ECOSUPPORT

Annual report Y1: 090101-091231

1. Deliverables for the present 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 but unified initial conditions are delayed
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, afterwards continously updated	Month 3	Delivered

2. Year 1 scientific summary

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 (SLP) is physically closely connected with wind, precipitation, and short wave radiation. The daily SLP data set from the EMULATE project have been used to reconstruct those daily fields. This work was completed within 2009. Reconstructions of daily temperature fields are hampered by the poor availability of long daily temperature records. Temperature will therefore be reconstructed on a monthly mean basis, which should be sufficient to drive the ocean Baltic Sea model.

River run-off in this period is being compiled by Thomas Neumann, based on the run-off reconstructions kindly provided by A. Omstedt (U. Gothenburg). The suitability of these reconstructions for Ecosupport prior to 1900 does however still need some checking.

45 published articles with information of the historical airborne load to the Baltic Sea have been reviewed and the relevant concentration and deposition data have been transformed into electronic form. The data cover the period from 1860 to 1970. The first compilation of data tables has been sent to the ECOSUPPORT database at SMHI in November. The rest of the material will be prepared and delivered to the database by the end of December.

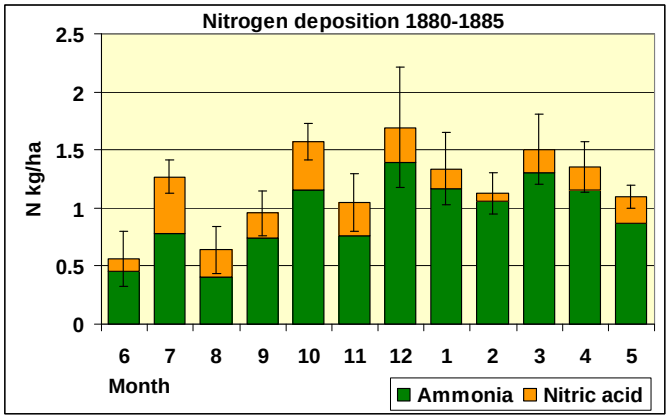

Fig.1 Seasonal variation in atmospheric nitrogen load at an agricultural research area near Copenhagen, Denmark. Values are monthly means for ammonia and nitric acid deposition with precipitation in 1880-1885. Standard deviation is for the sum of the inorganic nitrogen deposition. Data from: Tuxen, C. F. A., 1890. Undersøgelser over Regnens Betydning her i Landet som Kvælstofkilde for Kulturplanterna. Tidskr. f. Landsøkonom., 9, 325-350.

Task 1.2 Atmospheric forcing data 1960-2100

Dynamical downscaling with RCAO: SMHI/Rossby Centre has further developed the regional coupled model RCAO. The coupling between ocean and atmosphere models with very different resolution (6 nautical miles for the ocean and initially presently 25-50 km for

the atmosphere) initially generated specific requirements for the coupling technique. After addressing those, RCAO realistic hindcast runs became possible. During the control period, the high resolution version gives generally more realistic surface winds. Other differences are not prominent. Scenario runs were carried out in a 25 km or 50 km atmospheric configuration, driven by ECHAM/5MPI-OM and HADCM3. Atmospheric deposition for 1960-2008 has been delivered. For time slices during 2008-2100 data have been delivered assuming present emissions.

Task 1.3 Nutrient load forcing 1960-2100

Nutrient load data have been compiled from 1960-present. The data still present some caveats: errors of up to ± 20 % of total flow volume are estimated for some rivers and the parameterization of the some nutrient-relevant processes is still uncertain. Regulation of dams is not included in the model at this stage

Task 1.4 Estimation of uncertainties

Not initiated yet according to the plan.

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

The work within WP2 during the first year has focused on Task 2.1: model validation of biogeochemical processes. This task comprises an assembly of forcing and validation data sets, production of model results and validation of model results. All for the "instrumental" period, 1960-2006, with good coverage of all data sets.

Task 2.1 Model validation of biogeochemical processes

Task 2.1.1.Unified high quality initial, forcing and validation data sets

1. *Downscaled ERA40 atmospheric forcing from SMHI.* New atmospheric forcing was delivered during spring to the relevant partners and the downscaling is documented in a report (Höglund, 2009). New atmospheric forcing implemented in all three models. An updated ERA40 downscaling using RCAO were produced during autumn and delivered using 50 km grid instead of 25 km and corrected for incorrect temperatures.

