Baltic-Earth working group meeting on scenario simulations

Meeting: 2014-03-06, 9:15 – 17:30, Plenisalen, SMHI, Norrköping

Participants: Vladimir Ryabchenko, Oleg Savchuk, Bo Gustafsson, Erik Gustafsson, Rene Friedland, Thomas Neumann, Anders Omstedt, Helen Andersson, Christian Dieterich, Elin Almroth Rosell, Kari Eilola, Matthias Gröger, Irene Wåhlström, Ivan Kuznetsov, Semjon Schimanke, Ye Liu, Markus Meier

Minutes: Christian Dieterich

Introduction:

Participants have expressed different expectations on today's meeting.

Among them peer-reviewed paper, commitment on future meetings, thorough discussion of ongoing research, exhaustive literature review, hear about what others in the group are doing.

Organizational details like agenda, lunch and coffee breaks.

To Do:

Anders: Send around C-cycle guide by Oschlies and book chapter by von Storch.

Markus: Within two weeks send email with first instructions.

All: Please give input whether you want to be on the email list.

All: Please give input whether your presentation can be published on the Baltic-Earth page.

All: Think about an appropriate journal for the paper.

Commitments to contribute to a paper:

Thomas, Anders, Rene, Vladimir, Bo, Erik, Oleg, Kari, Ivan, Elin, Helén, Markus

Summary:

Agreement on publishing a paper with the broader scientific community (other marginal seas worldwide) in mind, based on our experience in the Baltic Sea so far. An international journal, read overseas would be best. Paper could be structured like Markus' bullet points from his introduction and it should in some form include an overview of the literature so far. Use our material that is available now and reformulate as a new ensemble of scenarios for the Baltic Sea. Also, there should be key processes like e.g. hypoxia included. Group the material in a way so it could be used as a guide how to setup scenarios for marginal seas, how they can be used by others (higher trophic levels) and where to put extra emphasis. Include a stance on the complexity of the problem. Address different sources of uncertainties, how to deal with them and how to take advantage of the ensemble approach and the variety among the individual members. In addition, a coordination of scenario simulations to be performed during 2014 and later is recommended. Both ensemble simulations and climate change need to be taken into account in revised BSAP calculations.

Scientific contributions:

Markus Meier:

Summarizes scenario results from what has been presented at the last BALTEX conference.

There are differences among different approaches that have been published in the past.

Reasons for model disagreements:

Different loads, uncertainties, model deficiencies in Bothnian Sea, different model sensitivities among models more sensitive: BALTSEM, less sensitive: ERGOM, medium: RCO-SCOBI.

Different implementations of different nutrient load scenarios.

Uncertainties in the hydrological models (maybe also in other models that are used to produce boundary conditions).

Initial conditions are important as shown by the mismatch of reconstruction and initial conditions around 1960 in nutrient pools.

Proposition of a peer-reviewed article (AMBIO).

Anders Omstedt:

Presents papers from Baltic_C

Emphasize on a proper representation of the CO2-O2 system as it links the climate change and eutrophication in a logical way. Also open up for validation through new high resolution pCO2 data.

In hypoxic water you must include alkalinity generationso there is no overestimation of acidification..

Missing source of phosphorus as has been shown by Omstedt et al 2014 at Gotland. Interpret as an uncertainty in knowledge.

There should be a benchmark test for the models (same forcing from the GCMs and other boundary conditions).

Delta change needs to be included in Baltic Sea modelling which adds uncertainties..

The models are much more sensitive to emissions than to different GCMs when simulating acidification.

Remineralization rates are also very important for model results and temperature.

Changing pH has sparked interest in the biologic community because they have not looked yet at seasonal variations and long term trends in pH.

To be able to model the right alkalinity we need the observations

Missing sink could point to sinking which is not right (Thomas).

Missing sink is not important for nutrient cycling (Erik).

Juvenile freshwater from the Bothnian Sea, transparent exopolymers, look into the ferry box data coming in from the Kemi-Gothenburg line.

Erik Gustafsson:

BALTSEM-C

Meant to be able to model organic carbon with separation between terrestrial and marine carbon.

According to measurement of Stepanauskas there is a large variability among different rivers for organic P and N.

River load 340 Gmol/y, Atm deposition 34 Gmol/y as external sources, 90 Gmol/y from the Kattegat for DOC.

