Amber Annual Meeting 2010

Location: Leibniz Institute for Baltic Sea Research Warnemünde

Time: 15.3.2010, 9:00-18:00

Participants:

Michael Böttcher, Hannah Brocke, Olaf Dellwig, Barbara Deutsch, Joachim Dippner, Evelina Griniene, Tina Henrich, Jens Hürdler, Karin Junker, Frederike Korth, Markus Meier, Saskia Otto, Federico Montesino Pouzols, Arturas Razinkovas, Frank Schäffer, Maria-Theresa Schafmeister (9:00-13:00), Gerald Schernewski, Tom Schumacher (14:00-16:00), Beata Szymczycha, Markus Venohr, Susann Vogler, Maren Voß, and Ilppo Vourinen

not present:

Rabea Dieckmann, Emil Eirola, Jari Hänninen, Susanna Hietanen, Christoph Humborg, Helena Janti, Lech Kotwicki, Christian Möllmann, Carl-Magnus Mörth, Thomas Neumann, Michael Schlüter.

9:00 Opening and actual information (J. Dippner)

- B. Deutsch, T. Henrich, K. Junker and M. Voss write the protocol.

- The agenda was approved

- The Y1 Report is now available on the web page.

- The Vilnius Conference was viewed as quite successful for AMBER project (6 oral and 13 poster presentations).

- Information was given, that the structure of the meta data base of AMBER may become the official structure of BONUS data base. AMBER would welcome such a decision.

- Two AMBER workshops in 2010 have been announced: A workshop on “Biogeochemistry of Stable Isotopes” (15-23.9) in Stockholm and a workshop on “Climate Modelling” (13.10.) in Norrkoping.

- AMBER has become associated BALTEX Project. Advantage: Free access to BALTEX data base, web presence of AMBER. Please use in the future the BALTEX Logo in presentations.

- AMBER will become associated LOICZ Project. Advantage: Access to LOICZ data base and network, additional web presence of AMBER.

- The participants are kindly asked to concentrate on finalizing the delayed deliverables.

9:15 Reports from the working groups

All participants especially the Ph.D. students gave short presentations on their ongoing work. Before the meeting, a structure was sent with the request to deliver the following information:

- What have we reached so far (including major problems, if there are any)?
- What will be the next steps?
- Which peer reviewed publications are planned?
- Identification of common publications with other working groups?
- Identification of potential "products" for dissemination?

A-Cluster

1. Climate regime shifts (J. Dippner)

2000/2001 a regime shift occurs with the consequence that correlations of NAO with biological variables failed after 2000. Problem: The observed warming after 2000 cannot be explained with heat transport from the tropics to the Baltic and Arctic Sea. Next steps: Analysis of the Brewer-Dobsen circulation and development of a new index that works. Planned publications are a paper on regime shift and a paper on new index. Possible common publications: application of the new index. Products: a new predictor index and an improved potential predictability.

2. Data Analysis and Predictability (K. Junker, WP A3)

Various time series available in AMBER are consolidated (Baltic Proper (BP) and Kattegat (KT) phytoplankton, Archipelago Sea zooplankton, coastal monitoring data (LUNG), and climate indices). The data has been explored with Hovmöller diagrams, principle component analysis and wavelet analysis. A statistical downscaling experiment using NCAR SLP data and SMHI hindcast data as predictor and zooplankton time series of *Acartia* spp. in the Archipelago Sea as predictand indicated that inter-annual variability is controlled by climate variability, whereas the trend is controlled by salinity. The next planned steps are exploration, and statistical downscaling of BP, KT, and LUNG data and the application of POP model to

the data sets. The code fixing of the POP model takes too much time. Planned publications: Inter-comparison of methods to fill gaps in ecological time series, comparison of coastal and offshore Baltic Sea ecosystems regarding predictability, and Prediction of Baltic Sea ecosystem using statistical downscaling Products: identification of dominating factors, relationships and time scales in coastal ecosystem; identification of targets; advice for monitoring (variable, stations, frequency).

3. Regime shift and oscillating controls (S. Otto, D1, D2)

The establishment of data base of hydrological, zooplankton and fish data (cod and sprat) have been presented. The analysis of zooplankton data has started with respect to overwintering, reproduction, and accumulation periods. A first paper is in preparation: Linear and non-linear effects of density-dependence, predation and climate effects on the dynamics of *Pseudocalanus* population in the central Baltic Sea. Next steps and common publication: Cooperation with Archipelago Research Institute concerning hydrology and zooplankton in the Archipelago Sea.