2. *Use atmospheric and land nutrient loads from the present version of the ERGOM model*. IOW supplied integrated loads to the Baltic Sea. BNI has, in parallel, compiled atmospheric load forcing on basin scales from BED and EMEP data and made a revision of current land loads taking into account the latest PLC-5 data. SMHI have compared the integrated loads to RCO and ERGOM and sent around the information for discussions.

3. *Compare initial conditions of models.* IOW has delivered ERGOM initial conditions to SMHI and SMHI produced initial conditions by spin up, the latter will be integrated to BALTSEM boundaries and compared to BALTSEM initial conditions. A check in the BED database indicate that from observations one can construct initial fields of phosphorus for oxygen conditions similar to 1960, but for ammonia and nitrate one have to make some educated assumptions. The ERGOM and RCO initial conditions will be compared to the data set. This is delayed.

4. *Validation data and methods.* SMHI has developed an analysis and validation tool. An extraction tool for extracting time-series from single stations is available in Nest system. Also, BNI produced single station statistics and annual pools using DAS from all available data in BED.

Task 2.1.2. Model data sets

1. *ERGOM progress:*
    - First simulation ERGOM with RCAO-ERA40 forcing was started.
    - Several simulations with an ERGOM+carbon model with RCA-ERA40 forcing, with further sensitivity analysis were carried out. The necessity of reanalysis carbon to nitrogen ratio in phytoplankton was shown. Simulations with various carbon to nitrogen ratio started.
    - Sensitivity runs with various topography were started, and are currently under evaluation.
    - NetCDF files from the IOW with boundary conditions for the Baltic Sea as well as river loads have been delivered to the WP4 (MSI partners).
2. *BALTSEM progress*:
    - Model simulations using new meteorological forcing 1961-2006 have been made.
    - Recalibration of mixing parameters after implementation of new meteorological forcing is complete.
    - A new version is used in ECOSUPPORT, therefore some recalibration of biogeochemical cycles is still being done.
    - Incorporation of CO2 sub-model is postponed until late winter-early spring.

3. *RCO-SCOBI progress*
    - RCO-SCOBI 2nm simulations for 1961-2007 have been performed
    - coupling of RCO-SCOBI and a wave model, improved resuspension calculation and other model improvements
    - coupling of biology and physics (via absorption of light)
    - the implementation of the new loads from BNI is under testing and planned to be finished before New Year.
    - A new calibration of RCO-SCOBI using ERA40 downscaled atmospheric forcing and the new loads will be performed as soon as possible.

Task 2.1.3. Detailed assessment of model skills

SMHI draw a large collection of figures comparing data from all three models and observations. The results were presented at the first annual meeting of ECOSUPPORT in October 2009 and a report has been prepared (Eilola et al., 2010). The results show that all three investigated models as well as the ensemble average are able to reproduce the observed variability of biogeochemical cycles well. Results for nitrate and phosphate from the ensemble mean in the northern Baltic Sea and in the deepest parts of the Gulf of Finland need to be improved. The variation of hypoxic area in the Baltic proper was reproduced by the ensemble mean while the cod reproduction volume and its variability is overestimated relative to BED data. However, all models are still undergoing development and fine-tuning. This it

was agreed to repeat the assessment in spring 2010 when all partners have an improved model version available that will be used for the climate scenarios.

