ECOSUPPORT

Annual report Y2: 100101-101231

1.1 Deliverables for the Y1 reporting period

WP no	No	Title	Due	Status
1	1	Reconstructed atmospheric forcing fields 1850-2007, riverborne nutrient loads including diffusive and point sources , airborne nutrient loads	Month 12	Delivered
1	2	Model data of the first transient simulation to force hydrological models of the catchment area and BS models 1960-2100	Month 6	Delivered
1	3	Model data sets of the whole ensemble 1960-2100	Month 12	Delivered
1	4	River flow data, river- and airborne nutrient loads and CO2 emissions 1960-2100	Month 12	Delivered
2	1	Unified high quality initial, forcing and validation data sets, model data sets 1961-2004	Month 6	Delivered (Unified initial conditions is discarded as decided by Management Group)
2	2	Detailed assessment of model skills	Month 9	Delivered
3	1	Unified validation data sets	Month 9	Delivered
5	1	Organisation and meeting minutes kick-off, annual GA, final conference	Month 2	Delivered
5	2	ECOSUPPORT webpage for internal and external information and data exchange,	Month 3	Delivered

		afterwards continously updated		

1.2 Deliverables for the Y2 reporting period

WP no	No	Title	Due	Status
1	5	Quantification of forcing biases, analysis of causes of biases in reconstructed and simulated forcing fields	Month 24	Delivered
2	3	Model data sets 1850-2007, understanding and quantification of the models capability to simulate perturbations in climate and nutrient loads	Month 24	Delivered
2	4	Model data of first transient simulation with BALTSEM and RCO-SCOBI 1960-2100	Month 18	Delivered
2	5	Model data of all transient simulations	Month 24	Delivered
2	8	Calculation of nutrient load reductions necessary to meet the BSAP targets	Month 24	Postponed to Y3
3	2	Food web model and BEM simulation results 1961-2004	Month 24	Completed
5	1	Organisation and meeting minutes kick-off, annual GA, final conference	Month 13	Delivered
5	4	ECOSUPPORT mid-term report	Month 19	Delivered

2. Year 2 scientific summary

Top three highlights:

1. Unique ensemble of combined climate and socio-economic scenario simulations
2. Successful ECOSUPPORT workshop on uncertainties of scenario simulations
3. Visualization dome got large interest from stakeholders

The second year of the ECOSUPPORT project has been intensive and productive at many levels. One highlight of the year has been the great effort in the production of ensemble scenarios. For the first time 3 institutions with 3 different models of the coupled physical-biogeochemical Baltic Sea system have joined forces by running the same climate and nutrient scenarios in order to compare and learn from the different model approaches. Model runs have been performed from 1850 to 2100, giving a unique chance to study the development of the Baltic Sea, from a more pristine state through the onset of eutrophication and into projections of future climate. Four different runs with Global Climate Models have been used as forcing of the biogeochemical models, representing two different Global Climate Models, two different IPCC emission scenarios and two different initial conditions. Runs are also being performed with four different nutrient scenarios in order to compare the ecosystem status with nutrient loads as of today compared to reduction scenarios in line with the Baltic Sea Action Plan. The modelling effort will give an exiting start to the final year of the project, where focus will be on further analysis of the different scenarios, their uncertainties and give insight in the impact on higher trophic levels of the ecosystem through the fish models.

A second project highlight during the year was the well-visited scientific workshop on "Uncertainties of scenario simulations". The usage of models is the only way we have to project and understand possible future developments in the Baltic Sea system. However, all models produce uncertainties and when we use a hierarchy of models, from the IPPC scenarios, through Global and Regional Climate Models, catchment, ocean and ecosystem models, uncertainties are created at many levels and it is of high importance, in order for science to serve as support for decision making, to estimate and minimize these uncertainties. The gathering of the scientific community at the BONUS+ cluster workshop gave a much needed opportunity to look into these problems and learn of different approaches (see Section 2.5).

The third highlight of 2010 has been the many occasions where we have had the chance to meet stakeholders for scientific communication of project results. We have used a new form of communication using visualizations in an inflatable dome with room for about 20 participants. We have given about 35 presentations in the dome for scientist, students, politicians, governmental officials and decision makers at different levels. The aim has been both to communicate the processes in the Baltic Sea leading to different sorts of eutrophication-related problems, our current understanding of climate change in the Baltic Sea area as well as current scientific understanding on the impact of nutrient load and climate change on the state of the Baltic Sea, which can serve as a background for policymaking and decision support. The work is further presented in Section 2.5 and in Andersson et al (2010), see Appendix.

Educational activities were also undertaken in the one-day Ph.D course on Climate Modelling where ECOSUPPORT partners were active in both the organisation and as lecturers. The course was followed by 20 participants, of which 16 were PhD students or in their early career.

ECOSUPPORT partners have participated in the ICES/HELCOM Working Group on Integrated Assessment of the Baltic Sea, which is doing some similar work in parallel with ECOSUPPORT WP3. Under 2010 there have also been two meetings with TARGREV/HELCOM, addressing the Baltic Sea Action plan, where partners from the ECOSUPPORT project were active.

The ECOSUPPORT project and the influence of the climate change on the atmospheric nutrient load to the Baltic Sea was presented at the Vene (Boat) 2010 exhibition to the visitors. The fair is the largest in the field in Scandinavia with 76000 visitors in 2010. ECOSUPORT was also represented at the "Summary for Stakeholders Meeting", UNESCO, in Paris, at the Nordic Council of Ministers' "Workshop on Effects of Climate Change on Marine Ecosystems" in Copenhagen and at the 3rd European Maritime Day Stakeholder Conference in Gijón, Spain. This conference was part of the annual EU "Maritime Days" event and the main attendees were different kinds of policymakers, government officials in environment, fisheries and nature agencies.

