



## **Baltic-C Fourth Scientific Study Workshop on the Baltic Sea carbon cycle**

**IOPAS, Sopot**

**24-26 May 2011**

### **Minutes**

***Tuesday, May 24, 2011:***

13:00 – 13:15: Welcome and organizational information (Karol Kuliński)

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

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

WP1. Anders Omstedt

The program is in its third year and will end 31 December 2011. Baltic-C Science Steering Group (BCSSG) represented by the PI's is established and administration works well through the BONUS electronic system, workshops and meetings. Several members of Baltic-C are involved in the BACC II process, which is one important outreach activity. Contacts with BALTICStern, HELCOM and the Swedish Institute of the Marine Environment are other examples of outreach.

Several publications will come including the Bornholm Book, Guide for process modeling of lakes and coastal seas. New book chapters will also be coming from Anna Rutgersson and from Bernd Schneider. During the Baltic-C period Bernd Schneider has appointed to become professor at Gothenburg, Magnus Mörth and Christoph Humborg professors both in Stockholm and Anna Rutgersson professor in Uppsala.

WP2. Bernd Schneider and Annekatrin Löffler

During Baltic-C several important activities have been taken place with regard to observations on the CO<sub>2</sub> system. The Baltic-C cruise data, the Cargo vessel data and also new platform data with high temporal resolution of pCO<sub>2</sub> have been collect, analyzed and served as inputs for the modeling. This data gives new knowledge about the Baltic Sea, providing new insights into biogeochemical processes such as biological production, mineralization, CO<sub>2</sub> dynamics and phosphorus dynamics. The Baltic-c data set provides an excellent source for model development and validation.

BALTIC-C cruises are listed below.

MERIAN	(IOW)	18.06. – 14.07.2008	(“MSM 08/03”)
ARANDA	(FMI)	12.01. – 06.02.2009	(„Baltic C”)
ARANDA	(FMI)	26.03. – 08.04.2009	(“CO <sub>2</sub> /ALKA/WAVE”)
ARANDA	(FMI)	03.08. – 10.08.2009	(“FYTO 09/COMBINE 3”)
MERIAN	(IOW)	28.08. – 08.09.2009	(“MSM 12/04a”)
ARANDA	(FMI)	11.01. – 04.02.2010	(“Baltic C”)
ARANDA	(FMI)	09.08. – 27.08.2010	(“COMBINE3/Trofia”)
ALKOR	(IOW)	30.06. – 12.07.2010	(“AL356”)

### WP3. Matti Pertillä

A new data base with regards to river runoff to the Baltic Sea has been created and submitted to SU for model development. In general a large amount of data has been collected- but still important rivers are missing such as the Neva River.

Analyze of the CO<sub>2</sub> system and in particularly pH require that the seasons are treated separately. For acidification winter values are important and for eutrophication summer values reflect biological production. The WP has generated the first maps of the Baltic Sea horizontal distribution of pH and Omega with interesting implications.

It is obvious within Baltic-C that the monitoring programs need to improve with regards to pH measurements. A recommendation on improved praxis will be formulated as a result from the Baltic-C research.

### WP4. Janusz Pemkowich

An overview of WP 4 activities was given 25 April, see below.

Aleksandra Szczepańska presented: “Carbon return flux from the Baltic bottom sediment”

Anna Maciejewska presented: “POC and DOC dynamics in the southern Baltic Sea - -model and experimental verification”

Both presentations outline the topics for pH D thesis work and they are both planned to be ready next year.

WP5. Anna Rutgersson

The different deliverables are in good shape and some more works are needed as listed below:

- D24: Improved parameterisations of the gas exchange transfer velocity, month 18. Work is ongoing and will come in September.
- D25: Measurements from the first 12 month of the project from the Östergarnsholm station, month 18. Measurements running and data will soon be delivered.
- D26: Acidic depositions for the Baltic Sea drainage basin, month 8. Done
- D27: Compiled present and future scenario, data + land use data for the Baltic Sea drainage basin, month 12. Done.

The WP has successfully been able to collect a large amount of data for model studies and for scenarios run. Also new measuring data from Östergarnsholm and a new parametrization on air-sea gas exchange is on its way. All should be delivered not later than September, 2011.

