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Deep-water inflow event increases sedimentary phosphorus release on a multi-year scale

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Phosphorus fertilisation (eutrophication) is expanding oxygen depletion in coastal systems worldwide. Under low-oxygen bottom-water conditions, phosphorus release from the sediment is elevated which further stimulates primary production. It is commonly assumed that re-oxygenation could break this 'vicious cycle' by increasing sedimentary phosphorus retention. Recently, a deep-water inflow into the Baltic Sea created a natural in-situ experiment that allowed us to investigate if temporary re-oxygenation stimulates sedimentary retention of dissolved inorganic phosphorus (DIP). Surprisingly, during this three-year-long study, we observed a transient but considerable increase, rather than a decrease, in the sediment efflux of DIP and other dissolved biogenic compounds. This suggested that the oxygenated inflow elevated the organic matter degradation in the sediment. As a result, the net sediment DIP release per m^2 was 35-70% higher over the years following the re-oxygenation than before. In contrast to previous assumptions, our results show that inflows of oxygenated water to anoxic bottom waters can increase the sedimentary phosphorus release.