The major sink terms (flocculation, mineralization) are poorly constrained. DOC modeling will not help to resolve the model's problems to model the Bothnian Bay.

Erik's reason to introduce DOC is to be able to model isotopes.

Microbiological part in Bothnian Bay? Plankton that doesn’t follow Redfield. Plankton that doesn’t need nutrients. It could be possible to couple BALTSEM-C with color.

Vladimir Ryabchenko:

Geochemical fluxes in scenarios with SPBEM (same as BALTSEM) embedded in circulation model.

Different initial conditions lead to different solutions e.g. for hypoxic areas (10-year spinup).

In SPBEM the nutrient fluxes (PP) are much higher than in the ECOSUPPORT ensemble mean.

SPBEM seems also more sensitive to temperature (higher warm bias in HadCM3 than others).

Would it be possible to do a benchmark on hypoxic are? (Anders).

Different sediment approaches in different models lead to different responses.

Thomas: In ERGOM only 50% of river P is bio-available.

O2 depletion is larger than expected from solubility effect (increase micro activity and interaction with sediment).

To make ERGOM reproduce the “W” in the pCO2 measurements the second increase in pCO2 could be related to plankton taking up C without consuming N and P. Lab measurements show it can happen and it would produce transparent exopolymers.

There is no BONUS funding to gather field evidence to test the hypothesis but IOW will try to get measurements anyway.

Rene Friedland:

With a strong reduction in P loads there is a shift between a N limited system to ta system limited by P during the century.

Anoxic zones don't change too much but the O2 saturation does increase.

According to Friedland 2012 the TN/TP ratio matters.

How do ECOSUPPORT results compare to the TARGREV report?

Plans to set up new scenarios to address issue with the new water directive project.

It would be useful if we could agree on how to setup nutrient load scenarios.

Why do you allow 50% only for P bioavailability?

The bioavailability of river P might decrease with time.

One interpretation that the ECOSUPPORT models are comparable despite the assumptions on the bioavailability on P that differ 50% to 100%.

Bo Gustafsson:

Reports on new BSAP and how the science comes in:

The bloom 2005 seemed to have initiated political action which has subsided now.

The HELCOM way to sell things: clear water on the top (sell this to politicians) below targets below allowable loads, country-wise reduction allocations.

We should have deadlines when to reach the reductions in allowable loads.

Kari Eilola:

P sink with the Baltic Sea is reduced in scenarios (not N sink). Different possible reasons.

Data bases probably need to be carefully maintained.

There is a lack of information on open boundaries of regional models.

Life cycle model for cyanobacteria is supposed to address open questions in N fixation in Baltic Proper which has been funded by VR.

Could data mining be of help to dig up more data for our purpose?

We definitely need processed and quality controlled data in databases.

Kari's approach to calculate TN could help with the pCO2 issue presented by Thomas.

How will RCO-SCOBI look like if we apply 100% bioavailability for P without recalibration?

Different sediment models might be a major source for model sensitivity, especially on longer timescales.

Matthias Gröger:

Missing physical processes in GCMs or even RCMs have a strong impact on biogeochemical processes.

Freshwater input on Baltic Catchment might increase or decrease according to GCM solutions.

Discussion 14:55 – 17:30:

Markus: Put out a paper ASAP to make/let others know how to do it and how not to do it. There is enough material around. SMHI and IOW are about to setup new scenarios this year. We could take into account Bo's new numbers.

Anders: paper to general scientific community? After that we need to get into contact with HELCOM . Then HELCOM might need to fom a working group with guidelines how to run scenarios. Or should we rather go slowly and take a scientific approach that we can develop over the next ten years.

Vladimir: In a couple of month he will know whether they get funded.

Anders has a FORMAS project (SHIpH, Coordinator David Turner) and will continue to work with CO2 including ship emissions.

Bo: BNI will continue on their line of work. HELCOM will be hard to convince to take messages of a bunch of modelers.

Maybe something quick about what we have learned with SRES and how to proceed with RCP.

Markus thinks here about spinup, loads and those things that have been treated differently during ECOSUPPORT.

Thomas has no concrete plans or projects for scenarios but will do some out of personal interest

Bo: First the paper to get the general idea how better scenarios should be produced E-HYPE as forcing? So far, E-HYPE has no carbon in it, but in progress.

