

SCOR-WG 140 - BEPSII Meeting minutes
Ventura, California, Saturday March 16th 2013

Present: Martin Vancoppenolle, Brice Loose, Bruno Delille, Klaus Meiners, David Thomas, François Fripiat, Clara Deal, Lisa Miller, Michel Gosselin, Rosina Grimm, Lynn Russell, Letizia Tedesco, Steve Ackley, Jiayun Zhou, Nadja Steiner, Jacqueline Stefels

The below report also covers issues discussed during pre-meetings for each of the task groups in the period 11-13 March at the same venue.

1. Crosslinks to other programs (ART, PICES, SOLAS, ASPeCt, PAGES, AOMIP, OASIS)

ART (Christine Michel): Contact established. We'll keep an eye on collaborative interests...

PICES (Lisa Miller): Contact established. We'll keep an eye on collaborative interests. Work in Saroma-Ko would be of particular interest to PICES.

SOLAS: Swedish Secretariat for Environmental Earth System Sciences (SSEESS) strives to enhance the Swedish involvement in international trans-disciplinary research efforts. SSEESS proposes the organization of a workshop, involving scientific leaders from SOLAS and Swedish researchers, which centers on research questions addressed in the science plan and Mid Term Strategy of SOLAS. Representatives from Swedish funding agencies will also be invited to give presentations and discuss funding opportunities for existing research proposals or proposals developed during the workshop and involving the Swedish SOLAS network. The workshop is planned to take place in Stockholm, autumn 2013. Jacqueline can present BEPSII's aims and progress, with an open invitation to Swedish scientists to contribute (provided the workshop is before mid October). As a potential collaborator in BEPSII Katrin Abrahamson was mentioned: halocarbon distribution in sea ice.

A workshop on EPS/aerosols was organized by Caroline Leck; polar regions are important source regions. There will be a review paper being produced.

ASPeCt: Is very good in standardizing protocols for ice observations from ships. Until now this comprised mainly physical data. Data are stored in the Australian Antarctic Data Centre: <https://data.aad.gov.au/aadc/seaice/>. Recently chl-a data were added to the database. There are new plans for an observation system around Antarctica using mass balance buoys. A potential future development is to add biogeochemical sensors to the buoys. There is collaboration with the Arctic on observation protocols from ships (Hutchings). All future polar projects into the ice are encouraged to use the ASPeCt protocol.

PAGES-SIP (Sea Ice Proxies): Linkages would be at the level of the biogeochemical processes that control sea ice proxies. That would mean principally:

1. The processes leading to DMS emission for the ice core MSA proxy;
2. The processes leading to release of biomarkers (IP25 and related compounds) into the ocean
3. A better understanding of the conditions in sea ice or sea ice margins that allow the key marker biota in marine sediments (specific diatoms, dinoflagellates etc) to thrive.

The first workshop last year resulted in a special issue of QSR (almost complete: some papers are online now). This includes the review by Vancoppenolle et al (attached), and is perhaps of strongest interest to BEPSII. Most of the plans for the next workshop and the third one are about calibrating,

comparing and compiling sea ice proxy data to obtain ice extents in the past. This may not directly feed back to BEPSII, but SIP will be very interested in anything that puts the proxies on a sounder theoretical basis. James Levine is using an atmospheric chemistry/transport model to assess the impact of changing sea ice and meteorology on how chemicals reach ice core sites. So far he has concentrated on sea salt but he may be able to move on to DMS/MSA later so this would provide a clear point of contact. **François** is planning to go to the upcoming PAGES-SIP meeting in June and present his data on processes driving $\delta^{15}\text{N}$ and $\delta^{30}\text{Si}$ in sea ice, as a potential tool for estimating sea-ice extent.

AOMIP = FAMOS = validating and intercomparing regional Arctic models. Many of our large-scale modelers are part of the group. Since adding biogeochemistry is a clear interest within AOMIP, we can benefit from collaborating. Katya Popova has been taken on board during this meeting.