2.1. WP1: Drivers related to changing climate and changing river- and airborne nutrient loadings due to anthropogenic activities

Task 1.1. Forcing data 1860-2007

Daily sea-level-pressure, wind, precipitation, short-wave radiation needed to drive the Baltic Sea model RCAO in the period 1850-2009 have been reconstructed based on a statistical method using observations of daily sea-level pressure reported for the stations within the EMULATE project and the output of the climate simulations with the model RCAO. Since the connection between SLP and temperature is weaker than for the variables mentioned above, a separate statistical model was set-up to reconstruct the high-resolution temperature using long term temperature observations from a set of Baltic Sea stations. The statistical method also aims to reconstruct the serial autocorrelation at daily timescale of the forcing fields. This data set has been delivered to the project partners at the beginning of 2010, and in later months refinements were introduced and errors corrected in collaboration with SMHI. . A publication describing the reconstruction method is being prepared.

The reconstruction of run-off was originally intended to stem from the data set provided by Hansson and co-workers from the University in Gothenburg. This reconstruction, which is based on past atmospheric circulation indices and proxy-based temperature reconstructions, turned to display some undesirable statistical properties that would make it unsuitable for its application for the future scenario simulations. Mainly, the variability seems to be subdued. The statistical method used by Hansson and co-workers has been tested, but no significant errors were found. Some attempts were conducted to derive a new statistical method to link run-off to the atmospheric circulation, but this did not yield entirely satisfactory results.

Barring satisfactory results by the time of start of the simulations with nutrients scenarios, the run-off directly simulated by the regional climate model will be used to drive the management scenarios.

The final data set (67 files) of the published historical atmospheric nutrient load has been uploaded to the home page of the ECOSUPPORT. A summary containing data coverage, discussion about the quality of the data and preliminary analysis of the levels and changes in the deposition levels, also at the ECOSUPPORT home page. A poster about the data base has been also presented at the BALTEX 2010 conference. The ECOSUPPORT project and the influence of the climate change on the atmospheric nutrient load to the Baltic Sea were presented at the Vene (Boat) 2010 exhibition to the visitors.

Task 1.2 Atmospheric forcing data 1960-2100

Three climate scenario simulations up with the regional atmosphere-ocean model RCAO up to 2100 are available:
RCAO+ ECHAM5 OM under scenario A1B
RCAO+ ECHAM5 OM under scenario A2
RCAO+ HadCM3 under scenario A1B

The model RCAO displays a warm bias in the Northern Baltic region of about 2K when driven by the observations in the present climate. This bias is mostly compensated with the cold bias present in the global model HadCM3. However, the global model ECHAM5 presents almost no temperature bias in the present climate, and so that scenario simulations are found too warm in this area. A publication describes the details (Meier et al., 2011).

Task 1.3 Nutrient load forcing 1960-2100

After delivering a hindcast Q, N and P for 1961-2008 (Dec 2009),. the precipitation and temperature forcing data sets including ERA-40 and ERA-40 downscaled using the model RCA have been tested. Based on comparisons of yearly water balance it is believed that the spatial distribution of precipitation in the ERA-40 is not realistic and thus the model calibration based on ERAMESAN data was considered more reliable and was retained. When necessary, the temperature and precipitation from the RCA3 model were bias-corrected to the ERAMESAN temperature and precipitation, based on a control period from 1980 to 2004, using the Distribution Based Scaling (Yang et al. 2009) method.

In total, five climate scenarios for volume flows have been delivered to the project partners.

Task 1.4 Estimation of uncertainties
Uncertainties of forcing data stemming from statistical reconstructions and from the RCM simulations have been assessed. The estimation of uncertainties in the reconstructed meteorological forcing has been addressed by varying internal parameters and assumptions implicit in the statistical reconstruction method within reasonable ranges. The uncertainty ranges will be included in the corresponding final product and is described in a manuscript in preparation. Biases of a large ensemble of uncoupled RCM simulations have been assessed

and compared with coupled simulations (Meier et al., 2011). Based upon this assessment we concluded that coupled atmosphere-ocean models are needed for dynamical downscaling. Two global models belonging to the group of "better" driving models have been selected.