4. Work group report (I. Vuorinen, A1, A2)

The existing monitoring time series have been updated up to today. A manuscript on nutrient concentrations in relation to runoff, loadings and nitrogen and phosphorus concentrations is submitted. The next step will be an intensified cooperation with Aalto University concerning modelling and prediction major Baltic inflows, historical runoffs and bridging zooplankton gaps. Planned publications: 1) High vs. low runoff consequences in Baltic and North Sea, 2) Zooplankton during high and low runoff-salinity conditions, and 3) Herring and zooplankton time series. Common publications with other groups: 1) Missing data of zooplankton, 2) Reaching back the rainfall-runoff series, and 3) Predicting the MBIs. Potential dissemination products: 1) public lectures, 2) articles in newspapers, and 3) an update of the BACC book.

5. Time-series prediction and Chemoinformatics (F. Montesino Pouzols)

Federico Montesino Pouzols as new PI in AMBER gave an overview on possible contribution of his group to the project. Non-linear methods and predictions are of major interest.

6. Coupled Climate-Environmental Modelling (M. Meier, A4)

The analysis of existing scenario simulations is ongoing, calculation of budgets, ecological quality indicators (e.g. Secchi depth, bottom oxygen concentrations, winter nutrient concentrations, cod reproductive volume). Examples are presented. SST warming is different in north and south Baltic Sea. Model data were delivered to project partners (please

coordinate the requests). Next steps: New scenario simulations are in preparation (transient simulations 1961-2099). Feed back from AMBER partners are welcome to improve our model results (observations, e.g. nitrogen fixation rates). Next steps: production of maps. Planned peer reviewed publications: 1) Meier et al. (2010): Climate-related changes in marine ecosystems simulated with a three-dimensional coupled biogeochemical-physical model of the Baltic Sea. Clim. Res., under review, 2) Meier et al. (2010): Quality assessment of atmospheric surface fields over the Baltic Sea from an ensemble of regional climate model simulations with respect to ocean dynamics. (in preparation), and 3) Meier et al. (2011): Simulated changes of ecological quality indicators in future climate (in planning). Potential products for dissemination: maps on the web side.

B-Cluster

7. DOM input and transformation (B. Deutsch, B2, B3, C2)

Sampling reports are given for the March 2009 cruise with r/v Professor Albrecht Penck and the August/September 2009 cruise with r/v Maria S. Merian. Results from a published regression models are presented as an example. They are based on primary emission (i.e. annual N emission from humans, pigs, and cattle), specific runoff, and atmospheric deposition. Scenarios on combined climate and life style effects are simulated using four regional climate change scenarios. The combined effect of life style changes (i.e. increase in animal protein consumption) and climate changes is 3-75% increase in total nitrogen. Next steps: 1) Further processing of samples (TOC/DOC, TOS/DOS, TON/DON concentrations, Stable isotopes ($\delta^{13}C$ -, $\delta^{15}N$ -, $\delta^{34}S$ -DOM)), 2) sampling of the Kalix river will be continued, and 3) Continuing modelling work. Planned publication (including common publications): 1) Comparison of DOM-input and estuarine transformation patterns from three estuaries (Oder, Nemunas, Kalix), 2) Results from the Merian cruise (together with Frederike Korth), 3) Modelling results, and 4) TOC-Budget of the Baltic Sea.

8. Sources, turnover and bioavailability of nitrogen components in the coastal zone (F. Korth)

Most of the dissolved organic nitrogen (DON) enters the Baltic Sea from agricultural land, but the bioavailability is poorly understood. The objectives of the work are characterisation of nitrogen input and its fate, the process modification of nitrogen input and the DON bioavailability. The investigation areas are the estuaries and/or rivers Oder, Nemunas and Kalix. The data base for the process studies is observations in the Kalix and Nemunas River, the Curonian and Szczecin lagoon and a transect through the Baltic Sea. Analysis of the stable

isotope signature of nitrate will give an insight into the N-sources. For the future the following cooperations are planned: 1) Susanna Hietanen (N uptake and losses in the Szczecin lagoon), 2) Michael Böttcher/ Susann Vogler (Source identification of groundwater in the Puck Bay) and 3) Arturas Razinkovas (N uptake and losses in the Curonian lagoon). One paper is submitted to Estuarine Coastal and Shelf Science.