The WP has demonstrated in an elegant manner that forcing data and climate model data are freely available and could be used by independent research groups. This is of course of high scientific value as reproduction of different groups finding is the base for science development.

WP6. Benjamin Smith and Peter Frodin:

The vegetation model is now developed and applied for the 15 Baltic-C scenarios. This is the first time that a dynamic vegetation model is applied in Baltic Sea research. The different climate forcing fields are under investigation. First view illustrated that with temperature increase DOC increases. The preliminary conclusion is that in general only a weak correlation between DOC single climate factors.

#### WP 7 Magnus Mörtth and Teresia Wällstedt

The first results from the 15 Baltic-C scenarios have been run. As the scenarios in general are quit wet due to too much precipitation, the modeling have problems and it seem as only the delta-change scenarios could be used. As this limit the possibility to analyses different scenarios Benjamin Smith suggested that we should run delta-change on all scenarios. The group will analyses the calculations of total alkalinity and look into the possibility of extra alkalinity sources. The first general conclusions from the work were outlined as follows:

- Concentrations of DIC, Alk and DOC generally relatively constant, changes up to 10%
- Flux changes mainly driven by runoff.
- Only scenarios with delta change give reliable results.

#### WP 8 Anders Omstedt, Erik Gustafsson and Moa Edman

Erik Gustafsson and Moa Edman presented results from validation studies introducing objective measures. The validation was performed for a number of important parameters and for three regions: the Kattegat, the Baltic Proper and the Bothnian Bay. The results were discussed and Bernd Schneider suggested that ammonium should be added to the validation.

1830- Joint dinner

#### ***Wednesday, May 25, 2011:***

0900 WP 4 Janusz Pempkowiak presented an overview of WP4 including deliverables. Starting from the budget approach IOPAS have quantify the fluxes organic and inorganic carbon within the Baltic Sea region. The budget gives intresting implications and calls for field studies. Extensive field measurements have been performed by the group by collecting and analyzing sediments cores from different regions and from different sediment types. It is shown that the sediments are important sink for C but also large amounts of C are recycled.

0930 WP 8 Anders Omstedt was giving a presentation about "Baltic Sea acid-base balance in the future?" The presentation was based on forcing data from the other groups and was our first effort in modeling the future effects in pH. Objective measures were used illustrating that most scenarios show poor performance expect for the three delta-change runs. Forcing problems were illustrated in total alkalinity were the inflow data from SU was probably too low. We discussed possible reason for this as missing alkalinity due to diffuse sources or due to modeling errors? Strong acidification signals were calculated in the deeper parts of the Baltic Sea. Based on the discussion and new data from SU the model will be re-run.

1000-1145 Working group activities

The group was divided into two working groups:

Working group 1. Scenarios and modeling

Working group 2. Baltic-C deliverables, Baltic-C data base, Baltic-C outreach

1145- Group photo

1200-1300 Lunch

1300- Reports from the working groups and summarized in a number of action items, see below.

1400- Maija Sirola from BONUS presented the coming activities including outreach strategies. Several levels of information tools will be available such as posters, briefing documents, BONUS high lights, BONUS Newsletter, BONUS WEB, panel meetings etc. More information about this will be given during the BONUS meeting in June.

1500- Björn Carlson Claremar made a presentation about the delta change method.

1530- Karol Kuliński presented new ideas about how one could distinguish between Corg coming from land or sea.

16:00-16:30 Discussion about new BONUS calls

The call information will be available in the end of August. Anders will invite Baltic-C member to a first meeting about a new BONUS proposal with focus on the carbon cycle. The meeting will take place in Gothenburg 6 September.

19: 00- Joint dinner

***Thursday, May 26, 2011:***

9:00 – 10:00: Summary of the meeting and action items

11:00 End of the Meeting and thanks to Karol Kuliński and IOPAS for organizing an excellent meeting in a beautiful environment.