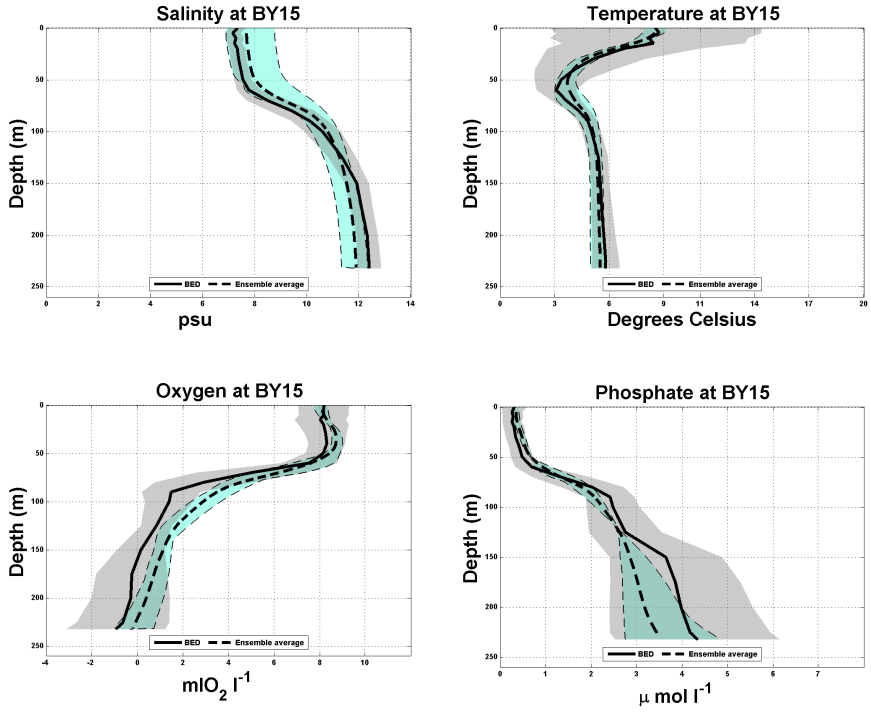

Fig. 2. Average (1970-2005) salinity, temperature, oxygen and phosphate concentrations at BY15. The black solid line and the grey shaded area indicate the mean value and ±1 standard deviation of BED data. The black dashed line and the blue shaded area indicate the mean and spread of the model ensemble.

Task 2.3: Scenario simulations of biogeochemical cycles

According to the plan the calculation of scenario simulations has been started. To test the quality of the forcing fields from the Global Climate Models two scenario simulations for 1961-2099 using RCO-SCOBI and the forcing fields from RCAO/ECHAM5 A1B and RCAO/HadCM3 A1B (see WP1) have been performed. At present the results are analyzed.

2.3. WP3: Impact on the food web

The main focus of the reporting period has been on Task 3.1 where work has been performed to produce unified validation data sets and to develop food-web models. Representatives from the WP has also participated in project kickoff meeting, quarterly management meetings, and annual project meeting as well as in the organisation of a project 1-day data workshop on data needs, requirements and formats. Work has also been done on job advertisements and employment of staff (e. g., Ph.D. students and post-docs). Deliverable status is on schedule and there is no foreseen changes necessary in the research or deliverable plan

A working group of ICES/HELCOM (Working Group on Integrated Assessment of the Baltic Sea) is doing similar work in parallel with ECOSUPPORT WP3. To facilitate collaboration and cooperation, several members of ECOSUPPORT participate in WGIAB and vice versa. For example, this includes a WG co-chair who is a partner of ECOSUPPORT and a 2nd co-chair of WGIAB whose institute is an associated partner of ECOSUPPORT. The leader of ECOSUPPORT WP3 participated in the 2009 meeting of WGIAB.

Task 3.1: Process validation of food web models

Task 3.1.1Unified validation data sets

1. *Identification of a set of variables* (e. g., fish spawner biomass, recruitment and fishing mortalities; hydrography, zooplankton, chlorophyll) for use in model hindcasts and forecasts of fish population and foodweb development
2. *Extraction, compilation and preparation of historical datasets* for model validations.
3. *Some datasets exchanged* among partners and workpackages (WP1, WP2)