Who has time to contribute to a paper during April and May? Thomas, Anders, Rene, Vladimir, Bo/2, Erik, Oleg, Kari, Ivan, Elin, Markus

We have no time for thorough analysis. We should use what's available, but we should agree on common figures. Someone from SMHI should volunteer to collect data from different models to produce these figures. We don't have to decide on which figure now. There will be email on data request.

Let's talk about the recommendations in the remaining time. If possible try to agree now on what the conclusions are.

Anders: Should we do a literature review?

There is limited time till midsummer!

What about material that hasn't been published.

Vladimir will have his results published in a paper with Morten Skogen.

Bo: Use the available data format that was used in ES. It was an effort in itself to gather all that data.

No need to go into the detailed flux discussion.

The purpose is not to do a very complicated paper.

What conclusion can we draw from a couple of similar setup that are still different in important details?

Some sort of discussion of how for example C is treated in different models.

After the experience with the paper with Bärbel it can become complicated and lengthy if we discuss model differences.

Scientifically it might be a relatively thin paper but it will be strong on the variety in different models, groups.

Strength should be on the common recommendations.

We should collect the relevant literature on the Baltic Sea. But we need relevant examples from other marginal seas. For example OSPAR efforts in North Sea. Please disseminate your examples within the group

Brief description on what a biogeochemical for the Baltic Sea needs to include.

Oleg could provide a table on the biogeochemical models that are available.

Laetitia Tedesco hasn't produced scenarios but she could be invited to join the group.

Bo: We should have some Danes on board. Karin …, Marie Maar, Katja Fennel, ...

What do we want to say with that paper?

Like a listing of possible reasons of uncertainties? We can not work out the real uncertainties.

All the added uncertainties are huge and no model will be able to withstand real scrutiny. Still, the models together can produce credible answer.

Manual for best practice by Oschlies for biogeocxhemiccal modeling. Anders sends around this guide.

In combination with the uncertainties and what we have learned.

Don't just present the uncertainties because we want further funding. There are forces working against funding ecosystem modeling.

Our results are continuously used by others in higher trophic levels. That is important.

Build on Markus bullet points from his todays presentation for the discussion of uncertainty.

Science community needs to be able to test other peoples hypothesis. This is why it is so important that data becomes freely available.

We are addressing a very difficult problem how biogeochemistry reacts on physical environment. Chapter by Hans von Storch will be sent around by Anders.

Hydrology models are coming up with N and P but the quality might not be very high. What about C?

Thomas: Yes! It's easy to measure.

Ivan: No! It is an additional uncertainty.

Anders. Yes, uncertainty increases but state of the art advances.

Oleg: Yes, we can address new open question like pCO2 drawdown as shown by Erik, Thomas

Bo: Well, C is living it own live.

Thomas should win a price for this clever ideas to let plankton use C to produce TEP and not build any tissue from N and P.

Paper layout:

Tentative structure for paper could follow Markus' bullet points.

Different GCMs:

Assessment of available GCM and which ones perform well in the Baltic Sea.
Anders: Eric Kjellström says some are good for this and others for that.
Markus: Yes, but this is a view biased towards land surfaces. Not so relevant for us.
Emission scenarios: Two are enough if there are no nonlinear responses.
RCM: Do we need coupled or uncoupled models to downscale?
Atm deposition of nuts: Do we need MATCH or is it good enough to use an idealized forcing.
Most important thing. We need a control run.

Land surface:

It's difficult to assess but it's not just noise. There is an agreement among models that runoff will increase, but Anders disagrees. Anders makes the argument that hydrological modeling needs to take some major steps to improve and reduce uncertainties. We could discuss this in the paper. In the new BACC book there was a good argument.
If we imagine that we were the biologist that use RCM output how would we use RCM results. Because we are in a sense consumers of what is produced by GCMs. We need a guide on how to use other peoples data. This should be in discussed as well.

Uncertainty in models:

Missing processes as shown by Eilola et al 2011.
We need a way to treat the results in a systematical way (statistics).
Uncertain process: Processes related to C

Uncertainty in model sensitivity:

Depending on parameterizations.
Also the example by Vladimir.
Should we recommend to integrate from 1850 to show that models can reproduce past trends.
Anders make the point that trends should be included in the control periods the validate the models ability to reproduce past trends.
We need more Rembrandts to validate that the past trends are really there.

