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Seasonal and inter-annual variations of nitrogen diagenesis in the sediments of a recently impounded basin

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Abstract. The Méry-sur-Oise (France) storage reservoir is an artificial basin of 9 m average depth, fed by water from the river Oise with a mean residence time of about 4 days. Sediments are accumulating at a rate of about 0.7 cm/month. In the sediments, two fractions of organic nitrogen with different rates of bacterial degradation could be distinguished, one associated with fresh phytoplankton, the other made of detrital and more refractory compounds. The fluxes of oxygen, nitrate and ammonium across the sediment-water interface were measured with a bell-jar system at different seasons during a 3 year period following flooding of the basin. The measurements show clear seasonal variations in relation with the variations of temperature and input of fresh phytoplanktonic material to the sediment. In addition, a long term trend of increasing ammonium was observed. Measurements were also carried out after dredging of all accumulated sediments of the basin. They showed a considerable reduction of the flux of nitrate to the sediments and a significant reduction of the flux of ammonium to the water column.

These results are interpreted in the light of a non stationary model of N diagenesis in accumulating sediments. This model is able to predict at least the general trends of benthic N cycling of basins during the early stage of their ecological succession.

Introduction

The importance of benthic processes in nutrient dynamics of shallow aquatic ecosystems is now largely recognized (Rowe et al. 1975, 1977; Billen 1978; Fisher et al. 1982; Hopkinson & Wetzel 1982; Blackburn & Henriksen 1983, Billen & Lancelot 1988). Recently flooded basins, however, are systems initially deprived of a benthic phase and where a gradual accumulation of sediments occurs. The development of a progressively deeper sedimentary column can result in a slow change in the ecological function of the whole ecosystem. This paper reports observations of sediment deposition and nitrogen accumulation, transformation and recycling, in an artificial basin