



Baltic-C Third Scientific Study Workshop

Lund University

8-10 November 2010

Agenda

Monday, November 8, 2010:

13:00 – 13:15: Welcome and organizational information (Ben Smith)

13:15 – 13:30: Introduction to the workshop (Anders Omstedt)

13:30 – 17:00: Achievements and deliverables (each 30 min including discussions and coffee)

Anders Omstedt (GU): *Building predictive capability regarding the Baltic Sea organic/inorganic carbon and oxygen system.*

Magnus Mörth and Theresia Wällstedt (SU): *Status report on large scale modeling and Baltic –C*

Guy Schurgers (LU): *Simulating dissolved organic carbon in the Baltic Sea catchment areas.*

Peter Frodin (LU): *Vegetation modeling, future scenarios and preliminary results.*

Anna Rutgersson (UU): *Atmospheric forcing, air-sea interactions, atmospheric deposition, climate scenarios.*

Maria Norman (UU): *Impact of varying transfer velocities in the PROBE-Baltic model.*

Björn Carlsson (UU): *Analysis of dynamically downscaled climate simulations over the Baltic Sea drainage basin—Evaluation in present climate*

1830- Joint dinner

Summary of day 1.

The first 2 years is almost passed in the program and we are now entering the final year where scenarios will be major challenges. We must also start to think on how we should send out our messages to the society. We should now keep to the scenarios that have been extracted and analyzed by the Uppsala University group. Based on these scenarios the data flow between LU to SU and GU need to be starting. A first version of the scenarios should be available at GU within month 24 or not later than 1 January 2011. This will be called the scenario version 1.0 and later when updates are done in LU or SU new version number should be given. In the Baltic Sea scenario runs version 1.0 should apply Wanninkhof et al., (2009) version both for CO₂ and for O₂ but later the COARE algorithm can be used depending on the Uppsala group recommendations.

Tuesday, November 9, 2010:

09:00 – 10:00

Januz Pemkowiak. *Budget approach to carbon cycling in the Baltic Sea.*

Aleksandra Szczepanska. *Carbon deposition/return fluxes.*

Anna Maciejewska. *POC/DOC for model validation.*

Karol Kulinski. *Burial rates.*

Beata Szymczycha. *DIC and DOC from Submarine Groundwater Discharge (SGD).*

10:00-10:30 Break

10:30-11:45

Bernd Schneider. *Baltic-C cruise with R/V Alkor, 30 June-13 July, 2010.*

Annekatriin Löffler and Bernd Schneider. *Baltic-C data base.*

Bernd Schneider. *The Baltic Sea CO₂ system. Kurt Buch*

Annekatriin Löffler.. *CO₂ gas exchange balances calculated from ships observations in the Gulf of Bothnia.*

11:45- Group photo

12:00-13:00 Lunch

13:00-14:00

Erik Gustafsson. *The Baltic Sea marine system: Human impact and natural variations.*

Moa Edman. *Modelling the Baltic Sea biogeochemical and inorganic carbon system.*

14:00-15:30

Working group 1. Strategies for the Baltic-C scenario runs

See Appendix 1

Working group 2. Strategies for the Baltic-C data base

See Appendix 2

Break

15:30-16:00

The Baltic-C assessment of Baltic Sea CO₂ system. Two papers with several authors need to be written before the end of the program.

1. A scenarios paper with the modelers involved.
2. A synthesis paper for the whole program with all PI's involved.

For the second paper the journal Progress in Oceanography could be an alternative. It is up to the coordinator to initialize the writing in both papers.

Next meeting need to be planned.

16:00-16:45

Discussion about the possibilities to generate a second Baltic-C program with new challenges.

19: 00- Joint dinner

Summary of day 2:

There is a positive development in the program with several interesting new developments. It seems that the different parts are developing in the right direction and that we now need to focus on working through our plans. The Baltic-C scenarios should cover a reasonable set of combination to open up for a range of possible developments. The main thing to learn from this is the system understanding and what are the main control mechanisms. The sediment and research cruise data as well as the Kurt Bush data open up several possibilities for model improvements and increased understanding of the CO₂ system.

Wednesday, November 10, 2010:

9t:00 – 11:15:

Summary of the meeting

Action items including: Annual report, next meeting, BSSC 2011, final BONUS meeting

11:15: End of the Meeting

Action items:

1. Land use change scenarios to be decided by LU and SU that in a consistent way consider the ALARM scenarios. Working group 1 report rewritten by Ben Smith in cooperation with Björn Carlsson, Theresia Wällstedt and Anders Omstedt (Appendix 1).
2. First scenarios submitted from LU to SU should be delivered to GU not later than 1 Jan, 2011. Scenarios should be monthly means to Baltic Sea sub-basins from 1960-2100.
3. Oxygen and pCO₂ “observations” from BY15 should be submitted from GU to Maria Norman. Wannikof 2009 version both for CO₂ and for O₂ but later the COARE algorithm can be used depending on the Uppsala group recommendations (all fluxes?).
4. All Metadata forms must be reviewed and up dated. They should be submitted to Anders Omstedt and David Ryner in good time before the next meeting.