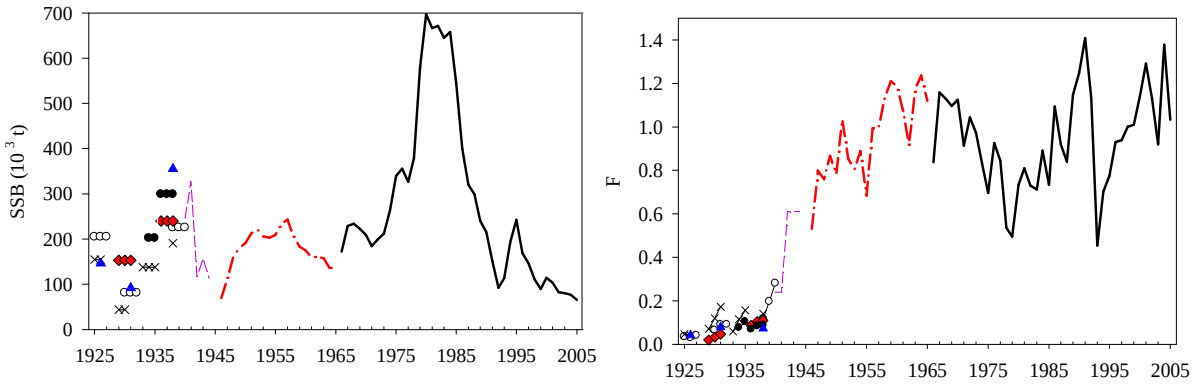

Fig.3. Population dynamics of cod in the Central Baltic during the 2nd part of the 20th century (Margit Eero et al. 2008 CJFAS): a) Spawning stock and b) biomass fishing mortality. Back to the 1940s: VPA based construction, before: catch curve analysis, cpue, egg abundance and estimates from analysing landings in north-eastern areas.

Task 3.1.2. Food web model and BEM simulation results 1961-2004

1. *Preparation and development of fish population and foodweb models*
2. *Preliminary results of some model developments and validations* disseminated in literature and at expert working group meetings and conferences.

2.4. 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 on 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 there are no deliverables during the present reporting period. The activities of WP4 are in line with original research plan.

Task 4.1: Impacts on the Gulf of Finland

1. *3D circulation model GETM and ecosystem model ERGOM have been set up for the Gulf of Finland*. To enable simulations, an extension of the existing Linux cluster from 16 to 32 nodes has been purchased. The period 1997-2006 has been selected for model validation run. WP1 and WP2 have provided initial fields of salinity and temperature, meteorological forcing fields, river flow, boundary data of sea level elevation,

temperature and salinity at Danish Straits for the circulation model simulation. The test runs of the GETM model are in progress.

2. *Data for model validation period* (1997-2006) in the Gulf of Finland are collected from the following databases: 1) ICES, 2) Alg@line (Helsinki-Travemünde), 3) Alg@line (Tallinn-Helsinki), 4) MSI+FIMR and 5) satellite sea surface temperature data (MODIS). Data consists of profiles of T (°C), S, nitrate (mmol m^{-3}), nitrite (mmol m^{-3}), phosphate (mmol m^{-3}), total nitrogen (mmol m^{-3}), total phosphorus (mmol m^{-3}), chlorophyll *a* (mg m^{-3}) and oxygen (ml l^{-1}) in 1997-2006. Transects of of T (°C), S, phosphate (mmol m^{-3}) and nitrate+nitite (mmol m^{-3}) between Helsinki-Travemünde, and phytoplankton (diatoms, flagellates, cyanobacteria) biomass (g WW m^{-3}) between Tallinn-Helsinki. Satellite sea surface temperature data (MODIS): with spatial resolution of 1x1 km are available since 2000.

Task 4.2: Impacts on Vistula Lagoon

1. Implementation of a model for Vistula lagoon and collection of the load data from catchment area is in progress.
2. A questionnaire were interactively made within the training seminar "Information basis of Integrative Coastal Zone Management" which was held in the Ministry of Territorial Development of the Government of the Kaliningrad Oblast" in February 2009. 30 respondents participated. The group consisted of managers at municipal level (economy, civil service, transport, spatial planning, property and international relations), practitioners in environmental protection, monitoring and management and representatives of tourism and science sectors. The general conclusions where that there was no serious attitude to the climate change issues, and that everybody is busy with more actual and urgent questions. There is, however, a potentially favourable attitude to scientific information about climate change and an interest to include this issue in today's activity. To achieve this more deep and wide education and training is needed among managers and practitioners.

Task 4.3: Impacts on the Polish Economical Zone

1. *Biological valorization* on biota and species based on methodology published by Weslawski et al. 2009 will be performed in the Polish Economical Zone. Basic assumptions for the methodology of economic and socio- cultural valorization with the list of functional and structural links between analyzed factors and processes are elaborated.
2. *Environmental data* - bathymetry, temperature, salinity, light regime, sediments, pelagic and benthic biota occurrence, habitats and key species occurrence have been collected. Detailed survey of the Gdansk Bay coastal belt by using 1500 aerial photos will be analyzed before March 2010. A draft paper *'Inevitable conflict – nature conservation and exploitation of sea space in Polish Marine Waters (EEZ)'* will be submitted by the end of December 2009.
3. *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.