OASIS: There will be a new meeting in Telluride, June 2013. By tradition, the group has a focus on snow-atmosphere interaction: photochemistry and oxidation processes. They are trying to add more ice-ocean to the group. The latter is the strong point of BEPSII, whereas we are lacking more of the atmosphere-snow interactions. Although probably both groups will go their own way, we should try to combine expertise every now and then by organizing (a) joint meetings. **Brice** will go to Telluride and advocate this to the group.

MOSAIC (SHIBA 2.0) Matt Shupe (CIRES) coordinates this project aiming at a year-round ice flow study in the Arctic. There are quite a few Europeans involved. Currently there are mainly physicists involved and not so much biogeochemists. If they are interested, this could be a good possibility to collaborate. **Brice** is on the mailing list and will contact Matt.

Arctic Science Partnership (Barber/Rysgaard): There is an enormous investment in polar field campaigns the coming years: Amundsen drift station + 3 ice camps in 2015; Hudson Bay (2016), Baffin Bay (2017). You can join! (David T can provide you with the contact).

Antarctic Fast ice Network: This group is coordinated by Petra Heil (Australian Antarctic Division) and aims to derive a baseline of Antarctic fast-ice extent and volume, to observe change in these parameters, and to explore the ocean-ice-atmosphere system. AFIN uses ice mass-balance stations in coastal locations. There are plans to add bio-optical sensor to these stations.

2. Task group presentations with summary of group meetings during GRC

2.1 TG1 on Methodologies and Intercomparisons (Leads: Lisa and Lynn)

TG1 has three primary goals:

1. Methodological review;
2. Intercomparisons and intercalibration projects; and
3. Guide of Best Practices.

Review paper (Lead: Lisa, Michel, Lise-Lotte):

- Well underway: 29 incomplete pages. The biology section has some new contributors. Once a draft is ready the entire BEPSII network will have the opportunity to comment as internal reviewers.
- We are envisioning to end with >>100 pages. Potential journals should be willing to provide us with a full issue. Options are:
 - Progress in Oceanography
 - Methods in Oceanography (Elsevier; new journal. They are eager to get us on board)
 - *Elementa: Science of the Anthropocene*: This is a new open access journal with 6 knowledge

domains of which one is Oceans (<http://elementascience.org/>). Jody Deming will be the editor. Jody and the *Elementa* director have confirmed their enthusiastic interest and have invited us to submit the manuscript to them. Elementa charges a flat publication fee of \$1450, although they can choose to waive that for particularly important reviews. Unless there are objections to submitting to *Elementa*, Lisa will plan to do so.

- **Timeline: Submission by the end of this summer; 'Finished' by next meeting.**

Intercomparison exercises (Lead: Lynn)

Several dedicated projects are needed, because method intercomparisons are incompatible with multi-disciplinary process studies. There are three options to explore:

