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Trace metal fluxes in the Scheldt estuary, SW Netherlands

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The Scheldt river and estuary are polluted since an important part of the industrial and domestic wastewaters is still discharged without prior treatment. Especially during summer an anoxic zone extends from the freshwater into the upper estuary. The Scheldt estuary provides an ideal opportunity to study the behavior of trace metals over a redox gradient. Data on trace metals in the estuary were obtained during cruises from 1987 on. Monitoring data were also used. A one-dimensional, dynamical, tidal average, box model for the behavior of trace metals was also developed.

The geochemistry of dissolved Cd, Cu and Zn appears to be related to the redox conditions in the upper estuary and phytoplankton activity in the lower estuary.

The Cd, Cu and Zn levels in (suspended) sediment decrease with increasing salinity due to mixing of contaminated fluvial and relatively unpolluted marine particulates.

Mn will serve as an example of the trace metal fluxes in the estuary. Mn but also Fe diffuses from the pore waters in the high turbidity zone to the overlying water where they are subsequently oxidized. Dissolved Fe precipitates immediately, dissolved Mn is metastable due to the suboxic conditions in the high turbidity zone and precipitates in the lower estuary where oxic conditions are restored. A similar behavior can be observed for Ni and Co. Part of the precipitated Mn (and Ni and Co) is transported back to the upper estuary where the suspended matter sediments and the process starts again. This results in a zone with high dissolved Ni and Co concentration that are ecologically significant. In the future the redox gradient in the upper estuary will slowly disappears because of sanitation measures and the dissolved Ni and Co concentrations will decrease.

References

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