5. The Metadata forms will be the basic description of the Baltic-C data base (Appendix 2). Meta data forms should be ready before next meeting. Added to this a supplementary appendices need to be added to the synthesis paper.
6. Janusz Pempkowiak will send the working group 2 summaries to Anders Omstedt within a week.
7. The coordinator will initialize the writing of paper 1 and 2 including a suggestion for outline. The manuscripts need to be ready as manuscripts before the end of the program.
8. All PI may consider the possibility to get national money to support the Baltic-C work during 2012.
9. All papers that are related to Baltic-C should be e-mailed to the coordinator who will put the references on the Baltic-C web. Photos on laboratory or field work should also be submitted to the coordinator for publication on our web.
10. All presentations will be transformed to pdf-files and put on the Baltic-C internal homepage.
11. The annual report for 2010 need to be submitted after Christmas. Anders will send out the 2009 report and instructions.
12. Information on BSSC meeting and submitting abstract should be mailed to all.
13. Next meeting will be in Sopot 24-26 May, 2011.
14. Final BONUS meeting prel. Dec 2011.
15. Mail to Matti P.

Thanks to all for your contributions



Appendix 1

Coordinated scenario strategy for Baltic-C

Arising from an outbreak discussion at the Baltic-C workshop in November 2010

Document history: Ben Smith 2010-11-10

Background

Scenarios of possible future changes in greenhouse forcing, climate and human land use are needed to provide a basis for the analysis of interactions and feedbacks in the Baltic Sea CO₂/O₂ system accounting for land-sea biogeochemical coupling. For a coherent analysis of the system dynamics, it is obviously important that the same information on specific driving variables be used to force models of different components of the coupled system, and that spatial and temporal variation in different driving variables be consistent with each other in terms of underlying assumptions.

It was previously decided to adopt a selection of the IPCC-SRES narratives, and climate model simulations based on these, as the basic scenario framework of Baltic-C. Seven GCM scenarios, downscaled for the Baltic Sea Basin using the RCA3 RCM were chosen to span the possible future climate development of the 21st century and to accommodate uncertainty in the true nature of the global climate system (represented by three different GCMs), natural climate variability (represented by three ensemble members for the ECHAM5 GCM) and the future course of socio-economic development (represented by three GHG emissions scenarios).

In the present document, we discuss additional considerations relevant to adopting scenarios of land use change consistent with the underlying socio-economic assumptions of the SRES-based GCM scenarios already chosen. By *land use change* we envisage both land cover transitions (e.g. forest to agriculture) and nutrient loads associated with e.g. agricultural management.

We also discuss criteria for handling bias in the scenario data when used to force the Baltic-C models.

Aims of the scenario analysis (clarification)

It was emphasised that the primary aim of the future scenario analysis in Baltic-C is to explore the dynamics and sensitivities to major forcing factors of the Baltic-C system in a framework relevant to what we know or may expect in terms of future changes in the drivers. It is not realistic nor intended to provide predictions or projections of any “accuracy”. Thus the main criteria for the choice of scenarios to explore are that they cover the scope of possible future changes in a comprehensive

way, maintaining realistic relationships between different driving variables, and accommodating major aspects of uncertainty.

Ensemble approach

The approach will be based on analysis of an ensemble of simulations, each exploring responses to one or a combination of driving factors, i.e. climate, emissions, anthropogenic land cover change, anthropogenic nutrient loads. The ensemble will be designed in such a way as to address “single factor” and overall (multi-factor) responses in an adequate way, while keeping the number of individual simulations to a reasonable number.

An additional consideration concerns the inevitable bias all climate models show in the representation of actual historical climate. The bias can be reduced by subtracting the difference (anomaly) between average model simulated values for a given parameter (e.g. temperature) and observations of the same parameter for a control period/simulation from simulated values for a scenario simulation. This so-called delta change approach may potentially lead to more “realistic” simulation of future changes by impact models when driven with the bias-corrected climate model output. It has, however, been criticised because the independent correction of bias in different parameters may be expected to break the physical consistency between them. Since there are arguments both in favour of and opposed to the delta change approach, it was considered desirable to simulations driven both by delta change-corrected and uncorrected climate model output.

