

Air-water exchange of nutrients and inorganic trace elements on the North Sea and over the French-Flemish North Sea Coast

Eyckmans K., J. de Hoog, F. Deutsch, and R. Van Grieken

Universiteit Antwerpen (UIA), Departement Scheikunde, Micro and Trace Analysis Centre
Universiteitsplein 1, B-2610 Antwerpen, Belgium
E-mail: eyckmans@uia.ua.ac.be

There is a great uncertainty concerning the atmosphere as a source of nutrients to the North Sea. Especially during the summer months, when the riverine input is at a minimum and ammonia emissions are at a maximum, the atmosphere can become an important source of nutrients. Therefore, it happens that during late spring and summer, when algal primary production in the North Sea appears to be nutrient limited and when some parts of the North Sea are, due to the natural current, isolated from the North Atlantic inflow, the atmosphere becomes the dominant source of nitrogen compounds. These nutrients can cause algae blooms and even eutrophication over large sea areas, resulting in a damaged natural equilibrium of the ecosystem. At the end of these blooms, hypoxic and even anoxic states can occur, resulting in a massive mortality in the marine flora and fauna.

Various sampling campaigns were organised to increase the knowledge of the anthropogenic pollutants and the sources of the nutrients. The pollution on the North Sea was investigated on the research vessel Belgica. During eight different campaigns, from 1998 until 2000, samples were taken from the Channel to the Central North Sea on various fixed sampling points.

Marine and continental influences were examined at the Belgian coast in Adinkerke, Blankenberge and Knokke-Heist. In Knokke-Heist, samples were taken on a weekly basis over a period of one year (from June 1999 until May 2000). At the sampling point of Adinkerke, near the French border, the borderline transport of pollutants and the impact on the environment was investigated. Intensive sampling campaigns of a period of one month (June 2000, December 2000 and February 2001) were organised to improve the knowledge on the seasonal variations of the pollution.

The particulate matter was sampled, using filter holders and glass fibre filters for nutrients (NO_2^- , NO_3^- , PO_4^{3-} and NH_4^+ compounds) or Nuclepore filters for trace elements. These trace elements under investigation either have a biological role (Al, Si, Mn, Fe) or are very toxic (Cd, Pb, Cr, Ni, Cu, Zn). Impactor samples were taken in order to achieve some additional information concerning the particle size of the pollutants and the history of the air masses. Primary and secondary sea salt particles and the pollutants and their reaction products give information concerning the origin and the anthropogenic or marine influences of the air masses. Gaseous nutrients, like ammonia, nitrous acid and nitric acid are sampled, using a denuder set-up.

After the analysis with Ion Chromatography, the data are compared with meteorological data (air mass back-trajectories) and fluxes will be calculated.