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Tracing Pb contaminated sewage sludge off the Israeli Mediterranean coast using Pb isotopes

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The isotopic composition of Pb in costal sediments is used as sensitive indicator for anthropogenic Pb contamination and source. The excess activated sludge of the Dan Region Wastewater project in Israel is being discharged through a single outfall, 5 km offshore. The sludge consists mainly of organic biomass and may contain among other metals, up to 1700 kg yr^{-1} Pb [1]. Surface sediments (1 cm) were sampled in 10 stations along the 38 m isobath, close to the sewage outfall. Pb was released from the sediments using 0.6N HCl and the isotopic composition was measured by MC-ICP-MS. Data points form a linear array on a $^{206}Pb/^{204}Pb$ vs. $^{208}Pb/^{204}Pb$ plot (Fig. 1). In this array three stations located several km north and south of the outfall, have similar values, significantly higher than those of nearby stations. This pattern is interpreted as a mixture of anthropogenic Pb and 'background' levels, indicative of sludge enrichment. The sludge end member is found in the vicinity of the outfall towards the north. Samples from stations north of the outfall are more contaminated probably due to the prevalent northward current. This suggests that the sludge-born Pb is being removed from the outfall area and deposited several km away from the outfall. Similar pattern is also shown using other Pb isotope ratios vs. 1/Pb. The Pb isotope ratios serve as a good indicator for the extent of metal transport originated from the outfall.

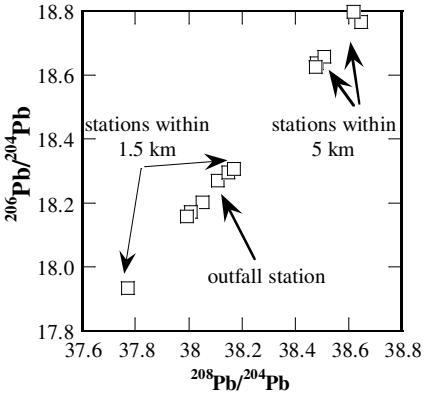

Figure 1. Lead isotopic composition of sediments in the vicinity of the Dan sewage sludge outfall, off shore Israel.

Reference

[1] Kress et al., (2004) *Marine Env. Res*. **57**, 213-233

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In-stream nitrogen attenuation: Model artefacts and management implications for coastal nitrogen impacts

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Catchment-scale nitrogen transport from land to coast, participating considerably in the problem of eutrophication that threatens coastal environmental quality world wide, is of broad significance for the whole society. Quantification of nitrogen attenuation in river basins is therefore the subject of many recent scientific studies. Different approaches are currently used for modelling catchment-scale nitrogen budget, in terms of model representations and spatial resolutions, with considerably contrasting information on resulting nitrogen transport and impact predictions and management recommendations. In this study, we directly compare nitrogen loss rate estimates from relatively fine spatial resolution modelling with corresponding large-scale aggregated results from different catchment-scale nitrogen budget models, using as an example case study the Norrström drainage basin in Sweden.

We show that the commonly used large-scale spatial parameter aggregation and poor up-scaling methodology in catchment-scale nitrogen budget modelling may lead to artificial apparent scale dependences in estimates of important transport parameters. Use of such different model estimates of nitrogen loss rates in the forward modelling of coastal nitrogen impacts from natural and anthropogenic emissions at the catchment-scale yields contrasting results and implications for nitrogen emission reduction strategies. Specifically, coastal impact prediction based on fine resolution loss rate data emphasizes the cost/benefit opportunities of adopting non-homogeneous allocation of emission reduction measures within the basin, which may be missed when artefacts on predicted coastal nitrogen impacts are introduced by large scale spatial model aggregation, in combination with insufficient sub-grid resolution and lack of relevant up-scaling methodology.

In general, the contrasting information and scientific guidance of reducing strategies for nitrogen, yielded by different model representations and spatial resolutions, implies major practical implications on the efficiency of management and mitigation measures for reducing coastal nitrogen loading within drainage basins and the findings of this study may therefore be of great interest to multidisciplinary scientific communities.