1. Bringing back multiple ice cores that are milled together to create homogeneous samples for distribution between labs. It was determined that this may be a strategy for intercomparison of EPS analyses (all other parameters were deemed impossible on stored ice cores). Lisa will ask Eric Collins whether he is interested. If so, Klaus should be contacted for potential return of ice cores with RV Polarstern. A comparable control experiment for chl-a has already been done by the Belgium group. Can we retrieve these data and use in the chl-a/HPLC section of the review?? (**J-L & Jaiyun** will report to Jacq).
 2. Ice camps are needed for doing direct melting experiments for biological parameters and processes. This requires field-camp operations where all interested groups can directly participate: Probably 10-20 people for 2-3 weeks. Landfast ice is needed for homogeneity and might involve artificially creating a large patch of young ice. Under-ice spectroradiometers might be needed to check for spatial heterogeneity and choose the best spot for core retrieval -> Klaus.
 - **Francois** will draft a list of biological parameters and an experiment design (due: April 2013). Issues to consider:
 - compare different ice types using same method in different ice
 - compare seasonal variability in different areas using same method
 - compare open ocean (deep, interior) and coastal (shelf) areas.
 - Items to be investigated (report to Lynn by September):
 - 1) travel cost from designated commercial airport
 - 2) per diem cost for lodging/food
 - 3) lodging capacity
 - 4) lab facilities and costs (what kind of labs are needed? bench space and hoods/sinks? more?)
 - 5) vehicle/security/internet/communication costs (for what operations?)
 - Potential locations to explore:
 - Svalbard strongest possibility? (**Agneta**)
 - EU funding
 - Ny Ålesund station proposal calls every 1 or 2 years
 - A number of countries have stations
 - (After-meeting follow-up: Agneta reports that ice has been undependable at both Longyearbyen and Ny Ålesund in recent years, but she will investigate the options).*
 - Hokkaido – Saroma-Ko lagoon? (**Daiki & Jun**)
 - Inexpensive (\$25/day-person)
 - Large freshwater flux at times
- Resolute: Less favorable option due to very high costs and permission process.
Alert (**Lynn**)
Rumor that they've lost their funding

\$3000 round-trip airfare

Lodging for 40 scientists

Barrow (**Eric?**)

Good ice, but expensive for non-NSF scientists (NSF costs hotel+\$60/day?)

Possibility of coordinating with UAF training course

Gaspé Bay (northeast coast of the Gaspé Peninsula, Québec, Canada) – Landfast ice, tides?

(**Michel**)

McMurdo – NZ or US funding will cover logistics (**Brice** & a New Zealander? Pat Langhorn—**Bruno** to ask)

Churchill (Hudson Bay) – a lot of fresh water (**Michel**)

CCGS Amundsen – \$65,000/day

3. Laboratories can be used for controlled physico-chemical experiments, like gas exchange experiments. Not for biological measurements. Potential facilities are:
- CRREL (**Brice**)
 - Hamburg – no point
 - Winnipeg (**Lisa**)
 - Victoria (small tanks, **Lisa**)

Manual of Best Practice:

To produce a manual on our own is not feasible for the near future. Alternatively, we could add a biogeochemistry section to the next edition of Hajo Eicken's book? (**Daiki**)

*After-meeting follow-up: Daiki reports that Hajo is currently in discussions about whether or not to produce another edition of the book, but if they do, it would likely be done next year, and they would be very interested in having us involved. We would **need a volunteer to lead and coordinate our contribution and communicate with Hajo.***

Additional suggestion: to consider publishing the manual on-line as a wiki or other type of living document.

2.2 TG2 on Data (Leads: Klaus and Martin)

This task group has two primary goals:

1. Produce new data inventories and datasets by collation of existing data;
2. Provide recommendations for standardized protocols and databases

Data inventories:

The first dataset on chlorophyll-a from the Antarctic has been published by Klaus and Martin (and co-workers) in GRL 2012 (attached). This inventory was first instigated through the ASPeCt program of SCAR and uses the database facilities of the Australian Antarctic Data Centre. Although ASPeCt was originally more ice physics oriented, they stimulate the data collection of biochemical parameters, so this is a clear topic for collaboration between ASPeCt and BEPSII. The GRL paper acknowledges that the chl-a database is a contribution to the BEPSII goals.

Parameters for the database should be 1) key parameters for modeling purposes, and 2) not suffer from disputed methodology. The latter aspect, for instance, rules-out a parameter like EPS, which is analyzed in many different ways that have never been inter calibrated well. Assigned, key parameters are: chl-a, POC/N, DOC/N, nutrients. Ancillary data like temperature and bulk salinity of the ice cores are important to accompany the key parameters, since they are essential to constrain the models. The

same is true for simple ice-physical data: depth of snow and ice, freeboard. TDIC/alkalinity were discussed, but set aside for the moment since the data set is too limited.

For the **Antarctic** data base, **Klaus** will continue with collecting data on POC, DOC and nutrients.

