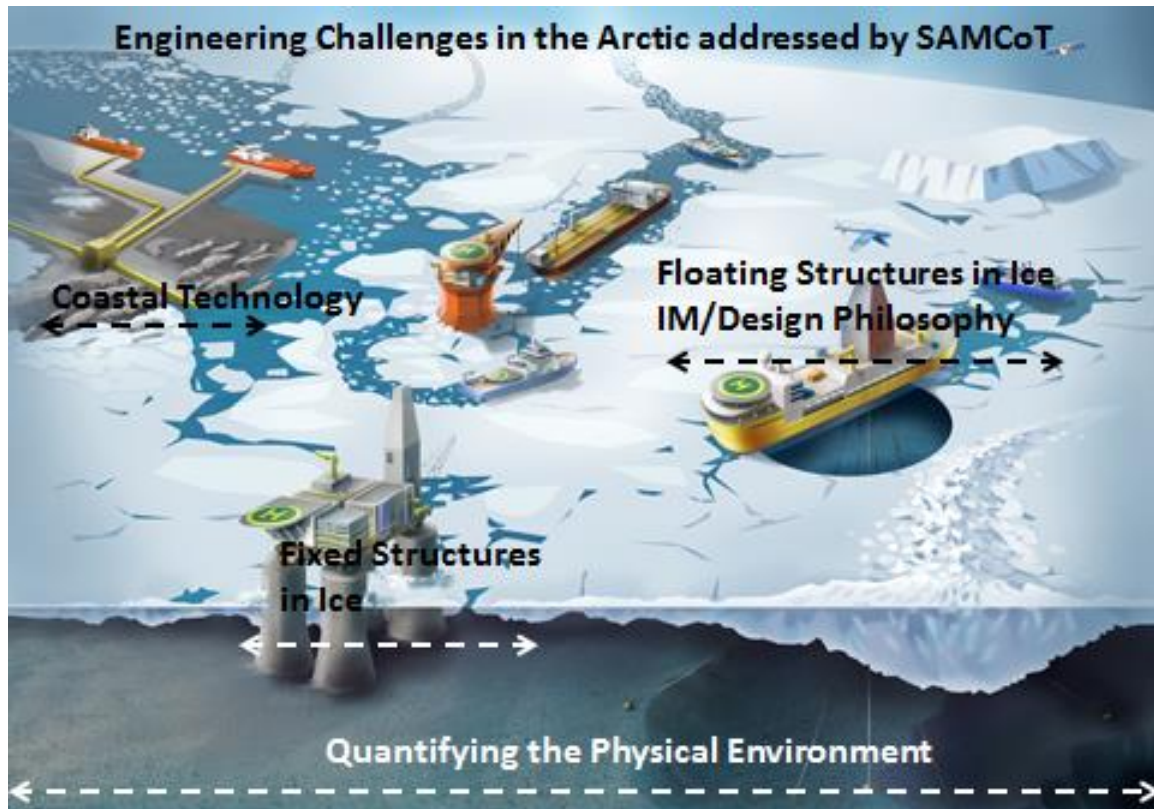# SAMCoT News Letter 02/2013 (February-April 2013)

Administrative reporting

Most of the research activity in SAMCoT can be summarized in the figure below.

Briefing on Activities:

HSE: Safety course at UNIS

- Week 3, 2013.
- SAMCoT participants: Andrei Tsarau (NTNU); Chris Keijedener (TUDelft); Hayo Hendrikse (TUDelft); Stanislav Pavlov (UCL); Peter Sammonds (UCL)

2nd International WP Workshop arranged 5th and 6th February 2013

The two annual workshops of SAMCoT, the PhD Workshop in the autumn and the WP Workshop mid-winter are too similar in their format. Suggestions:

- The PhD Workshop may benefit in having more of a conference format and run over two days. Discussion at a more scientific level, where PhDs do not present a summary of what they have done or the plans of what they will do, but concentrate on a fewer specific scientific topics where time allows feedback.
- The WP Workshop should focus on the overall strategy where the WP Leaders/Deputy-Leaders present their strategy and achievements. Research priorities should be discussed for each WP.

The PhD candidates/postdocs should attend, but with main discussion between Industry and Research participants at a less scientific detail level.

The priorities from the WP Workshops are listed in the WP briefing included in this newsletter.

Recruitment:
One new PhD student (Petter Norgren) with funding from NTNU has started in WP5 (see details on page 10).

