks and sources of carbon in the land-ocean transition zone of the river Elbe.

References

Chen, C.-T.A. and Borges, A.V. (2009), „Reconciling opposing views on carbon cycling in the coastal ocean: Continental shelves as sinks and near-shore ecosystems as sources of atmospheric CO2", Deep-Sea Research II (56), 578–590.

Cole, J. and Prairie, Y. and Caraco, N. and McDowell, W. and Tranvik, L. and Striegl, R. and Duarte, C. and Kortelainen, P. and Downing, J. and Middelburg, J. and Melack, J. (2007), "Plumbing the Global Carbon Cycle: Integrating Inland Waters into the Terrestrial Carbon Budget", Ecosystems 10 (1), 172-185.