Uncertainties in nutrient loads and bioavailability:

How to build consistent scenarios for the BS?
We don't even know the loads.

It can depend on model formulation.

Official end, 1700:

Please give input whether you want to be on the email list
Please give input whether your presentation can be published on the Baltic-Earth page.
Most people have to leave…

Sprint to the finish line:

IOW is forced to follow MIA. Stakeholders input here.
Does reduction mean reduction from total? It means percentage of a percentage.
Reduce 30% of 50% bioavailable nuts as an example.

Uncertainty in initial conditions:
Store the model fluxes for later analysis (Oleg). That's a recommendation.
Maybe start from at least 30 years before 1950 to produce an acceptable state at 1950.

Sell the paper as a new ensemble and use something like hypoxia as a catchy keyword.
Thoughts about the journal?
AMBIO special issue deadline is 2. June, which is probably too early.
Something visible outside the Baltic Sea would be nice. What are the Americans reading? Environmental Modeling.
One of the EGU journals. Biogeochemical cycles? Maybe Tellus but there is an issue with A or B but not both.

Within two weeks Markus is sending email with first instructions…

Annex 1

Participants of the workshop

1) Vladimir Ryabchenko (Mon+Tue)
2) Oleg Savchuk (Mon+Tue)
3) Bo Gustafsson (Tue)
4) Erik Gustafsson (Tue)
5) Rene Friedland (Mon+Tue)
6) Thomas Neumann (Mon+Tue)
7) Anders Omstedt (Mon+Tue)
8) Helen Andersson (Tue)
9) Christian Dieterich (Mon+Tue)
10) Elin Almroth Rosell (Mon+Tue)
11) Kari Eilola (Mon+Tue)
12) Matthias Gröger (Mon+Tue)
13) Irene Wåhlström (Mon+Tue)
14) Ivan Kuznetsov (Mon+Tue)
15) Semjon Schimanke (Mon+Tue)
16) Ye Liu (Tue)
17) Markus Meier (Mon+Tue)

Annex2

Agenda

5 March, 20:00 – 22:00 SMHI Restaurant “WEIBES KÖK” weibes.se, Norrköping (Building close to the parking place, located left to the SMHI main entrance, please come directly to the restaurant and ask in the hotel Kneippen how to find to SMHI. If you arrive earlier, please make an appointment with another SMHI colleague because I will not be in my office during 15:45-20:00. Registered participants are invited by SMHI for dinner.)

6 March, SMHI, Norrköping:

09:15-09:30 Coffee and tea in the SMHI lobby from the coffee machine, when you register at the reception please ask for internet access to get a password (if you wish)

Plenisalen, 09:30-17:00

09:30-09:45 Introduction

09:45-10:00 Markus Meier: Motivation for the Baltic Earth working group on scenario simulations

10:00-10:30 Anders Omstedt and the Baltic-C group: Scenarios developed in the Baltic-C program

10:30-11:00 Erik Gustafsson: BALTSEM-C - recent development of the BALTSEM model

11:00-11:15 Short health break

11:15-11:45 Vladimir Ryabchenko: Biogeochemical fluxes in scenario simulations for the Baltic Sea in the period 1960-2100 with Saint-Petersburg Baltic Eutrophication Model (SPBEM)

11:45-12:15 Thomas Neumann: Scenario simulations performed with ERGOM, part 1

12:15-12:45 René Friedland: Scenario simulations performed with ERGOM, part 2

12:45-13:30 lunch

13:30-14:00 Bo Gustafsson: what is new in the revised BSAP? Which information would be useful for HELCOM?

14:00-14:30 Kari Eilola, Elin Almroth, Ivan Kuznetsov: do we need better models? Recent developments

14:30-14:45 Matthias Gröger: what has been done outside the Baltic Sea? E.g. NW European shelf under climate warming: implications for open ocean – shelf exchange, primary production, and carbon absorption

14:45-15:00 Discussion (deciding on an outline of the paper)

15:00-15:15 Coffee break

15:15-17:00 Discussion

References

Eilola, K., Hansen, J., Meier, H., Molchanov, M., Ryabchenko, V., Skogen, M., 2013. Eutrophication status report of the North Sea, Skagerrak, Kattegat and Baltic Sea: A model study present and future climate. Tech. Rep. Oceanografi 115, SMHI Norrköping, Sweden, 38pp.