SAMCoT`s Annual Report for 2012:

A digital version was sent to the Research Council of Norway (RCN) following the reporting deadlines from the RCN.

The printed version is underway to SAMCoT`s Parties Representatives (GA, Board, EIAC, SAC) for internal distribution.

An electronic version is posted on SAMCoT`s webpage and can also be found at the e-room: HERE.
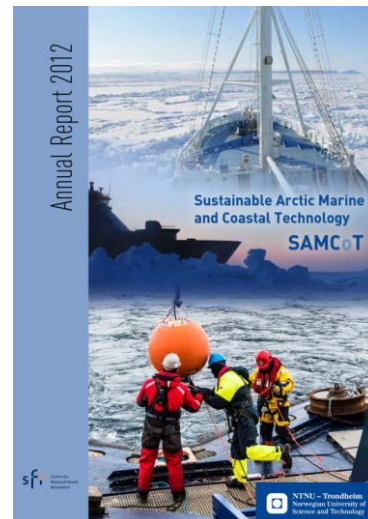
Achievements:
- 2nd International Work Packages Workshop arranged 5th and 6th February 2013
- 1st EIAC meeting 2013
- SAMCoT Annual Report 2012
- SAMCoT Newsletter 02-2013

Notifications:
SAMCoT`s Board Meetings for 2013:

1st SAMCoT Board meeting 2013:	Tuesday 21st May	Trondheim
2nd SAMCoT Board meeting 2013:	Wednesday 20th November	To be decided

SAMCoT EIAC 2nd meeting in 2013:

Date/Time:	Tuesday 11th June, from 15:00h to 18:00h.
Location:	POAC 2013, held on the Aalto University campus in Finland.

Reporting of In Kind and Cash incurred costs from SAMCoT Parties:
All SAMCoT Parties will be requested to report three times a year on incurred costs, both In Kind and Cash, related to SAMCoT Activities. The reports should be sent to the Center Coordinator.
- **DATES**
  Reporting of 1st half 2013: deadline *July 15th 2013*.
  Reporting of 2nd half 2013: deadline *December 1st 2013*.
  Final Reporting 2013: deadline *January 13th 2014*.
- **FORMAT**
  For the reporting all Parties will use the financial reporting form from the RCN. It can be found HERE (SAMCoT e-room; templates; deliverables and costs).

Work Package 1: Data Collection and Process Modelling

Briefing on Activities:

Field works on sea ice in Svea (March 4-16):
- Strength tests on land fast ice in the Svea Bay: uniaxial compression, flexural strength tests with cantilever beams, indentation tests
- Measurements of land fast ice deformations, ice loads near shoreline and ice loads on cofferdam of the fixed quay in Kapp Amsterdam
- Measurements of tides, sea currents and CTD profiling in the Van-Mijen Fjord
- Investigations of river run off in Braganzavågen in the ice season

Field works in the coastal zone in Longyearbyen:
- Measurements of soil temperature and pore pressure around submerged water pipeline in coastal zone of Longyearbyen
- Erosion profiles near Vestpynten

Laboratory works:
- Experiments on thermal expansion of saline and freshwater ice in the UNIS cold laboratory

Modelling:
- Harmonic analysis of tides in shallow water regions and channels in the Svea region, numerical simulations of tide induced currents.
- Elaboration of mathematical model describing heat transfer in the soils of coastal zone of tidal seas
- Numerical simulations of flexural strength tests
- Numerical simulations of ice loads in shallow water coastal zone induced by tidal variations of the water depth
- Analysis of CTD and ADCP profiling near the iceberg in the Greenland Sea

GIS development:
- Analyses of the date of ADCP profiling near an iceberg in the Greenland Sea
- Mapping of river run off in Braganzavågen