For the **Arctic**, **Christine Michel** has agreed to lead the data collection together with **Michel Gosselin**. They will start with chl-a.

The challenge is to motivate people to provide their data. This means that the transfer needs to be easy for them, without much effort. Therefore people will be asked to provide excel sheets. Klaus and Martin can provide a Matlab script to convert excel files in the database into other formats.

Contributors should be offered co-authorship on the paper. Also, their data in the database should be linked to a DOI-number, so that the data are always linked to the original owner.

Quality control of the data is essential. It was discussed whether we should leave out the bad data, or keep them in the system and flag as being bad, so that a potential user of the database knows that they are seen and judged. A simple flagging system can be done straight away: "good", "bad" or "potentially problematic".

Questions remaining:

- A safe and user-friendly data repository is needed. Storage of both Arctic and Antarctic data in one database would be nice, but is not essential, as long as good links between the databases can be provided. PANGAEA is an option for the Arctic or the Polar Data Catalogue. It should be regularly updated and kept alive. *Has SCOR ideas?*
- Do we only accept data covering full vertical profiles?
- Do we also include fast-ice data? Yes, but the method should be ok, not be too old.
- A little money is needed for someone to put together the actual databases. Australian project? SOLAS? DFO for Arctic data?

Output: A potential forum to publish the database is the open access journal Earth System Science Data (ESSD; <http://www.earth-system-science-data.net/>), but this will be decided after the collection is done.

Timing: in 1 year: tools ready for extracting data from excel files for Arctic data, Arctic chl-a data collected; discuss at next year's meeting which data center is best. In 2nd year: all data collected, draft of Arctic chl-a paper ready.

Standardized protocols:

Experience within ASPeCt and the new chl-a database can be used to provide recommendations for standardized data-collection protocols. **Klaus** et al. can write this into a section to be published in the review paper under TG1. This section should also contain guidelines on how to apply recommended flags to individual data.

2.3 TG3 on Modeling

Clara Deal agreed to co-lead TG3 with **Nadja**

TG3 has four components:

1. Recommendations from modelers to observationalists,
2. Review papers on major biogeochemical processes
3. Intercomparison of 1D models and publication of a review,
4. Application in regional models with links to global & regional climate modeling.

Recommendations from modelers to observationalists

The aim is to create a short paper/report aiding observationalists in understanding what kind of data and variables modelers need and why and how they are useful.

Who would like to participate? Nadja, Clara, Letizia, Katya?

The consent is that it is a good idea, but the format is not clear. Roland von Glasow suggested a paper is better in the sense that it is citable, but not sure what journal would be best suited. Clara suggests to have a paper feed into the Polar Climate Working Group (PCWG, http://www.cesm.ucar.edu/working_groups/Polar/). They have a working document on the observational needs for climate models in polar regions.

Potential contents of a paper:

- A short explanation on the different kind of models and different approaches and timescales (if it not exists already?);
- Difference between time series, small scale variability and flow scale variability and issues with individual measurements within large scale data sets;
- Explanation that observationalists can help with the development of conceptual models: how many boxes do we need, how do we differentiate what we need and at what scale (M. Reigstad presented a talk at GRC with an example for zooplankton). We cannot model processes that are not understood.
- A recurring point in all task groups was the need for ancillary measurements to go with biogeochemical parameters (e.g. T, S, wind, Boundary Layer Height, etc.).
- Roland started an explicit list of variables:
 - physical structure and chemical composition of the ice
 - information about brine channels
 - fluxes of gases into/out of ice as function of at least temperature so that inferences about possible precipitation processes in ice can be made
 - background atmospheric composition of gases (and ideally aerosol)
 - met parameters: T, humidity, wind, radiation levels (or at least "sunny - overcast")

Review papers on major biogeochemical processes

We don't need another big overview paper, but might want to focus on very specific processes that would be of interest to the community. The idea is not only to describe how the process works, but also (or predominantly) how to parameterize them in a model.