2.2. WP2: Impact on BS nutrient cycles, autotrophs and zooplankton

Task 2.2: Validation of the long-term biogeochemical variability

The high-resolution meteorological forcing for 1850-2007 and nutrient loads between 1902-2006 has been implemented to Baltsem. The first set of simulations has been limited to the period 1887-2006 because then actual daily sea level observations are available. In Figure 1 an example of results for the central Gotland Sea is shown. The model reproduce clearly the increased eutrophication in recent decades with lower oxygen and increased nutrient concentrations, although nitrate at depth decrease due to denitrification. In detail, one finds that present river runoff estimates for the period is insufficient for accurate replication of all features. Also the reconstruction of nutrient loads seems to give a somewhat late development of anoxia in the Baltic deep compared to observations. Despite of this discrepancy, the results clearly demonstrate hat present state-of-the-art coupled physical-biogeochemical models can reproduce the onset of eutrophication during the 20th century.
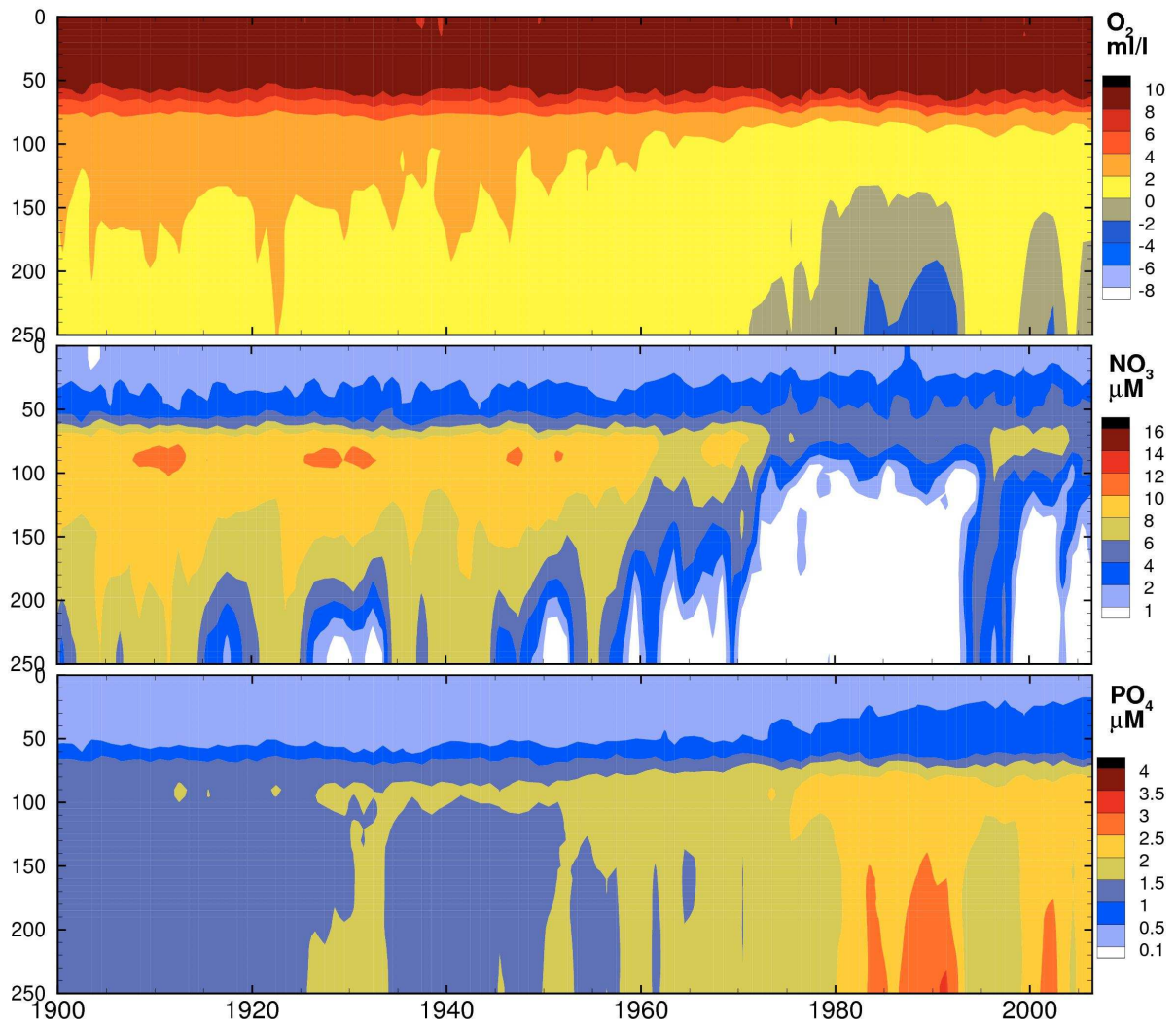
Figure 1: Time-depth plots of annual averaged oxygen, nitrate and phosphate concentrations as modelled by Baltsem. For clarity the plot is limited to the period 1900-2006.

Task 2.3: Scenario simulations of biogeochemical cycles

A quite large number of scenario simulations has been performed. These scenario simulations are driven by four different atmospheric climate scenarios, four different socio-economic nutrient load scenarios and two different hydrological modelling results, i.e., an ensemble of 96 simulations for all three coupled physical-biogeochemical Baltic Sea models together. Although we do not plan to perform the full ensemble, simulations have been carried out for a wide range of these climate/nutrient load scenarios with all three models. In detail, with ERGOM the reference load runs with RCO-HadCM3 A1B and RCAO-ECHAM5 A1B_3 were done and the load scenarios Business As Usual (BAU) and Baltic Sea Action Plan (BSAP) in combination with these climate scenarios are in progress. All combinations for one hydrological model has been simulated with BALTSEM. With RCO-SCOBI all scenario simulations for the emission scenario A1B and for one hydrological model including all socio-economic scenarios have been performed.

An example of the results from the future scenario simulations for 1961-2099 (Meier et al., 2011) are shown in Figure 2. Independently of the applied model we found the largest temperature changes in the Bothnian Bay and Bothnian Sea during summer. The increased water temperatures cause decreased oxygen concentrations in the entire water column because the oxygen saturation concentration decreases with increasing water temperature. As the bottom water is ventilated by surface water on a decadal time scale, also the bottom oxygen concentrations will decrease in future climate with up to 2 ml/l in a A1B scenario. However, the bottom oxygen concentration will not decrease in areas where the stratification is decreasing due to increased freshwater supply from the rivers. These areas are for instance regions where the permanent halocline hits the topography in present climate.

We found that nutrient load reductions are important and will have an effect also under the projected climate change. The results indicate that in the case of the Baltic Sea Action Plan most of the deeper regions will have bottom oxygen concentrations equal or even improved compared to present-day environmental conditions. However, current legislation is not sufficient to improve water quality and the business-as-ususal scenario suggests that the environmental status will be much worse compared to today's conditions independently of the climate projection used.
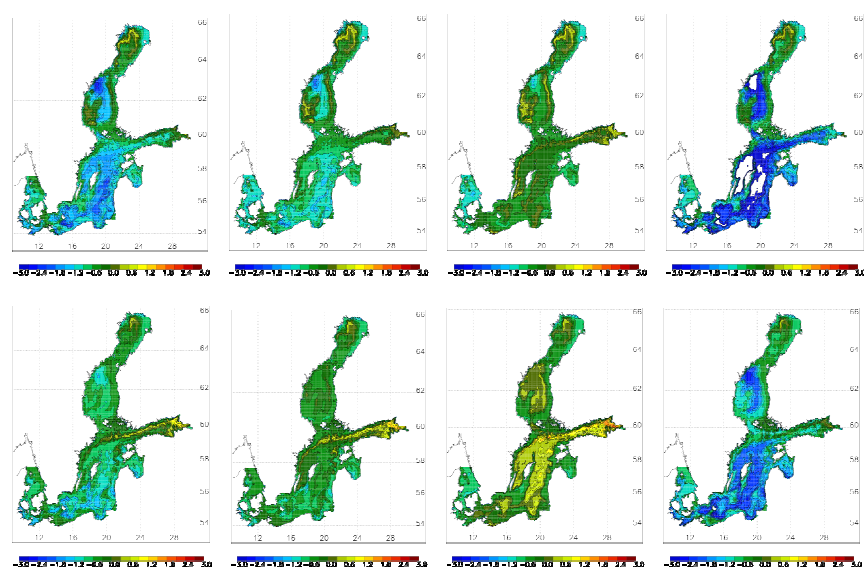

