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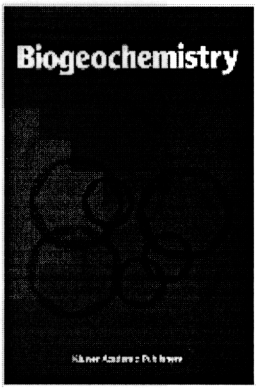


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# Decreased Silica Land–sea Fluxes through Damming in the Baltic Sea Catchment – Significance of Particle Trapping and Hydrological Alterations

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**Abstract** We tested the hypothesis that reservoirs with low water residence time and autochthonous production influence river biogeochemistry in eutrophied river systems draining cultivated watersheds. The effect of a single artificial water reservoir and consecutive reservoirs on silica (Si) river fluxes is exemplified by the moderately dammed Vistula River and the heavily regulated Daugava River that are compared with the practically undammed Oder River. The sum of the discharge weighted annual mean biogenic silica (BSi) and dissolved silicate (DSi) concentrations in the rivers Oder, Vistula and Daugava were about 160 $\mu$ M (40 + 120 $\mu$ M), 150 $\mu$ M (20 + 130 $\mu$ M) and 88 $\mu$ M (6 + 82 $\mu$ M), respectively. Assuming BSi and DSi concentrations as observed in the Oder River as typical for eutrophied but undammed rivers, complete trapping of this BSi could have lowered Si fluxes to the Baltic Sea from rivers with cultivated watersheds by 25%. The superimposed effect of hydrological alterations on reduced Si land–sea fluxes is demonstrated by studies in the boreal/subarctic and oligotrophic rivers Kalixälven and Lueälven. The DSi yield of the heavily dammed Luleälven (793 kg $km^{-2}$ $yr^{-1}$) constituted only 63% of that was found in the unregulated Kalixälven (1261 kg $km^{-2}$ $yr^{-1}$), despite the specific runoff of the Luleälven (672 mm $m^{-2}$ $yr^{-1}$) being 19% higher than that of theKalixälven (563 mm $m^{-2}$ $yr^{-1}$); runoff normalized DSi yield of the former, regulated watershed, was only half the DSi yield of the latter, unperturbed watershed. Based on these findings, it is hypothesized here that perturbed surface water–groundwater interactions are the major reasons for the reduced annual fluctuations in DSi concentrations as also seen in the heavily dammed and eutrophic river systems such as the Daugava and Danube.

**Keywords** Silica - Dissolved silicate - Biogenic silica - Retention