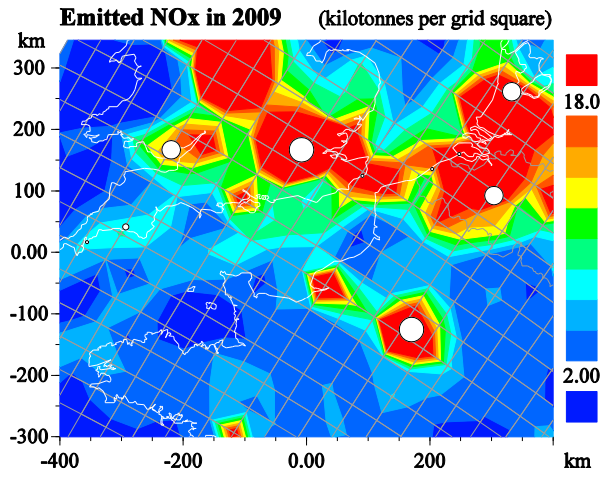
Atmospheric Modelling for ISECA

Some proportion of the nutrients responsible for the growth of algae in coastal waters are due to pollutants emitted from human activity in cities, land and sea transport networks and industry. Transported by the wind, they reach the coast where they may be deposited with the help of rain over several months preceding algal bloom events. Using computer models scientists can study the details of this *atmospheric input* to the '*foaming of the seas*'.

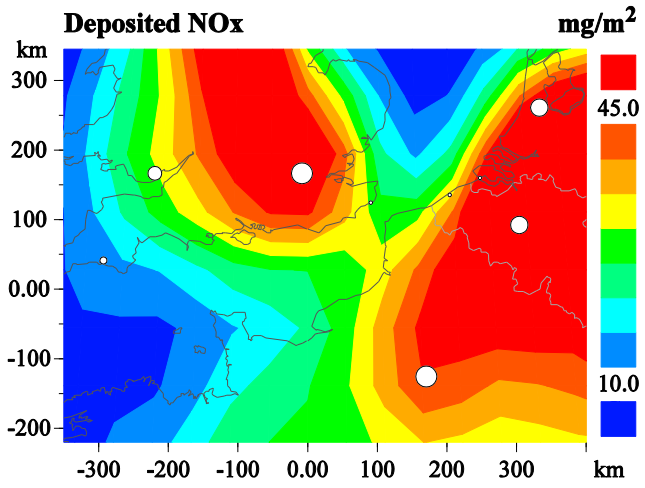
The University of Greenwich has been assigned the task within the ISECA project, of identifying suitable set-ups and of developing computer models to demonstrate the effect of atmospheric transport of algal nutrients to the coastal waters in the 2Seas region. The essential part of the computer model comprises three elements:
(i) the physics of species transport and deposition
(ii) the sources responsible for the emissions
(iii) the weather data (wind speed and direction, rainfall, temperature, etc.).

Since the deposition effect is cumulative, weather data are needed over a period of several months and for this we have used past and recent weather data available from the European Centre for Medium-Range Weather Forecasts (ECMWF) in their 'ERA Interim' data set. The data can easily be combined with the open source software Flexpart – a 'Lagrangian particle dispersion' model to prepare a tool for atmospheric transport numerical simulations. The model needs emissions data as input. Such data can be obtained from various sources and currently two emissions data sets are employed based on different geographical grids: a coarse-grid one from EMEP (Picture 1) and a refined-grid database from VITO. There is a mismatch between the grid sizes provided by ECMWF on one hand and the refined grid from VITO. To match the fine grid of the latter, we designed a link between the weather simulation package WRF and Flexpart. Comparisons of the two types of set-up will show how important grid spacing is for the modelled nutrient transport.

Picture 2 below shows an interim simulation result from a combined model of the coarse weather data with the fine emissions set. Calculated quantities of nitrogen oxides deposited over the 2Seas region in April 2009 are shown as colour contours. It can be seen that most strongly affected by such atmospheric deposits are the coastal waters of the Netherlands (which also see the highest riverine input!) followed by the Eastern English Channel which receives input not only from the neighbouring land but also from shipping.



Picture 1: Emissions of nitrogen oxides, source EMEP: www.ceip.at



Picture 2: Contours of deposited nitrogen oxides in the 2Seas region. The circles represent urban centres