9. Identification, characterisation and quantification of SGD (S. Vogler, B4, B5)

Areas of submarine groundwater discharge (SGD) have been identified and seepages have been analysed with respect to their geochemical composition. The new groundwater lances are presented which allow pore water sampling and first results are shown from the June 2009 cruise with r/v Professor Albrecht Penck and from the sampling campaign in the Puck Bay. Next steps: 1) construction of automated seepage meter for better quantification of SGD, 2) Rn and Ra measurements, 3) application of an in-situ temperature measurement system (groundwater flow direction), 4) sampling of wells and rivers discharging in the Puck Bay (assembly of water balance). Further investigation areas will be the Szczecin lagoon and the Pomeranian Bay. Planned publications: 1) estimation of quantitative composition of groundwater seepage, 2) biogeochemical evolution pathways leading to sulfidic groundwater seeps. Ongoing cooperation exists with working groups in Kiel and Bremen.

10. River basin induced functional changes in lagoon waters (A. Razinkovas)

The aim of this work is the analysis of the changing structure and function of the coastal lagoons with respect to climate change and nutrient availability and limitation. The concept of linking an NPZD model with a trophic network model was presented and a new compilation of a revised total nitrogen budget for the Curonian lagoon. No Russian data are available, but muddy sediment from an area close to Russian border may serve as indicator for the sediment quality in the Russian part of lagoon. The contributions to other partners are data transfer to IGB and sampling support to IOW. One paper is submitted to Hydrobiologia and one paper is accepted for Boreal Environmental Research.

C-Cluster

11. Status quo of WP C4 and C5 (F. Schaffer, C4, C5, D4, D5)

Goal is to model the influence of resuspension to water quality with focus on nutrients and benthic exchange processes. A further goal is the development of a model which covers the whole part of underwater light climate. The adaptation of the MOM/ERGOM model to the Szczecin lagoon is presented. An identified problem is to include macrophytes into the model.

Planned publications: 1) Nutrient and mass balance of the Szczecin lagoon, 2) Modelling underwater light climate and the role of resuspension effects.

12. Nutrient emission modelling (J. Hürdler, C3, D3)

Applications of the MONERIS model to nutrient emissions from the Oder catchment to the Szczecin lagoon have been presented. Assumptions are that lifestyle changes are translated into load changes. Nutrient reduction scenarios and the estimation of their effectiveness are simulated. The effects of changes in temperature and hydrology on the local variation of nutrient emissions are investigated. Socio-economic scenarios are used for up to 2030. The next planned steps are application of different climate change scenarios from SMHI for the Oder catchment and complete the data search to run MONERIS for the Nemunas lagoon. Working titles of planned publications: 1) Modelling future nutrient emissions to the Oder River Basin: An application of socio-economic development and climate change scenarios, 2) Modelling of monthly nutrient emissions and in-stream retention: paper on method, and 3) Consequences of economic transformation processes on water quality of a Baltic coastal lagoon (together with Inga Krämer, IOW). Potential products for dissemination: 1) Presentation of measurement catalog to ICPO (International Commission for the Protection of the Odra River against Pollution), and 2) Discussion of possibility for implementing MONERIS as management tool for the Oder catchment (including of cost effectiveness).

14:00 Invited Presentation from the PROBALT Project: The capacity of the European Union to solve the problem of Baltic Sea eutrophication. (Tom Schumacher)

Tom Schumacher from University Kiel, gave an invited presentation (For details see AMBER web page). He addressed the question on what can society do to improve the environmental conditions in the Baltic Sea? The fact that one third of atmospheric deposition of nitrogen is from distant sources requires the necessity to include non-Baltic-coastal states for abatement strategies. The “Marine Strategy Directive” has unfortunately no binding elements. He pointed out that EU compromises all of the relevant sectors important to fight eutrophication (Common Agricultural Policy, water/air pollution control policy, maritime policy, or Baltic Sea strategy) but that a specific European anti-eutrophication policy is lacking. This presentation was open for all IOW staff.

14:45 Translation: Science into Policy (H. Brocke)

Hannah Brocke gave a student’s view to the topic (for details see web page). She explained the Driving-Force-Pressure-State-Impact-Response (DPSIR) Model, Ecological Quality Objectives (EQO), with its tools Strategic Goals, Ecological and Operational Objectives,

Indicators, Targets and introduced the Ecosystem Approach to Management (EAM). The goals of AMBER cover only a part of EAM, but, a great challenge of AMBER could be a critical review of the EQO defined by HELCOM and a possible improvement in the light of climate change and change in land use.

