

SHIPFLUX

Atmospheric deposition fluxes to the Belgian marine waters originating from ship emissions

DURATION OF THE PROJECT
01/09/2009 – 31/08/2011

BUDGET
179.761€

CONTEXT

The anthropogenic pollutant input triggering coastal eutrophication (i.e., increased bioproductivity) at the Southern Bight of the North Sea is still a serious concern in present years. The contribution of atmospheric input of pollutants to eutrophication initiates an increasing scientific and policy-related interest, but it is still not well studied. Especially the role of pollutants released from the large cargo/ferry boats taking part in the national and international ship-traffic has not yet been characterized. Atmospheric nutrients and toxic substances deposited into the marine environment can be accumulated and amplified in the food chain, and might contribute to the coastal eutrophication. Therefore, their influence on marine ecosystems certainly needs to be systematically studied.

PROJECT DESCRIPTION

Objectives

The aim of the SHIPFLUX project is (1) to study the dry and wet deposition of ship-traffic pollutants (e.g. heavy metals and some gaseous/solid phase nutrients and persistent organic pollutants (POPs)) over the coastal waters of the Southern North Sea and at a coastal spot of the Belgian coast (De Haan), by means of atmospheric gaseous, aerosol, and precipitation samples, (2) to compare and understand temporal and seasonal differences in these atmospheric pollutant fluxes over North Sea waters.

The main objectives of the project are as follows:

- to carry out concentration measurements of nutrients and persistent pollutants (e.g., polycyclic aromatic hydrocarbons (PAHs) and heavy metals) on research vessels (Belgica and Zeeleeuw) which cross the shipping lanes of the Southern Bight, and at a Belgian coastal site (De Haan) as a background;
- to calculate deposition fluxes of relevant compounds from the measured concentrations using suitable models;
- to extend the limited existing shipping emission inventories in terms of considered chemical components, geographical region and spatial resolution;
- to calculate shipping emissions for a base case (2010) and two scenario cases (2005 and 2011) in line with current and forthcoming international regulations;

- to improve the accuracy of the deposition calculations of the BelEUROS and AURORA regional chemical transport models, especially above marine areas, and to calculate the regional air quality and deposition of nutrients, POP's and heavy metals for the region of interest for the base year 2010;
- to validate the model results for the concentrations of relevant compounds using the results of the measurements carried out in this project;
- to carry out model calculations (1) to quantify the contribution of shipping emissions to the deposition of relevant compounds to the Belgian marine waters, and (2) to carry out model calculations for the two emission scenarios (2005 and 2010) to assess the effects of changes in the S-content of shipping fuel
- to compare the calculated fluxes of nutrients and bioaccumulable toxic substances to the Belgian marine waters to the known fluxes of these compounds as introduced by rivers.

Methodology

The methodology is based on combining atmospheric measurements and computer-based model calculations. Measurements of relevant gaseous and particulate species will be carried out over sea during certain research cruises, aiming to collect a sufficient sample of observations for establishing a representative view on pollutant concentrations over the marine region under study. For the sampling of atmospheric gases, aerosols and precipitation, denuders (e.g. for HNO₂, HNO₃, NH₃), automatic air-quality monitors (e.g., for NO_x, SO₂, and O₃), and low (for metals) and high (for POPs) volume aerosol samplers, and rainwater samplers will be applied. For the analysis of various chemical species, novel X-ray spectrometric and chromatographic analytical methods will be elaborated and applied. The acquired atmospheric data, including precise geo-location determined by a GPS and temporal information, will then be used to validate computer simulations performed by means of atmospheric models.



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With respect to the latter, particular efforts will be done to properly represent the mechanisms of dry and wet deposition, and to provide detailed emission estimates. Once the models are validated for a base case (year 2010) simulation, scenario simulations will be run to assess the contribution of shipping emissions and of emission reduction measures on deposition. Finally, the share of shipping-related emissions to deposition of nutrients and bioaccumulable toxics in the Belgian marine waters will be compared to the input from rivers.

INTERACTION BETWEEN PARTNERS

The SHIPFLUX project is a multidisciplinary project devoted to monitor levels of nutrient inputs in the Belgian North Sea and furthermore to improve, validate and apply air quality models in order to quantify the contribution of shipping emissions to the deposition of nutrients and bioaccumulable toxics into the North Sea. To achieve these goals, a close cooperation between the partners is absolutely necessary, as the gathered measurement data will be used for the purpose of model validation. Hence, the main attention of the network management will be given to insure a good planning and exchange of information and data between UA and VITO. This will be achieved by the mutual planning of the sampling campaigns, by agreeing on time on suitable formats for the exchange of data, by respecting the formulated timing by all partners and finally by the mutual interpretation of the achieved results in regularly organized meetings of the project partners. This will ensure a correct development of the project as planned and a constant check with respect to the foreseen deliverables.

EXPECTED RESULTS AND/OR PRODUCTS

- Ground-level concentration and deposition maps for the years 2010-2011;
- Validated model;
- Assessment of the contribution of ship emissions to the deposition at sea;
- Quantification of the effect of emission reduction strategies on the deposition by means of a validated model;
- Comparison of deposition fluxes from shipping emissions with the input from rivers.

PARTNERS

University of Antwerp
(main task: sampling and analysis of atmospheric pollutants)

Flemish Technological Research Institute
(Vlaamse Instelling voor Technologisch Onderzoek – VITO)
(main task: computer modelling).

CONTACT INFORMATION

Coordinator

René Van Grieken
University of Antwerp
Department of Chemistry
Campus Drie Eiken
Universiteitsplein 1
B-2610 Antwerpen
Tel. +32-3-265-2362
Fax +32-3-265-2376
rene.vangrieken@ua.ac.be

Promotors

Clemens Mensink
Flemish Technological Research Institute
VITO
Centre for Integrated Environmental
Studies
Boeretang 200,
B-2400 Mol
Tel.: 014 335969
Fax: 014 321185
clemens.mensink@vito.be

Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting <http://www.belspo.be/fedra> or <http://www.belspo.be/ssd>