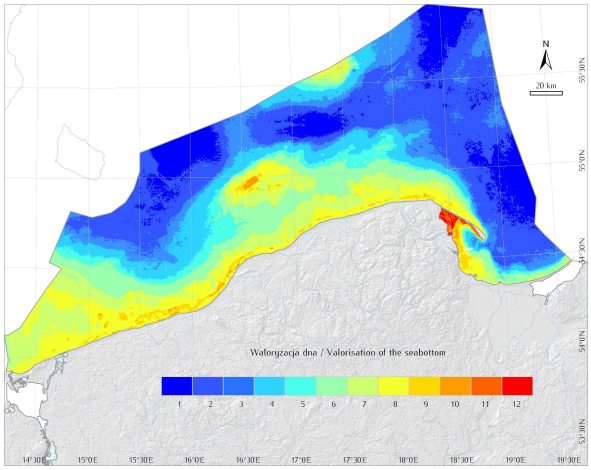

Fig. 4. The effect of the biological valorization of the seabed in the southern Baltic Sea.

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

During the first year of the ECOSUPPORT project there have been several meetings and workshops. The kick-off meeting was held at SMHI, Norrköping, Sweden in January 2009. A project scientific meeting was held in conjunction with the Baltic Sea Science Congress in Tallinn, Estonia. Two Project Workshops were organised: one which focused on WP2 and one which focused on Data integration and Modelling. The management group has held four meetings of which three has been telephone conferences. The project General Assembly took place in October at SMHI in Norrköping, Sweden and was followed by a one-day ECOSUPPORT workshop, open for all interested scientists, which discussed "The marine ecosystem in changing climate: On the added value of coupled climate-environmental modeling for the Baltic Sea".

The main dissemination product to stakeholders and public during the first year is the project webpage, which is now available at http://www.baltex-research.eu/ecosupport/.

ECOSUPPORT also supported the arrangement of a Ph.D. summer school during July 2009. Several lecturers from ECOSUPPORT were involved. The course was called Climate Impacts on the Baltic Sea: From Science to Management" and was organized by DTU Aqua, Gothenburg University and the Baltex secretariat. The course was supported financially and organisationally by the following organisations: BALTEX, BONUS, DTU Aqua, Euroceans Consortium, Fishnet.dk, GKSS, GKSS Student support association, and University of Gothenburg

Course background and short description:

The main purpose of the summer school was to develop skills in and understanding of the observation, modelling, projection and interpretation of physical and biological changes in the Baltic Sea. The course was designed to give students opportunities to learn both discipline-specific and interdisciplinary skills. One of the main objectives of the course was to demonstrate to students how discipline-specific knowledge can contribute to real management

problems at the ecosystem level and how that knowledge can help achieve wider goals related to ecosystem-based approaches to management. Another objective was to introduce students to problem-solving within individual disciplines via lectures, hands-on exercises and tutorials.

The course was co-listed as an official course at the Technical University of Denmark; students successfully completing the course earned 5 ETCS credits and received a notice of these credits from DTU. The maximum number of participants was set at 20 to facilitate teaching and organisational matters. Students from universities in 6 countries (Denmark, Estonia, Finland, Germany, Poland, Sweden) and 17 lecturers from 4 countries (Denmark, Finland, Germany and Sweden) participated.

Task 5.1: Co-ordination and data management

Task 5.1.1: 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. *Kick-off meeting (SMHI, Norrköping, Sweden, January 2009) organisation and minutes* (available on the external part of the webpage).
2. *Scientific meeting minutes (Tallin, Estonia, August 2009)* (available on the external part of the webpage).
3. *Minutes from project workshops (Göteborg, Sweden, September 2009, Norrköping, Sweden, October 2009)* (available on the external part of the webpage).
4. *Organisation and minutes from management group meetings (April 2009, June 2009, October 2009, December 2009)* (available on the internal part of the webpage).
5. *Minutes from the General Assembly (Norrköping, Sweden, October 2009)* (available on the internal part of the webpage).
6. *Co-ordination and production of Annual Report for first year (available on external part of webpage).*

Task 5.2 ECOSUPPORT webpage for internal and external information and data exchange, afterwards continously updated

1. *Webpage*, with external and internal parts, including presentation of project, consortium, events, meeting minutes, downloads of presentations and data etc. http://www.baltex-research.eu/ecosupport/index.html

Task 5.3: Dissemination and outreach activities

1. *Organisation of Ph.D Summerschool.*
2. *Publications (see Appendix).*
3. *Presentations (excl.ECOSUPPORT internal meetings, see Appendix)*
4. *Organisation and minutes and presentation summaries from the ECOSUPPORT open workshop: The marine ecosystem in changein climate – On the added value of coupled climate-environmental modelling for the Baltic Sea (Norrköping, Sweden, October 2009),* (available on the external part of the webpage).