**Action Items:**

1. All PI's must go through their deliverables and submit them through the BONUS electronic system.
2. References on all publication, including chapters in books, which could be related to Baltic-C should be submitted to Anders and he will then put the information on our homepage through the BALTEX secr. Also information about if anyone has been involved in summer schools activities etc.
3. Bernd, Anna, Magnus and Christoph have been appointed professors during the Baltic-C research program. Inform Anders about when, where and in which area the professorships are directed and this will come into the final report as added value. Also PhD examinations or other examinations need to summarize.
4. All Baltic-C cruises need to be put together into a table. Annekatriin have sended this information to Anders, thanks.
5. Matti and Bernd? Should write a short recommendation of pH measurements that address the need for improving the pH measurements in the monitoring programs. This recommendation should be given to for example HELCOM and the national authorities. The written statement should be mailed to Anders and he will send it to HELCOM and other institutes. The recommendation may also be put on our web.
6. Anna should deliver the data from Östergarnsholm and possible a new parameterization paper on air-sea gas exchange in September, 2011.

7. Peter and Ben should go deeper in the results from the land vegetation model to bring out climate change signals both in time and space.
8. Björn will introduce the delta-change methods in more GCM runs to generate a better data base for scenario studies. The results should be mailed to LU, SU and GU. This should be ready next week.
9. Peter and Ben will perform new runs after getting the delta-change data from Björn and deliver the new calculations within two weeks to SU.
10. Björn will also validate the two pressure points that GU is using for calculating the sea levels in the Kattegat. The results should be mailed to Anders.
11. Anders will take the lead for a scenario paper and outline a draft that involves all modeling activity. The results should present the implication of pH for the future, the reason for driving these changes and an investigation of the role of changes on land. Manuscript should be ready for submission in December 2011.
12. Anders and Moa will send the PROBE-Baltic division into sub-basins to SU and Magnus/ Teresia will create a new data base for river data that gives load to the 13-subbasins of PROBE-Baltic.
13. Magnus and Teresia will investigate the AT river calculations and estimate the possibility of missing sources due to diffuse sources or other reasons. The output from the river runoff calculations could be compared with Table 4 in: Hjalmarsson, S., Wesslander, K., Anderson, L.G., Omstedt, A., Perttilä, M., and L., Mintrop (2008). Distribution, long-term development and mass balance calculation of total alkalinity in the Baltic Sea. *Continental Shelf Research* 28(4–5), 593–601. DOI [10.1016/j.csr.2007.11.010](https://doi.org/10.1016/j.csr.2007.11.010)
14. Based upon the new climate scenarios from UU and LU, SU will re-run their model and send the results to GU as soon as possible.
15. SU will identify some rivers where DOC data is available outside the calibration period. These rivers will be used for model validation studies in LU and SU. The results are an important contribution to the joint scenario paper.
16. Anders/Erik/Moa will identify a number of sensitivity studies to explain the difference between changes due to mineralization, CO<sub>2</sub> increase and temperature increase. Ammonium and Omega will be included in the validation and in the scenarios.
17. Janusz/Karol needs to fill in needed information about deliverables in WP4. If the messages from BONUS are unclear please contact BONUS as soon as possible.

18. Baltic-C data policy will in the first phase rely on our metadata forms. In the second phase the Baltic-C database will be freely available possible through the BALTEX home page. The data base should be made freely available 1 jan. 2013, thus 2 years after ending of the program. The data should already now be collected and put together by GU and Anders will ask BALTEX if they accepted to host the database.
19. BALTIC-C SSG forms the group that is responsible for summarizing the main contributions from the different WP. Based on this material the SSG will summarize the main out comes and publish this together with BONUS Secr. as brief documentation? The results and pictures will also form the base for posters that will be created by BONUS or other partner.
20. Anders will get more information at BONUS meeting 15-16 June and will come back to the SSG with more clear instruction about our outreach activities. Everyone needs already now start thinking about what are the main results we have generated in Baltic-C and communicate this with respective PI's or Anders.
21. The new BONUS call will be available in the end of August. Anders will invite Baltic-C member to a first meeting about a possible new BONUS proposal with focus on the carbon cycle. The meeting will take place in Gothenburg 6 September.
22. We should be prepared for a final Baltic-C meeting, at least for the PI's, in the end of the program. Every PI should plan for a meeting 9 December.