Figure 2: Summer mean bottom oxygen concentration changes (inml/l) between 2070-2099 and 1969-1998 in RCO-SCOBI forced with RCAO-HadCM3_ref A1B_3 (upper panels) and RCAO-ECHAM5 A1B (lower panels). The columns show from left to right results of the following socio-economic nutrient load scenarios: (1) present-day nutrient loads of 1969-1999, (2) current legislation, (3) Baltic Sea Action Plan, and (4) Business as Usual, respectively.

2.3. WP3: Impact on the food web

Work in the reporting period has been focussed on Tasks 3.1 and 3.2, and some initial work has been started on Task 3.3. Much effort has been used via communication among partners regarding hydrographic and biogeochemical variables to be extracted from model hindcasts

for model validation and parameterisation of new foodweb and fish population models. The communication was accomplished via frequent email contact, telephone/skype calls and a WP3 workshop held in Charlottenlund in September 2010. An agreed table of variables for hindcasts and forecasts has been produced, circulated to other WP1 and WP2 leaders. Hindcast data from the 3 main biogeochemical models for variables such as temperature, salinity, and oxygen concentration have been developed and provided to WP3 from WP2. Representatives from the WP have participated in quarterly management and annual project meetings. Deliverable status is on schedule and there is no foreseen changes necessary in the research or deliverable plan. Some WP3 members continue to participate in the ICES/HELCOM Working Group on Integrated Assessment of the Baltic Sea) which is doing some similar work in parallel with ECOSUPPORT WP3.

Task 3.1: Process validation of food web models

Deliverable 3.1.2. Food web model and BEM simulation results 1961-2004 (completed at month 24)

Work has continued on development of foodweb and population models and on recovery of datasets for parameterisation, calibration, and validation of models. A request for model output data for hindcasting and validation purposes has been made to WP1 and WP2 and some preliminary data were received for cod reproductive volumes and temperature. The request was based on email, skype, phone and workshop discussions throughout the year. Data were received during 2010 and all data are now available.

The Ecopath model calibration and validation is finished and colleagues are preparing a manuscript for submission to Ecological Modelling. Efforts continued towards identifying links between the biogeochemical models and the Ecopath with Ecosim model. The link will be made through primary production from the biogeochemical models as a forcing factor for the food-web model besides salinity and temperature. The first tests with the Baltsem model results are promising. The ECOPATH model now includes hindcast periods extending to the early 20th century, and flatfish landings for this period. Analyses are also underway to attempt an extension of sprat biomass from 1974 back to the 1950s or 1960s. If this is successful, the new sprat time series will be included within ECOPATH hindcasts. Some of these results have been at the OCEAN-PAST meeting in Ireland and a manuscript on the topic will be submitted to its peer-reviewed proceedings volume (PLoS One).

Literature and some preliminary new experimental data on effects of acidification on Baltic biota will be included within ECOPATH to test the effect of acidification on macrozoobenthos and zooplankton groups in the food-web model. This will done by incorporating mortalities caused by acidification into the model and testing potential effects on the food-web.

Task 3.2 Scenario simulations of the foodweb

Deliverable 3.2.1 food web and fish population model simulations for 1960-2100 (month 33):

Preliminary analyses and comparisons of some of the hindcasted hydrographic and biogeochemical data (e. g., cod reproductive volume) show good correspondence with field

data, and also good correspondence of data from the three different biogeochemical models. Further analyses and comparisons are planned in coming months, and will be extended to include forecast data as these become available. Some statistical analyses of environmental effects on cod recruitment in past 30-40 years for developing new stock-recruitment-environmental models for application in forecasts have been conducted.

Task 3.3: Quantification of uncertainty of future food web projections

Deliverable 3.3.1: Probabilistic uncertainty assessments of biological responses (e. g., populations, food web structure) to model structure and forcing scenarios (month 33)

The large number of models and forcing conditions within the project will yield a potentially vast number of forecasts covering a wide range of forcings. The project will need to consider how to present, visualize and interpret the outputs. Some discussions regarding concepts for ensemble averaging options and approaches were discussed at the September WP3 meeting in Charlottenlund. An approach for doing this was identified and will be investigated further during the coming project period and used for forecast purposes.

WP4: Impact on socioeconomic and regional development, case study

WP4 task comprise three regional case studies – the Gulf of Finland, Vistula Lagoon, the Polish Economic Zone – and socioeconomic impact in the Baltic Sea scale. While the objectives of the tasks are similar the approaches and methods for the completion of the tasks are different. The fulfilment of the tasks depends on the output from WP1 and WP2, and therefore no deliverables are for the present reporting period.

Task 4.1: Impacts on the Gulf of Finland

3D circulation model GETM and ecosystem model ERGOM have been set up for the Gulf of Finland. The period 1997-2006 has been selected for model validation run. Circulation model is validated using HELCOM monitoring data in the Gulf of Finland. Annual surface layer temperature cycle is reproduced by the model. Surface layer temperature of the warmest summers was slightly underestimated. Both, short-term and long-term variability is in good agreement with observations. Surface and bottom layer salinity is overestimated. One reason may be that initial salinity fields are overestimated. Tests (1-year) of 3D coupled GETM-ERGOM model for the whole Baltic Sea area have been done and at present simulation results with field data is compared. Time slice 2010-2030 for the future projection simulations was chosen. Model setup for test run is in progress.

