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## *What is the origin of nitrogen in the North Sea*

Over the last decades, changes in the marine nutrients concentrations resulted from growing anthropogenic pressure. This led to cultural eutrophication which remains an ecological nuisance and a serious societal challenge for many coastal environments. Appropriate nutrient reduction strategies should therefore operate in a way that they efficiently minimize the adverse effects of eutrophication. Therefore, it is crucial to identify the human activities responsible for the eutrophication problems. This challenge for coastal waters is complex as (1) many nutrient sources and pathways exist, (2) nutrients can cause eutrophication nuisances far from their source of origin, and (3) nutrients undergo several biogeochemical processes and transformations during their journey along the river-ocean continuum. In this study, a 3D marine ecological model (MIRO&CO-v2) was used to simulate the response of the coastal ecosystem. This model results from the coupling of a 3D hydrodynamic model (COHERENS v2; Luyten 2011) with a biogeochemical model (MIRO; Lancelot et al. 2005) which has been designed for Phaeocystis-dominated ecosystems such as the southern North Sea. The nutrient tracking approach of Ménesguen et al. (2006) has been adapted and implemented in the MIRO&CO-v2 to track the nitrogen fate in the different components of the ecosystem, and trace it back to its sources. This method allows estimating the nitrogen contributions from oceanic and continental sources (riverine and atmospheric). The focus will be given over the southern North Sea for 2000-2010. Origin of nitrogen content in Phaeocystis will be assessed. Zones of river influence will be estimated and the importance of nitrogen atmospheric depositions compared to oceanic and riverine nitrogen loads will be discussed.

*Keywords: tagging, nitrogen, eutrophication, model, marine ecosystem, southern North Sea*