Fig. 5. The ECOSUPPORT consortium.

3. Changes in the work plan and deliverables

The planed deliverable of reconstructions of daily temperature fields were changed to a deliverable of reconstructions of monthly mean fields. This was due to the poor availability of long daily temperature records. The issue was discussed in a management group meeting and it was generally agreed that the monthly fields would be sufficient to force the Baltic Sea ocean models.

Results from scenario simulations of atmospheric variables, river- and airborne nutrient loads and CO2 emissions are available as planned. However, in some cases the quality needs to be improved and simulations will be repeated during the first half of 2010 before they will be delivered to all partners. This does not affect the overall work plan of ECOSUPPORT.

The ERGOM and RCO initial conditions will be compared to the data set. This is slightly delayed but in progress and it is not envisaged that this will hamper the general project work plan.

Appendix: Dissemination list

Publications .

- Eilola, K., 2009: On the dynamics of organic nutrients, nitrogen and phosphorus, in the Baltic Sea. Rapport Oceanografi No.99, SMHI, Norrköping, Sweden, 16 pp. http://www.smhi.se/sgn0106/if/biblioteket/rapporter_pdf/Oceanografi_99_2010.pdf
- Eilola, K., H.E.M. Meier, and E. Almroth, 2009: On the dynamics of oxygen, phosphorus and cyanobacteria in the Baltic Sea; a model study. J. Marine Systems, 75, 163-184.
- Eilola, K., B. G. Gustafson, 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 in hind cast simulations 1970-2005, Rapport Oceanografi No.101, SMHI, Norrköping, Sweden. http://www.smhi.se/sgn0106/if/biblioteket/rapporter_pdf/Oceanografi_101_2010.pdf

- Höglund, A., H.E.M. Meier, B. Broman and E. Kriezi 2009: Validation and correction of regionalised ERA-40 wind fields over the Baltic Sea using the Rossby Centre Atmosphere model RCA3.0, SMHI Report Oceanografi No. 97, 35 pp.
- Lindegren, M., C. Möllmann, A. Nielsen, K. Brander, B. R. MacKenzie, and N. C. Stenseth. 2009. Ecological forecasting under climate change - the case of Baltic cod. Proc. Roy. Soc. Lond. B (in review).
- Meier, H.E.M., K. Eilola, and E. Almroth, 2010: Climate-related changes in marine ecosystems simulated with a three-dimensional coupled biogeochemical-physical model of the Baltic Sea. Clim. Res., under review.
- Almroth, E., K. Eilola, R. Hordoir, H. E. M. Meier, and P. Hall, 2010: Transport of organic material due to resuspension in the Baltic Sea - a model study. (Manuscript in preparation)
- Blenckner et al. Coherent and basin-specific drivers cause ecological regime shifts in the Baltic Sea, (will be submitted within Feb 2010).

Presentations (excl.ECOSUPPORT meetings)