Task 4.2: Impacts on Vistula Lagoon

Collected data sets of hydrography and water quality indicators in Vistula Lagoon comprise data for water level for three points in the Vistula Lagoon and one point from the open sea shore for different time periods; three years (1998-2000) of meteorological and river run-off data; monthly monitoring data of vertical profiles of T,S,O2, and Secchi depth. Collection of water quality indicators (nutrients, Chl) is in progress. Data on strategies of socio-economic development of local municipalities were collected. The analysis showed that at the present time the climate related problems are not proper considered in the socio-economic strategies, priorities given in strategies are not verified versus climate changes.

Task 4.3: Impacts on the Polish Economical Zone

Biological valorization on environmental factors based on methodology published by Weslawski et al. 2009 has been performed in the Polish Economical Zone for present situation.

The questionnaires focused on consequences of climate change among different users groups (NGOs, local administration, education sector, general public) in Kaliningrad oblast and Poland have been collected and is analyzed. The report "Attitude to climatic changes in everyday management practice at the level of Kaliningrad region municipalities" has been published. The results of analysis of questionnaires show that world-wide consequences of climate change are known, not local. User groups expressed lack of confidence in scientists and local authorities and lack of accessible information on consequences of climate change.

The activities of WP4 are in line with original research plan.

2.5. WP5: Co-ordination, data management, DSS, dissemination and outreach activities (all partners)

During the second year of the ECOSUPPORT project the consortium have gathered at a number of times for workshops and meetings. WP workshops have been held on 4 occasions: WP2 have met twice, WP1-3 had a workshop focusing on data exchange and integration and WP4 held one workshop. The whole consortium was represented at the BONUS cluster workshop on "Uncertainties of scenario simulations" arranged by ECOSUPPORT and IBAM and at the ECOSUPPORT General Assembly. The management group has held four meetings of which three has been telephone conferences.

The main public dissemination products during the second year have been the project webpage http://www.baltex-research.eu/ecosupport/ and a number of presentations for stakeholders using new visualization techniques for scientific communication/decision support in a GeoDome^{TM}. A prototype of the web-based decision support system has also been set up and linked to the ECOSUPPORT webpage. This database will give information on the state of the Baltic Sea regarding oxygen content, cod reproductive volume, nutrient content, chlorophyll concentrations etc under different scenarios of nutrient loads and climate change. The project has been represented with talks and posters at a number of scientific meetings and conferences, e.g. BONUS annual conference in Lithuania, the BALTEX conference Poland and the EUTRO 2010 conference in Denmark. 2 scientific posters summarising ECOSUPPORT efforts have been produced during the year as well as technical reports and refereed scientific articles (see Appendix).

Extensive data sets have been produced by WP1 and WP2 during the year, e.g. atmospheric forcing, river runoff, sea surface height, nutrient loads, physical and biogeochemical ocean parameters etc. The datasets are mainly made available for downloading from the project webpage.

ECOSUPPORT also supported the arrangement of a one-day Ph.D Climate Modelling School. Several lecturers were held by ECOSUPPORT partners and both students and scientists from the project participated in the course.

Workshop on "Uncertainties of Scenario Simulations"

About 50 scientists gathered at SMHI in Norrköping, Sweden for a one-day workshop on uncertainties of scenario simulations. 14 presentations were held, addressing a wide range of applications: from the uncertainties in global climate models (GCMs) to the uncertainties produced when using results from these models as forcing for land-use models, models of the physical and biogeochemical states of the sea and food-web models. The day finished with group discussions on how to handle different levels of uncertainty in the different BONUS+ projects. Contributions to the workshop came from scientists in Denmark, Estonia, Finland, Germany, Latvia, the Netherlands, Russian and Sweden. Abstracts and presentations can be found at the ECOSUPPORT webpage http://www.baltex-research.eu/ecosupport/

Climate modelling School

The one-day Climate Modelling School held in Norrköping gathered 20 participants. In the framework of the **BONUS+** project **AMBER** (Assessment and Modelling Baltic Ecosystem Response), the workshop was aimed for Ph.D. students from countries around the Baltic Sea. The objective of the course was to make students become familiar with the tools, assumptions, results and uncertainties of state-of-the-art climate modelling on global and regional scales. The topics of the lectures where Global Climate Models, impacts of climate change on sea level rise and spatial planning in metropolitan areas, Regional Climate Models, Arctic climate modeling and Baltic Sea climate modeling and 3 of the 5 lecturers are associated with the ECOSUPPORT project.

Collaboration with other Baltic networks outside BONUS+

ECOSUPPORT was invited by the BalticStern network to participate in a workshop where it was decided to appoint a working group that will develop new socio-economic scenarios for the Baltic Sea region. The first meeting of the BalticStern working group on scenarios took place on Jan 24, 2011, with participants from Stockholm Resilience Centre, Södertörn University/CBEES, Lund University, SMHI, Gothenburg University/HMI and SLU. The following items were discussed: the end product, what approach to take, available models, what subject should be addressed, what time horizon, what kind of drivers and trends. A review of relevant projects, models and output, with focus on the Baltic Sea, will be carried out during the spring

Visualizations for stakeholders of ECOSUPPORT results

Fig 3. The GeoDome^{TM} at the World Water Week in Stockholm

The ECOSUPPORT-project aims to help policy makers by supplying state-of-the-art research on the state of the Baltic Sea under different scenarios of nutrient supply, pressure from fisheries and impact of climate change. In order to make the research results accessible, a new form of scientific communication was been tested. Presentation of research data and physical, chemical and biogeochemical processes on land and in the sea were made using a special visualization platform, Uniview, which was projected onto a cupola-shaped screen inside an inflatable, enclosed dome. The visualization was tested on different audiences including policy makers, politicians, researchers and university students. Overall, the response was overwhelmingly positive with the audience expressing the view that the used visualization technique enhanced their understanding and receptiveness. Presentations were made at e.g. the World Water Week in Stockholm (the leading annual global meeting place for capacity-building, partnership-building and follow-up on the implementation of international processes and programmes in water and development), at the Government Offices of Sweden (with special focus on the Ministry of the Environment and the Ministry of Rural Affairs) and at Stockholm University (including two presentations for the ca 50 scientists and stakeholders of the EU FP7 ERA –NET project CIRCLE2). The work with this dissemination is summarised in a report http://www.smhi.se/polopoly_fs/1.14483!Oceanografi_105.pdf.