Topics mentioned:

- DIC/Alk – separation during the freezing process (When does CaCO_3 precipitate, does DIC/ CO_2 get released into water or atmosphere? Ratios?). -> **Rosina, Bruno**, Brice, Sebastian, Lisa, Scott/Nicole, Nadja, (Martin)
- Iron and other minerals: what stays/get's produced in ice; what goes in the ocean?
-> **Delphine Lannuzel**, Veronique Schoemann?, Ben, Letizia, (Peter Croot?- to be contacted?)
- Light: parameterization of light transfer in sea-ice especially during transition times (It was suggested to contact/include physics light specialists. Roland: see references by F. Domine et al. on light absorption in snow, atmospheric chemistry and snow albedo)
-> Nadja, Klaus, (potential contacts: Jens Ehn, Bonnie Light (UW), Karen Frey (Clark U), Don Perovich (CRREL-NH), Suzanne Muller, CJ Mundy, Marcel Nicolaus (GRC poster)), (Martin)
- Processes of ice algal release into the water. There are many observations and reviews. Letizia has

recently published a paper on the coupling of algae in sea ice and the pelagic, using data from a Greenland fjord (Tedesco et al. Ecological Modeling 226, 2012). In Martin's paper there are several references on this subject. Michel can provide references of field data. A review on this topic including (new?) models and observations would be welcome.

-> **Letizia**, Nadja ?, Diane ? ...

- From Roland's mail: include the atmospheric chemistry link. Some review papers are currently in press (e.g. Bartels-Rausch et al.) Relationship between snow microstructure and physical and chemical processes. Do we need a review for our purposes? Roland?
- Elena: review the parameterization of turbulent mixing in the Arctic Ocean models;

When putting together these we have to remember our task of linking/bridging of scales - identify important processes in process scale models – simplify for application in regional and potentially global scale models.

Intercomparison of 1-D models (Physical and biochemical).

Four different intercomparison exercises were identified:

1. General ice-phytoplankton models (includes light and brine drainage??)-> Letizia, Martin, Clara, Ben, Alexandre Forest (Nadja's), Diane Lavoie (Eiji Watanabe? Clara will contact him).
2. DMS -> Clara, Letizia?, (Nadja)
3. Physical: convective mixing (EoS), ice thermodynamics, advection processes -> Elena
4. Atmosphere-ice? -> Roland

There are now 7 1D ice-biochemistry models and a few new ones to come: models from Letizia, Martin, Clara, Ben, Nicole, Kevin, Alexandre Forest, Nadja, Diane Lavoie (Eiji Watanabe? Clara will contact him). **Letizia** will send out an email to ask people to contribute: what is their latest model description, what are the main features/strengths of each model, what would be important parameters to compare (e.g. light response, efficiency of nutrients dynamics (link to physics), PP and C export, DMS, ...).

Letizia will compile all info and aspects of the models including the physical setup (modeled, prescribed, scale) and send out an email with a summary of major common and different features and a tentative suggestions of what we can commonly (or at least partly commonly) look at and which questions we are able to answer together. All feedbacks will be combined in a plan for model experiments. For these experiments **long time series** of data are needed. Potential datasets were identified:

- CASES Franklin Bay 2003/2004, CFL -Lisa – get access to that.
- Ice Station Weddell – atmosphere lacking
- Palmer tsr water column, but not much bio
- Fast ice near Neumayer – T, S, bio -> Gerhard Dieckmann?
- ISPOL – 1 month high resolution – Jacqueline to compile in April
- McMurdo Sound -> Bruno et al.?
- Resolute data – Michel, CJ, Lisa, Tim, Maurice
- Barrow data 2002/2003
- Kobbefjord: Western Greenland....pelagic, snow/ice 2006
- Point barrow, to be checked?
- Dumont D'Urville -> Bruno

Any volunteers to help with sorting out a heterogeneous (both poles) dataset? -> Martin, ...