Based on the above considerations, a suite of 15 scenarios was recommended (Table 1). The baseline climate/SRES scenario is ECHAM5-A1B-#1. All other scenarios represent a deviation in terms of one or more factors from this base scenario.

| | <i>GCM</i> | <i>SRES narrative</i> | <i>Ensemble member</i> | <i>Land cover</i> | <i>Nutrient loads</i> | <i>GCM bias correction</i> | <i>Factor addressed</i> |
|----|------------|-----------------------|------------------------|-------------------|------------------------|----------------------------|---------------------------------------|
| 1 | ECHAM | A1B | #1 | present-day | present-day | none | (baseline scenario) |
| 2 | ECHAM | A1B | #2 | present-day | present-day | none | natural variability |
| 3 | ECHAM | A1B | #3 | present-day | present-day | none | natural variability |
| 4 | HadCM | A1B | | present-day | present-day | none | climate system |
| 5 | CCSM | A1B | | present-day | present-day | none | climate system |
| 6 | ECHAM | A2 | | present-day | present-day | none | emissions (higher) |
| 7 | ECHAM | B1 | | present-day | present-day | none | emissions (lower) |
| 8 | ECHAM | A1B | #1 | GRAS | present-day | none | land cover change |
| 9 | ECHAM | A1B | #1 | present-day | "medium" | none | nutrient loads change |
| 10 | ECHAM | A2 | | BAMBU | "business as usual" | none | multi-factor, "business as usual" |
| 11 | ECHAM | A1B | #1 | GRAS | "medium" | none | multi-factor, "balanced policy" |
| 12 | ECHAM | B1 | | SEDG | Baltic Sea action plan | none | multi-factor, "environmental" |
| 13 | ECHAM | A2 | | BAMBU | "business as usual" | yes | bias-corrected version of Scenario 10 |
| 14 | ECHAM | A1B | #1 | GRAS | "medium" | yes | bias-corrected version of Scenario 11 |
| 15 | ECHAM | B1 | | SEDG | Baltic Sea action plan | yes | bias-corrected version of Scenario 12 |

Note on bias correction

The specifics of the delta-change bias correction were discussed and the following agreed:

- Bias-correction factors (anomalies) will be based on the relevant climate model control simulation compared to observations, averaged over the control period 1961-1990.
- Independent anomalies will be applied to each calendar month and grid cell on the 50 × 50 km "RCA" grid

- Arithmetic anomalies will be applied for temperature; for other variables such as precipitation and radiation, geometric anomalies are to be preferred to avoid physically impossible corrected values (negative precipitation etc)
- Anomalies will be applied equally (for a given month and grid cell) to all years of the relevant climate model scenario
- **Björn and Peter** will collaborate on producing the delta-change corrected climate data files
- LPJ-GUESS requires longer-term (c. 100 years) historical data to spin up vegetation and soil carbon, avoiding sudden shifts in the transition from spin up to historical/scenario climate. **Peter and Ben** will take responsibility for constructing such a dataset based on CRU gridded climate.

Observed climate data

Shortcomings have been noted in the RCA-downscaled ERA-40 historical climate data set used thus far for testing and calibrating Baltic-C models. Significant biases in precipitation and cloudiness were of particular concern. A new baseline observed climate dataset will be compiled for use in finalising models as well as delta-change bias correction. Data sources for this revised climate dataset were agreed as shown in Table 2.

Table 2.

| | <i>Land</i> | <i>Sea</i> |
|----------------------|-------------|------------|
| Temperature | E-obs | ERA-40/RCA |
| Precipitation | E-obs | Raw ERA-40 |
| Cloudiness/radiation | CRU | ERA-40/RCA |

Appendix 2

Strategies for the Baltic-C data base

The Metadata forms will be the basic description of the Baltic-C data base (Appendix 2). Meta data forms should be ready before next meeting. Added to this a supplementary appendices need to be added to the synthesis paper.

Introduction, short summary of the Baltic_C data base status, and possible further actions

The strategy for the Baltic-C database was discussed and it was decided that:

a) First level

For the first level all data should be described using the metadata form developed within the AMBER program. Some scientist have started up to fill these form and they are given on the Baltic-C homepage under metadata files (<http://www.baltex-research.eu/baltic-c/metadata/metadata.html>). All data including model runs should be reported according to this form. Also a copy of the data should be mailed to the coordinator who will store them as a back-up.

b) Second level

For the second, more detailed, level a supplementary appendices should be added to the synthesis paper.

c) To be considered

- The contact person should be a person that is available to reach.
- Storing data in the institutional data bases and preserving a link to Baltic_C
- Making authors of the data, and institutions where data were produced visible/ finding a way to cite them in the papers that use the data