Task 5.1: Co-ordination and data management. Technical reports (mid-term and final) and meeting minutes, organisation of annual GA meetings and 3-monthly SSG telephone and internet-based conference calls, set up of the ECOSUPPORT webpage for internal and external information and data exchange

1. *Organisation and minutes of project workshops (available on the external part of the webpage):*
   - *WP2 Stockholm, Sweden, May 2010*
   - *WP1-WP3 Charlottenlund, Denmark, September, 2010*
   - *WP4, Sopot, Poland, September, 2010*
   - *WP2, Norrköping, Sweden, October, 2010*
2. *Organisation and minutes of management group meetings (April 2010, June 2010, October 2010, January 2011) (available on the internal part of the webpage).*
3. *Organisation and Minutes from the General Assembly (Norrköping, Sweden, October 2010) (available on the internal part of the webpage).*
4. *Distribution of information, presentations and data using internal and external parts of the webpage. The webpage has been continuously updated throughout the year* http://www.baltex-research.eu/ecosupport/index.html.

5. *Co-ordination and production of Annual Report for the second year (available on external part of webpage).*

T5.2: Decision Support System (DSS)

1. *A prototype of the database of ECOSUPPORT results that will be available as a decision support system from the project homepage has been set up.*

Task 5.3: Dissemination and outreach activities

1. *Organisation/lectures of Ph.D Climate Modelling School .*
2. *Publications (technical reports and scientific articles see Appendix).*
3. *Scientific presentations (excl. ECOSUPPORT internal meetings, see Appendix)*
4. *Scientific Workshop "Uncertainty of scenario simulations (SMHI, Norrköping, Sweden, October 2010, organisation, minutes, presentations (available on the external part of the webpage).*
5. *Presentations for stakeholders (See Appendix)*

3 Changes in the workplan

It was decided in the Management Group that the prospect of using unified initial conditions had to be abandoned since this was not realisable due to the differences in model formulation. This will not impact the outcome of the work on comparisons of model results.

It was decided by the ECOSUPPORT management group on 10 January 2011 to postpone deliverable 2.8, Calculation of nutrient load reductions necessary to meet the BSAP targets, to Y3 because it is more meaningful to analyse the transient scenario simulations first before doing inverse modelling of the BSAP.

Within WP3 we have been investigating methods for applying CART models to environmental data in order to assess possible impacts of pH on species distributions. However, it turned out that these models will have limited applicability in ocean acidification studies because these models are correlative and based on existing (or historical) environmental parameter values and species distributions. The T - ‰ combinations that will exist are currently present in environmental parameter space, however the T° - ‰ - pH combinations most probably are not. Consequently any attempt to use these models will necessarily be extrapolatory, and will involve many uncertainties. Thus, the work plan was changed and it is now planned to use EwE models to estimate the effects of pH inter alia on the benthic macrofauna.

Appendix: Dissemination list

Publications .

1) Alexandrov S.V., Gorbunova Ju.A. Biogenic load to the Vistula Lagoon with the run-off of the Pregolia River. Water: Chemistry and Ecology. 2010. № 1. Pp. 4-8. [In

Russian] Александров С.В., Горбунова Ю.А. Биогенная нагрузка на Вислинский залив со стоком реки Преголя Вода: химия и экология. 2010. № 1. С. 4-8

2) Almroth Rosell, E., K. Eilola, R. Hordoir, H. E. M. Meier, and P. O. J. Hall, 2011: Transport of fresh and resuspended particulate organic material in the Baltic Sea - a model study. J. Marine Systems, accepted.

3) Andersson, A. and H.E.M. Meier, 2010: Hur påverkas haven runt Sveriges kust av klimatförändringar? (How does climate change affect the seas around the Swedish coasts?) In: Formas fokuserar: Sverige i nytt klimat, Forskningsrådet Formas, Stockholm, Sweden, p. 117-132 (ISBN 978-91-540-6040-5)

4) Andersson, H.C., P. Wallman and C. Donnely 2010, Visualization of hydrological, physical and biogeochemical modelling if the Baltic Sea using a GeoDome^{TM}, SMHI report, Oceanography No. 105, 2010, 22 pp.

5) Arheimer,B., Dahné,J., Donnelly, C., Lindström, G., Strömqvist, J. 2011. Water and nutrient simulations using the HYPE model for Sweden vs. the Baltic Sea basin - influence of input data quality and scale. Manuscript submitted to Hydrology Research January 2011.

6) Donnelly, C., Yang, W., Dahné, J., Rosberg, J. and Strömqvist, J. 2011. River Flow to the Baltic Sea in a Future Climate: New Predictions and Uncertainties. Manuscript submitted February 2011.

7) Eilola, K., B. G. Gustafsson, R. Hordoir, A. Höglund, I. Kuznetsov, H.E.M. Meier, T. Neumann, O. P. Savchuk, 2010: Quality assessment of state-of-the-art coupled physical-biogeochemical models for the Baltic Sea. In: Proceedings of the fifth study conference on BALTEX, Ed.: M. Reckermann, Miedzyzdroje, Island of Wolin, Poland, 14 to 18 June 2010,International BALTEX Secretariat publication series No.46 GKSS, Geesthacht, Germany, 95--96.