Timeline: Model runs ready for the next BEPSII meeting -> discuss there. Papers ready before the 3rd meeting.

Observationalists who provide the datasets should become involved in the intercomparisons.

Link to regional modeling and global earth system models:

Contributors: Nadja, Clara, Katya, Elena -> strong link with AOMIP

This component will deal with the applicability and relevance of small-scale processes and model parameterizations in 1-D models to the larger scale models.

Elena: Modeling of temperature, salinity and currents is essentially a three-dimensional process. If, however, we still put the emphasis on one-dimensional physical parameterizations, the most important is the parameterization of turbulent mixing. On the basis of the numerical model (ICMMG SB RAS) we can simulate thermohaline structure of the Arctic Ocean for different parameterizations of vertical mixing. We can offer AOMIP participants to conduct this experiment, thereby paying special attention to the reproduction of a homogeneous mixed layer depth (Measurement data are needed for comparison.)

The following items have been identified at the last AOMIP/FAMOS meeting:

- a) Pan-Arctic ecosystem models: what observational information do we have to verify them?
-> lead: Katya Popova
- b) Arctic biological provinces in models and observations -> lead: Clara Deal
- c) Downscaling and future predictions of the Arctic ecosystems under IPCC emission scenarios
-> lead: Nadja Steiner
- d) Ocean-atmosphere exchange of pCO₂ in the models and its verification against new data sets
-> lead: Meibing Jin

Further discussion on possible AOMIP/FAMOS ecosystem experiments during the GRC and SCOR meeting lead to the following two directions as most suitable to pursue for the moment:

1. *Primary production of the ice-covered areas and its contribution to the pan-Arctic estimates.*
The idea is based on the fact that satellite-derived algorithms for primary productions are valid only for areas with less than 15% ice concentration. This approach misses a substantial proportion (if not the majority) of primary production in the basin. The study will involve existing model runs and comparison with satellite-derived estimates.
2. *Shelf-basin exchange of nutrients as a control mechanism for the Arctic Primary production.*
The idea is based on original hypothesis by Aagard and recent publication by Nishino et al (in press) documenting changes in the shelf pump following reduction of the sea-ice and also numerical experiments by Popova et al (in press) showing that the mechanism can sustain at least 1/4 of pan-arctic primary production.

These ideas will also be posted on the FAMOS website:

<http://www.whoi.edu/page/live.do?pid=115676> (Experiments => Ecosystem Modeling)

Discussions will be continued at the next AOMIP/FAMOS meeting in Woods Hole in October 2013.

3. Discussion: overarching issues, meeting possibilities, webpage, publications etc.

- Should we write an EOS meeting paper on this meeting? Ask the editor first.
- Options for the next meeting:
 - IGS - International Symposium on Sea Ice in a Changing Environment, Hobart, Australia, March 2014 (pdf with session topics attached and on IGS site: <http://www.igsoc.org/symposia/2014/hobart/>)
 - Ocean Sciences meeting (AGU/ASLO/TOS), Honolulu, Febr 2014: <http://www.sgmeet.com/osm2012/>
 - EGU, Vienna, Austria, April 2014: <http://www.egu.eu/meetings/calendar/egu/>
 - IMBER- Open Science Meeting, Bergen, Norway, June 2014: <http://www.imber.info/index.php/Meetings/IMBER-OSC-2014>

We will do a poll amongst the full network, to get as many people as possible.
- Outreach:
 - **Jayun** will contact APECS to ask whether they want to organize a meeting with us before the next BEPSII meeting: e.g. on the topic “How do you run a working group.”
 - In the case of a field campaign, we could invite high-school kids to join in on one of the experiments. However, this may not take place before the end of this SCOR-period.
 - Do we need our own webpage? Ask SCOR. Or can we just use the SCOR web site and link to:
 - A Facebook page: **Jayun** and **François** will start one and find out how everyone can post his/her own message.
- There should be a link to the ASPeCt database on the SCOR website.

16:30 End of meeting