15:30 Discussion in parallel groups

Time Series Prediction

To achieve a better structured work in the work package a meeting of Cluster A in October 2010 was agreed upon. It was decided that in the time series prediction "zooplankton gap-filling experiment" needs to be done. For that exercise the zooplankton data from the Archipelago Sea should be used for a comparison of methods. However, first attempts showed it's not as simple as anticipated. To overcome the problems it was decided

- to concentrate only to a specific season,
- to consider one species, e.g. *Acartia* spp.

to start as first experiment with the Latvian zooplankton data, generate an artificial gap and to fill the gap with various methods

to compare the prediction with the observation,

- to determine the quality of prediction.
- to apply the same method to the real gap in the Archipelago zooplankton data.

At a later stage other zooplankton organisms may be considered such as *Eurytemora* and Cladocera.

Otto and Junker will discuss within the next two month which common time series experiments they plan with the group of Montesino Pouzols and with Dušan Sovilj while he's visiting the IOW.

Coastal Research and Sampling Activities

A small meeting with the groups actively measuring processes in coastal waters was held. Deliverables are all in time and interesting first results on groundwater discharge and biological effects as well as nutrient turnover and removal were briefly presented. Besides the Curonian Lagoon it was decided to sample the Oder Lagoon on a seasonal basis (if possible) for nutrient uptake and removal. Possible groundwater effects will also be investigated. Maren Voss asked all participants whether all promised deliverables could be achieved.

WP B.1: Maren Voss knows from Susanna Hietanen that there are difficulties in sampling the Kalix river, all other deliverables will be achieved.
WP B.2: Barbara Deutsch reports that the samples in the estuarine gradient were taken from all 3 rivers. The seasonal sampling has only started for the Kalix so far. Odra seems impossible, Nemunas will be organized.
WP B.3: Frederike Korth and Maren Voss report that all deliverables will be achieved
WP B.4: Olaf Dellwig reports that all deliverables will be achieved.
WP B.5: Beata Szymczycha reports that all deliverables will be achieved.
WP B.6: deliverables will be achieved.

Exchange of SMHI data

Markus Meier mentioned that a coordinated planning of data sets is necessary to avoid double work. He recommended using firstly the old data to test the models or routines. Newer, better data will follow. File formats for bigger datasets will be netCDF or GRIB. Single TS can be ASCII. It is advisable to use LINUX to read the GRIB datasets, but libraries exist also for WINDOWS.

16:30 Plenary Discussion

Possible Common publications

The following common publications were identified:

Gap filling experiment (Montesino Pouzols, Sovilj, Dippner, Junker, Möllmann, Otto, Hänninen, Vuorinen)

Combination of future salinity distributions from SMHI scenarios with maps of species distribution to get a picture of future changes of biodiversity in the Baltic Sea (Meier, Vuorinen).

Consequences for groundwater properties when biogeochemical cycles change (Böttcher, Dellwig, Kotwicki, Schafmeister, Szymczycha, Vogler).

Changes in nutrient emission using socio-economic transformation scenarios together with climate change scenarios (Venohr, Meier, Hürdler, Razinkovas).

Discussion science to policy

Dippner proposed to use the HELCOM EQOs as starting point and to proceed from there with suggestions of more focused EQOs. An essential goal of AMBER will be the science – based

development of improved EQOs with respect to climate change and change in land use. A cluster workshop with other BONUS-projects was suggested to discuss this issue on a broader scale.

The future: A follow-up of the AMBER project

Dippner gave an overview on the BONUS 169 activities (see attachment). He proposed three general scientific topics: 1) A project may concentrate on a regional scales, 2) Transient runs of climate change scenarios should be used instead of time slices experiments, and 3) Results from AMBER should be incorporated like groundwater modelling with respect to sea level rise and estuarine processes. There was an agreement to look in the future to regional scale because of different driving forces and strong regional diversity. It was agreed that it is too difficult to discuss details of a future project at the present stage and that the discussion should return to that subject later in the year.

Deliverables

Meier mentioned it is necessary to discuss the format and content of maps for the web-presentation. The following maps were proposed: 1) ensemble mean with defined uncertainty of future and present salinity, 2) bottom oxygen and 3) different nutrient scenarios, changes in mixing depth, and differences in Brunt-Väisälä frequency (up to three maps). For the change in sea level ensemble mean for best and worst case will be presented. It was suggested that for an improved biological understanding not only mean variables should be provided but also extreme situations.

18:00 Miscellaneous

- It was agreed that some smaller meetings within clusters should be held in between annual meetings
- Jens Hürdler won the bottle of champagne for the design of the AMBER Logo.
- The annual meeting was closed.

B. Deutsch, T. Henrich, K. Junker, M. Voss