8) Eilola, K., Gustafsson, B.G., Hordoir, R., Höglund, A., Kuznetsonv, I., Meier, H.E.M., Neuman, T. and Savchuk, O., 2010: Quality assessment of state-of-the-art coupled physical-biogeochemical models in hindcast simulations 1970-2005. SMHI report, Oceanography 101/2010, 21pp.

9) Gorbunova J., Input of biogenic substances from the Pregolia River watershed into the Vistula lagoon. // Bulletin of Immanuel Kant Russian State University, 1, 2010 С. 87-93. [In Russian] Горбунова Ю.А. Поступление биогенных веществ с водосборного бассейна реки Преголи в Вислинский залив // Вестник РГУ им. И.Канта. 1, 2010 С. 87-93

10) Gustafsson, B.G. and M. Rodriguez Medina 2011: Validation data set compiled from Baltic Environmental Database (Version 2), Technical Report No. 2, Baltic Nest Institute, Stockholm, Sweden, 25pp, ISBN: 978-91-86655-01-3.

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Presentations (excl.ECOSUPPORT meetings)

1) Arheimer, B. Dahné,J., Donnelly,C., and Strömqvist, J.: Parameter estimates in dynamic models for PUB - influence of input data quality and scale. European Geophysical Union (EGU) Conference, Wien, May 2010.
2) Arheimer, B. Donnelly, C., Strömqvist, J. and Dahné, J.: Balt-HYPE - a tool for evaluating the combined effect of measures for nutrient load reduction and climate change impact. Nordic Hydrological Conference, Riga, August, 2010.
3) Arheimer, B., Dahné, J., Wallman, P., Donnelly, C.: Enhancing freshwater information for the WFD using modelling. IWRM-net Final Conference, Brussels, Nov. 2010.
4) Arheimer, B., Donnelly, C., Dahné, J., Wallman, P.: Tools for better freshwater management. IWRM-net Final Conference, Brussels, Nov. 2010.
5) Donnelly, C., Dahné, J., Strömqvist & Arheimer, B. Uncertainty in Hydrological Predictions for the Baltic Sea, Rossby Day 21 Oct 2010, SMHI, Sweden.
6) Donnelly, C., Dahné, J., Strömqvist & Arheimer, B. Uncertainty in Hydrological Predictions for the Baltic Sea, Ocean Environment Dat, 14 Oct 2010, SMHI, Sweden.
7) Donnelly, C., Dahné, J., Strömqvist & Arheimer, B. BaltHYPE: A Tool for High-Resolution Simulation of Climate and Nutrient Reduction Scenarios for the Baltic Sea Catchment, 6th Study Conference on Baltex
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9) Donnelly, C., Dahné, J., Strömqvist & Arheimer, B. Calibration and Evaluation Techniques for Large-Scale Hydrological models, European Geophysical Union (EGU) Conference, Wien, May 2010.
10) Donnelly, C., Dahné, J., Strömqvist & Arheimer, B. Modelling Tools: From Sweden to Pan-European Scales for European WFD Data Requirements. Proceedings BALWOIS conference on Water Information and Observation Systems, May 2010, Macedonia.
11) Donnelly,C., Dahné, J., Rosberg, J., Strömqvist, J., Yang, W. and Arheimer, B. 2010. High-Resolution, Large-scale, Hydrological Modelling Tools for Europe. Proceedings of the 2010 UNESCO FRIEND conference. Fez, Marocco, 25-29 October 2010. IHAS publications. In press,
12) Gorbunova, J., Alexandrov S. Evaluation of anthropogenic influence on the Vistula Lagoon (Baltic Sea) via nutrients load from the Pregolia River. Proc. XI Int.Ecol. Forum "The Baltic Sea Days", Saint-Petersburg, 22-24 of March 2010. Saint-Petersburge: Maxi-Print Publisher. 2010. ISBN 978-5-94125-196-4. - P. 82 [In Russian] Горбунова Ю.А. Оценка антропогенного воздействия на экосистему Вислинского залива Балтийского моря за счет поступления биогенных веществ со стоком реки Преголя // Сб. материалов XI Международного экологического форума «День Балтийского моря». г.

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17) MacKenzie, B. R. Effects of global change on marine ecosystems and its biodiversity. Intl. GLOBEC Summary for Stakeholders Meeting, UNESCO, Paris, March 8-9, 2010.

18) MacKenzie, B. R. Effect of Climate Change on Foodwebs and Fish in the Baltic and North Seas. Nordic Council of Ministers, Workshop on Effects of Climate Change on Marine Ecosystems, Copenhagen, March 9-10, 2010

19) MacKenzie, B. R. Effects of global change on marine ecosystems and its biodiversity. 3rd European Maritime Day, Stakeholder Conference, Gijón, Spain, May 18-21, 2010

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35) Weslawski J.M., Piwowarczyk J., Beach and sandy shores in the marine ecosystem, Artificial reefs application for the sandy shores erosion control, rkshop in Jurata/Poland, 2010 (Zastosowanie modułów siedliskowych (Reef Ball) do stabilizacji brzegu morskiego oraz ochrony i odbudowy plaż)

36) BONUS annual conference 2010,Vilnius, Lithuania, 19-21 January, 2010, Author(s): H.E.M. Meier and ECOSUPPORT co-workers, Title: First results of recently performed scenario simulations for the Baltic Sea for 1961-2099.

37) BONUS annual conference 2010,Vilnius, Lithuania, 19-21 January, 2010, Author(s):Eilola, K., Almroth, E, Gustafsson, B.G. et al. Title: Uncertainty assessment of state-of-the-art coupled physical-biogeochemical models for the Baltic Sea.

38) BONUS annual conference 2010,Vilnius, Lithuania, 19-21 January, 2010, Author(s):Dahné, J., Donnelly, C., Strömqvist, J. et al. Title: Evaluating the combined effects of nutrient load reduction and climate scenarios for the Baltic Sea catchment.

