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Sr-Nd-Pb isotope fingerprint analysis of sediment from the river Weser (Germany) and its implication to trace human and climate-induced impacts

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River systems in Germany are under an increasing pressure due to human activities and the changing global climate in the recent decade. Human activities, such as agriculture and industrial manufacturing, for instance have supplied contaminates to many rivers, which has greatly affected the river ecosystem. Extreme events, as a result of the changing global climate, such as the more frequent extraordinary floods and droughts, are playing an increasingly significant role in the chemical compositions of the different river systems. To protect these unique river ecosystems, it is important to identify the contribution of these various sources of pressure and quantitatively assess their relative impacts on the different river systems.

Here, we will explore the potential of using the Sr, Nd, and Pb isotopes as a fingerprinting tool to quantify the relative contributions from both natural and anthropogenic sources supplying the materials to the river system. Sediment samples were collected from the river Weser, the longest river that lies entirely within Germany. The river Weser is formed by the junction of two rivers, Werra and Fulda, and flows towards its estuary in the North Sea. With a mean discharge of 327 m^3/s, it is one of the main rivers discharging into the North Sea. With its two headwaters and tributaries also sampled, sampling locations cover a geographical area of agricultural land and industrial sites, and expand to coastal areas of the North Sea. It is therefore ideal to evaluate the impact of various sources of human activities and the changing climate on the river system, and to provide insight into the contribution of river system to the ocean.

Sediment samples were analysed for their elemental compositions to evaluate the load of each chemical composition in the river Weser. Isotopic ratios of Sr, Nd, and Pb were measured on MC-ICP-MS (Multi-collector-Inductively Coupled Plasma-Mass Spectrometry) with the newly-developed automated prepFAST sample purification method (Retzmann et al., 2017). The Sr, Nd and Pb isotope results reported here are the first such dataset obtained from the river Weser sediment. Combined with the statistical analysis, such as the principal component analysis, the dataset allows the evaluation of the contribution of various sources to the load of the river Weser, and enables the quantification of the flux of the river to the North Sea, and an estimate of the contribution of the river system to contaminants transported into the coastal zone. These estimates will also be of interest to stakeholders and governments for targeted management

interventions of the socio-economically important Weser river system.

References

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