2. Introduction

The first EMEP Centres Joint Report for HELCOM was delivered in 1997 (Tarrason *et al*. 1997) and was followed by four annual reports (Bartnicki *et al*. 1998, 2000, 2001, 2002). Present EMEP Centres Joint Report for HELCOM is focused on the year 2001. It is based on the modelling and monitoring data presented to the 27th Session of the Steering Body of EMEP in Geneva in September 2003.

The EMEP Unified Eulerian model system has been used for all nitrogen computations presented here. This system has undergone a major overhaul the last two years, where the previous EMEP models (Lagrangian as well as Eulerian) have been merged and re-written in order to produce the Unified EMEP Eulerian model. The model has been documented in detail in EMEP Status Report 1/2003 Part I (Simpson *et al.* 2003). It has been verified against measurement data at EMEP stations for nine different years (1980, 1985, 1990, 1995-2000) in EMEP Status Report 1/2003, Part II (Fagerli *et al.* 2003). Following standard procedure, unified model results have been compared with the available measurements at the EMEP stations in 2001 and Model documented in Part III of the Status Report. Comparison of model results and measurements form the HELCOM stations nitrogen is described in the present report.

Atmospheric input and source allocation budgets of heavy metals (cadmium, lead, and mercury) to the Baltic Sea and its catchment area were computed using the latest version of MSCE-HM model. MSCE-HM is the regional-scale model operating within the EMEP region. This is a three-dimensional Eulerian model which includes processes of emission, advection, turbulent diffusion, chemical transformations of mercury, wet and dry depositions, and inflow of pollutant into the model domain. Horizontal grid of the model is defined using stereographic projection with spatial resolution 50 km at 60º latitude. The description of EMEP horizontal grid system can be found in the internet (http://www.emep.int/grid/index.html). Vertical structure of the model consists of five non-uniform layers and covers the entire planetary boundary layer and a part of the free troposphere up to about 4 km height. Meteorological data used in the calculations for 1990–2001 are based on the Re-analysis project data prepared by National Centers for Environmental Predictions together with National Center of the Atmospheric Research (NCEP/NCAR) in the USA (http://wesley.ncep.noaa.gov/reanalysis.html). Detailed description of the model can be found in EMEP reports (Ilyin *et al.*, 2002; Ilyin *et al.*, 2003) and in the Internet on EMEP web page http://www.emep.int under the link to information on Heavy Metals.

Evaluation of lindane atmospheric input to the Baltic Sea and its catchment area was carried out using the latest version of MSCE-POP model. MSCE-POP model is a three-

dimensional Eulerian multimedia POP transport model. The model is operating within the geographical scope of EMEP region both with spatial resolution 50×50 km and 150x150 km. Vertical structure of MSCE-POP is defined similar to MSCE-HM model. MSCE-POP considers the following compartments: air, soil, sea, vegetation and forest litter fall. The model includes the following basic processes: emission, advective transport, turbulent diffusion, dry and wet deposition, gas/particle partitioning, degradation, and gaseous exchange between the atmosphere and the underlying surface (soil, seawater, vegetation). Model parameterization for the lindane can be found in (Shatalov *et al*., 2003). Meteorological data used in the calculations for the period 1970–2001 are based on the Re-analysis project data. These data are prepared by National Centers for Environmental Predictions together with National Center of the Atmospheric Research (NCEP/NCAR) in the USA (http://wesley.ncep.noaa.gov/reanalysis.html). Detailed description of MSCE-POP model is given in several EMEP reports (Shatalov *et al*., 2001; Shatalov *et al*., 2003) and in the Internet on EMEP web page http://www.emep.int under the link to information on Persistent Organic Pollutants.

As decided by HELCOM all depositions, as well as, source allocation budgets have been calculated for the six sub-basins and catchements of the Baltic Sea. Names and acronyms of these regions, often used in the report are given below:

1. Gulf of Bothnia (GUB)
2. Gulf of Finland (GUF)
3. Gulf of Riga (GUR)
4. Baltic Proper (BAP)
5. Belt Sea (BES)
6. The Kattegat (KAT)

Depositions and source allocation budgets have been also calculated for the entire basin and the entire catchment of the Baltic Sea.

According to HELCOM requirements, the present annual joint report includes the description of the following tasks performed by the centres:

- Updated emission inventories of selected pollutants (two years in arrears). The selected pollutants are: oxidized nitrogen, reduced nitrogen, lead, cadmium, mercury and lindane.
- Estimates of annual depositions for the above mentioned pollutants, including separation to wet, dry and total deposition values over sub-basins and catchments of the Baltic Sea.
- Deposition allocation budgets for the Baltic Sea its sub-basins and catchments on country basis.
- Analysis of measurements of observed pollution levels, validation of the models and presentation of results from the field intercallibrations.
- Analysis of trends and interpretation of variability in the modeled and measured data.

- Comparison of model results and measurements available at the HELCOM stations.

The points listed above are followed in the structure of the report.