

Mobilization, transport and deposition of contaminated sediments in the River Spree (Berlin)

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Introduction: The Lake Rummelsburg is located as a part of the Spree River in the centre of Berlin, covering an area of 45 ha. The area was for almost a century affected by the discharge of untreated industrial and municipal wastewater. Consequently, this has led to a high accumulation of different chemical contaminants in the fine sediments and the quality of both the water and the sediments decreased dramatically over that period. In order to address a risk assessment, the spatio-temporal pattern of sediment contamination and sediment dynamics have been investigated between 2014 and 2015.

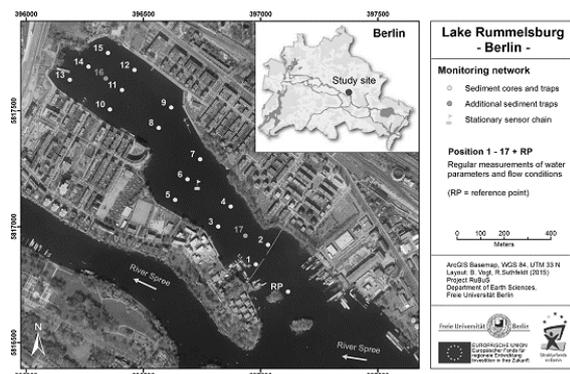


Fig. 1: A plan view of Lake Rummelsburg (Berlin) and its monitoring locations

Methods: To detect the spatial distribution of pollutants in the sediment, the upper 15 cm of over 200 sediment samples were collected via drill cores at 16 locations (Figure 1). The investigation was accomplished by installing 18 sediment traps which collected deposits over more than a year. Changes in boundary conditions which influence the spatial and temporal distribution of deposition and resuspension, like variations of wind speed and direction, were monitored by placing devices along and within the lake and taking different mobile measurements (precipitation, wind, radiation, ADCP-flow velocities, oxygen, turbidity, chlorophyll-a, temperature). To estimate the influence of motorboat manoeuvres on sediment flux within the lake, a special monitoring programme was installed in July 2015. The analysis of sediment and suspended matter included the determination of the total content of inorganic (Hg, Cd, Cr, Pb, Ni, Cu, Zn) and different organic compounds like polycyclic aromatic

hydrocarbons, total petroleum hydrocarbons, polychlorinated biphenyls and others in the sediment and suspended matter. The analysis of soluble sediment-bounded pollutants is based upon a 24 hour batch test. Certain toxic effects of the sediments were determined by different ecotoxicological test methods. In addition, the thresholds of the sediment quality guidelines published by de Deckere et al. [2] were used to assess the solid contents.

Results: Even though the industrial use of the surroundings went out of business over the last decades, the results of this and previous studies have demonstrated that all top sediments still show exceptionally high levels of contamination with heavy metals and organic compounds and a very low level of biodiversity [1]. Toxic effects for the benthic taxa can be expected [2]. With regard to the level of the European environmental quality standards (EQS), the results of the 24 hour batch test indicates a low mobility of the heavy metals and Benzo(a)pyrene. However, in several eluate samples other PAH compounds exceed the annual average maximum concentration permitted by the EQS. The results of the Luminescent bacteria test showed for the eluates of sediment cores that all samples are not or harmless polluted (non or low toxic effect). However, for the eluates of suspended particles all samples but two are critical polluted, they showed a moderate or increased toxic effect.

The results concerning the morphodynamics indicate a strong resuspension, transport and accumulation of these contaminated sediments and must be addressed for the risk assessment of this location and the connected River Spree.

References:

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