- Blenckner, T. Marine ecosystem services – where do they come from, how are they related and what is affecting them? Swedish EPA meeting in 16-17 Sept. 2009
- B.G. Gustafsson, Eilola, K., Kuznetsov, I., Meier, M., Neumann, T., Savchuk, O. et al.: First results from coupled physicalbiogeochemical modelling within the BONUS+ project ECOSUPPORT, "The marine ecosystem in changing climate - on the added value of coupled climate-environmental modeling for the Baltic Sea", Norrköping, Sweden, 16 October, 2009.
- Havenhand, J. Applications and limitations of bioclimate envelope models. Discussion workshop at the Centre for Marine Evolutionary Biology, Univ. Gothenburg, 9-11 Nov 2009
- Karlson, B., K. Eilola and M. Hansson, 2010, Cyanobacterial blooms in the Baltic Sea – correlating bloom observations with environmental conditions, Submitted to Proceedings of ISSHA (XIIIth International Conference on Harmful Algae in Hong Kong).
- Kuznetsov, I., Neumann, T.: Simulation of the carbon cycle in the Baltic Sea. MOM+ERGOM application, "The marine ecosystem in changing climate - on the added value of coupled climate-environmental modeling for the Baltic Sea", Norrköping, Sweden, 16 October, 2009.
- MacKenzie, B. R. ECOSUPPORT (Introducton). ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea (WGIAB), Rostock, Germany; Mar. 16-20, 2009
- MacKenzie, B. R. Impact of 21st Century Climate Change on Baltic Sea Fish and Fisheries, IDA and Nest Conference Linking Science and Management in the Baltic Sea Ecoregion,
  Sept. 9-10, 2009, Copenhagen
- Meier, H.E.M., ECOSUPPORT, Joint Baltic Sea Research Programme Kick Off Conference, 13-15. January 2009
- Meier, H.E.M., Havsmiljö och klimatförändringar, Seminar on the Baltic Sea organized by the Swdish Environmental Protection Agency, Stockholm, 23 April 2009

- Meier, H.E.M., Future challenges for regional coupled climate and environmental modeling in the Baltic Sea Region, 2nd Lund Regional-scale Climate Modelling Workshop: '21st Century Challenges in Regional-scale Climate Modelling', Lund, Sweden, 4 - 8 May 2009
- Meier, H.E.M., Regional coupled climate and environmental modeling for the Baltic Sea Region, Joint Assembly of IAMAS (International Association of Meteorology and Atmospheric Science), IAPSO (International Association for the Physical Sciences of the Oceans) and IACS (International Association of the Cryospheric Sciences), Montreal, Canada, 20-24 July 2009
- H.E.M. Meier, ECOSUPPORT - Advanced modeling tool for scenarios of the Baltic Sea ecosystem to support decision making, 7th Baltic Sea Science Congress, Tallinn, Estonia, 17-21 August 2009
- H.E.M. Meier, K. Eilola, and E. Almroth, Climate-related changes in marine ecosystems simulated with a three-dimensional coupled biogeochemical-physical model of the Baltic Sea, 7th Baltic Sea Science Congress, Tallinn, Estonia, 17-21 August 2009.
- H.E.M. Meier, New modeling tools for scenarios of the Baltic Sea ecosystem to support decision making, International conference on 'Linking Science and Management in the Baltic Sea Ecoregion', Copenhagen, Denmark, 9-10 September 2009
- H.E.M. Meier, Eilola, K., Höglund, A., Kjellström E. and ECOSUPPORT collaborators: Impact of changing climate on biogeochemical cycles in the Baltic Sea - an introduction, "The marine ecosystem in changing climate - on the added value of coupled climate-environmental modeling for the Baltic Sea", Norrköping, Sweden, 16 October, 2009,
- H.E.M. Meier, L. Bäarring, O. Bossing Christensen, E. Kjellström, P. Lorenz, B. Rockel, and E. Zorita: Selected examples of the added value of regional climate models (poster). 2nd Lund Regional-scale Climate Modelling Workshop: '21st Century Challenges in Regional-scale Climate Modelling', Lund, Sweden, 4 - 8 May 2009.
- Niiranen, S., Tomczak, M., Hjerne, O., and Blenckner, T. - "Baltic Proper food web dynamics in response to environmental drivers - linking time series analysis with modeling" (talk). CERF 2009, Portland, USA, November 2009
- Niiranen, S., Tomczak, M., Blenckner, T. and Hjerne, O. "Dynamics and regimes of the Baltic Proper food web – Linking time series analysis with modelling". ICES'09 ASC, Berlin, Germany (talk)
- Tomczak, M. Baltic food web model. ICES WGSAM, 2009
- Tomczak, M. Ecological Network Analysis, indicators of food-web changes in the Baltic Sea. ICES WGHAME, 2009 '
- M. T. Tomczak, J. J. Heymans, T. Blenckner, and S. Niiranen. Ecological network analysis, indicators of foodweb changes in the Baltic Sea. Presented at ICES ASC 2009, Berlin .ICES CM/2009/P:04
- J.M. Węsławski and Piwowarczyk, J.: Valuation of Polish coastal waters, "The marine ecosystem in changing climate - on the added value of coupled climate-environmental modeling for the Baltic Sea", Norrköping, Sweden, 16 October, 2009.