39) International workshop on "Effects of climate change on the marine environment" organized by the Nordic Council of Ministers, Copenhagen, Denmark, 9-10 March, 2010. Author(s): H.E.M. Meier Title: Impact of changing hydrography on biogeochemical cycles in future climates of the Baltic Sea. (invited presentation)

40) Deutsche Meteorologische Gesellschaft, Deutscher Wetterdienst, Seewetteramt Hamburg, Hamburg, 16 March, 2010. Author(s): H.E.M. Meier, Title:

Klimaszenarien für das 21. Jahrhundert - neue Ergebnisse basierend auf einem regionalen gekoppelten Atmosphäre-Eis-Ozeanmodell für die Ostsee.(invited presentation)

41) Presentation at Finland's environmental administration (SYKE), 24 May 2010, Helsinki, Finland, Author(s): H.E.M. Meier, Title: From daily algae forecasts toward scenario simulations of changing climate - an overview on environmental modelling activities at the Swedish Meteorological and Hydrological Institute. (invited presentation)

42) Sixth study conference on BALTEX, Miedzyzdroje, Island of Wolin, Poland, 14 - 18 June 2010, Author(s): H.E.M. Meier and ECOSUPPORT collaborators. Title: Transient scenario simulations for the Baltic Sea for 1961-2099. (solicited)

43) Sixth study conference on BALTEX, Miedzyzdroje, Island of Wolin, Poland, 14 - 18 June 2010, Author(s): K. Eilola, B.G. Gustafsson, R. Hordoir, A. H\"oglund, I. Kuznetsov, H.E.M. Meier, T. Neumann and O.P. Savchuk. Title: Quality assessment of state-of-the-art coupled physical-biogeochemical models for the Baltic Sea.

44) EUTRO 2010, Nyborg, Denmark, 14 - 18 June 2010, Author(s): H.E.M. Meier, H. Andersson, K. Eilola, R. Hordoir, and A. Höglund, presented by H. Andersson, Title: New scenario simulations of the Baltic Sea ecosystem to support decision making.

45) BalticStern workshop on scenarios, Stockholm Resilience Centre, Stockholm, Sweden, 6-7 October 2010, Author(s): H.E.M. Meier, Title: ``Coupled climate-environmental modelling for the Baltic Sea Region'' (invited presentation)

46) BONUS+ program cluster workshop on ``Uncertainties of scenario simulations'', Norrköping, Sweden, 14 October 2010. Author(s): H.E.M. Meier, A. Höglund, R. Döscher, H. Andersson, U. Löptien and E. Kjellström, Title: ``Quality assessment of atmospheric surface fields over the Baltic Sea of an ensemble of regional climate model simulations with respect to ocean dynamics''

47) SMHI & CSPR (ECOSUPPORT): Baltic Vision: Research results from the ECOSUPPORT project visualized by 30 mins presentations (ca 7/day) using a GeoDome^{TM}. Presenters P. Wallman and H. Andersson, Stockholm World Water Week, 7-9, September, 2010.

48) SMHI & CSPR (ECOSUPPORT): Baltic Vision: Research results from the ECOSUPPORT project visualized by 30 mins presentations using a GeoDome^{TM}. Presenters P. Wallman and H. Andersson, Stockholm University, November , 2010.

49) SMHI & CSPR (ECOSUPPORT): Baltic Vision: Research results from the ECOSUPPORT project visualized by 30 mins presentations using a GeoDome^{TM}. Presenters P. Wallman and H. Andersson, Government Offices of Sweden, November, 2010.

50) SMHI & CSPR (ECOSUPPORT): Baltic Vision: Research results from the ECOSUPPORT: Visualisation of the impact of climate change in the Batlic Sea region. Presenters P. Wallman and H. Andersson at the conference "One year with the European Union Baltic Sea Strategy. The East Sweden Region "Östsam", Norrköping, Sweden, October, 2010.

51) ECOSUPPORT: Project presentation by Helén Andersson at "Discussion- Baltic Sea" a one-day conference for scientists and stakeholders, Norrköping, Sweden, August, 2010.

52) ECOSUPPORT Decision Support System for the Baltic Sea in a future climate. Presented by Helén Andersson at the SMHI development day, May, 2010.

Posters

1) The ECOSUPPORT consortium (poster presented by H.C. Andersson), Selected Highlights from the ECOSUPPORT project. BONUS annual conference 2010 (Vilnius, Lithuania).
2) The ECOSUPPORT consortium (poster presented by M. Meier), ECOSUPPORT: Project approach and selected results. 6th Study Conference on BALTEX, Wolin, Poland, June 2010.
3) The ECOSUPPORT consortium (poster presented by H.C. Andersson), ECOSUPPORT: Project approach and selected results. EUTRO 2010, Nyborg, Denmark, June, 2010

Web Tools
http://www.emetsoc.org/annual_meetings/annual_meetings_2010.php

1) Baltic Sea HYdrological Predictions for the Environment <http://www.smhi.se/en/Research/Research-departments/Hydrology/baltic-sea-hydrological-predictions-for-the-environment-1.14179>

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Lectures:

1) Meier, M: Invited guest lecture for undergraduate students at Södert örn University, Huddinge, Sweden, ``Impact of changing climate on the Baltic Sea'' (2 lecture hours), Oct 2010:
2) Oct 2010: Lectures for graduate students within the ``Climate Modelling School'' organized by the BONUS+ project AMBER, Norrköping, Sweden, ``Baltic Sea Climate Modelling'' (lecturers: Erik Kjellström, M. Meier, Eduardo Zorita)
3) Piwowarczyk J., Weslawski J.M: ,Sandy beaches in need for sustainable development and public awareness, Institute of Oceanography, Nha Trang, Vietnam, 2010
4) Piwowarczyk J., Weslawski J.M: From conflicts to solutions: How science can help to solve the conflicts for marine resources, University of Science Ho Chi Minh City, Vietnam, 2010.
5) Wallman, P. Lecture for Kunskapsgymnasiet High School. Title: The Baltic Sea – a Threatened Inland Sea? Norrköping, December, 2010.