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Reconstruction of the Nitrogen Cycle in the German Bight/South East North Sea by means of Stable Nitrogen Isotopes in surface sediments, suspended matter and sediment cores - An empirical study

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In order to reconstruct past situations in the North Sea regarding the cycling of reactive nitrogen, we determined stable nitrogen isotope ratios (δ^{15}N) in surface sediments, suspended matter, and short/long cores at selected sites of the German Bight/South East (SE) North Sea. δ^{15}N of surface sediments decrease in offshore direction. In areas of deeper waters the isotopic signals are more depleted and typical of marine dissolved inorganic nitrogen (5-6 per mil). In contrast, ratios of the shallow estuarine area of the SE North Sea present δ^{15}N values up to 13.23 per mil. The 15N-enriched signal is interpreted as a trace of anthropogenic nitrogen sources on land and high transport of riverine material as a consequence of the North Sea current pattern. Upward increasing values of δ^{15}N in dated sediment cores from the Elbe and Helgoland muddy vicinity ($\delta^{15}N_{top-0cm}$: 7.97 per mil; $\delta^{15}N_{bottom-200cm}$: 5.60 per mil), clearly indicate an isotopic enrichment of nitrogen loads through time. The analysis of samples taken in the period 1955-2007 from the SE North Sea and the German Bight coastal area reflects the development of eutrophication. This study, together with a numerical ecosystem model that includes an N-isotope scheme, helps to distinguish inputs of reactive nitrogen reaching estuaries and areas of the German Bight, and to quantify the human impact that has affected this ecosystem over the past decades.