Educational activities at UNIS/NTNU and abroad:
- AT-211: Ice Mechanics, Loads on Structures and Instrumentation; AT-205 Frozen Ground Engineering for Arctic Infrastructures; AT-329 Cold Region Field Investigations (A. Marchenko, J.O.Larsen, A.Sinitsyn)
- AT-307F co-supervision on course "Arctic Offshore Engineering – Fieldwork" (A. Sinitsyn)
- Invited lecturing in Ice winter school in Dalian University of Technology (A. Marchenko)
- Other supervision/activities of MSc students:
  - NTNU: Rohit Kulkarni has been working on his study of sediment transportation outside of the coastal permafrost research site of Baydara, supervised by R. Lubbad.
  - UNIS: MSc student Antonia Linzbatch has been working on analysis of data from 3D laser scanning in Vestpynten. Erosion profiles and erosion rates were analyzed. At the moment Antonia is working on erosion protection solutions at the Vestpynten research site, supervised by A. Sinitsyn.
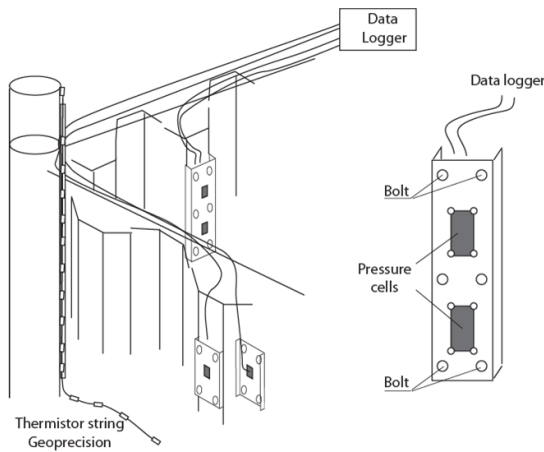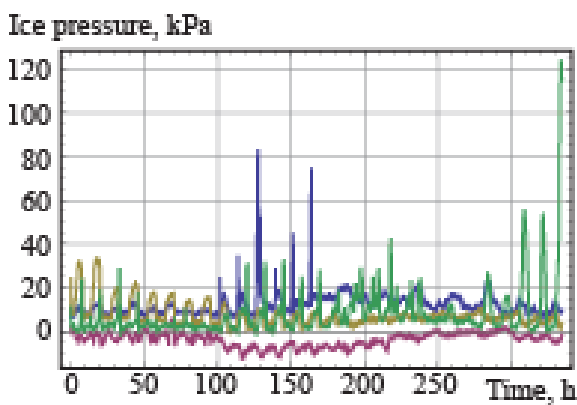
Achievements:
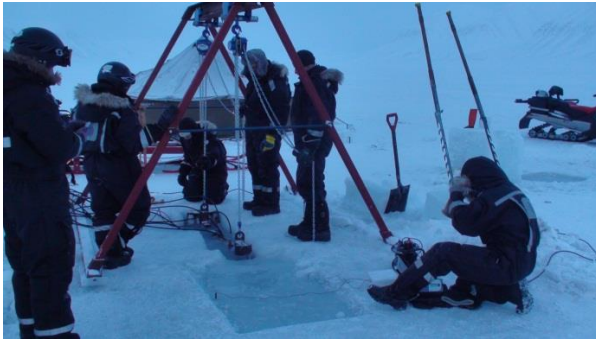
a)
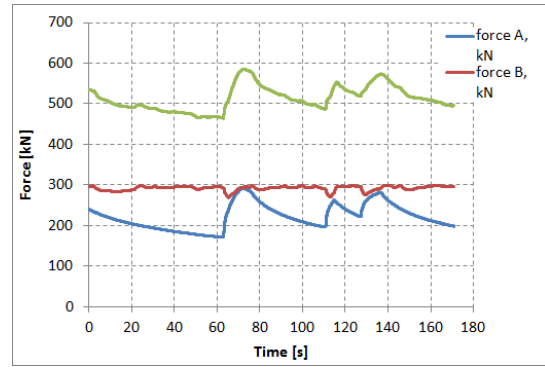
b)

Successful indentation tests in sea ice with thickness 20 cm and 70 cm (a). Record of ice loads and displacements (b).
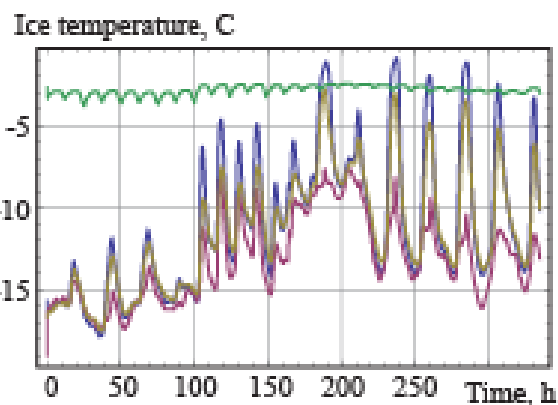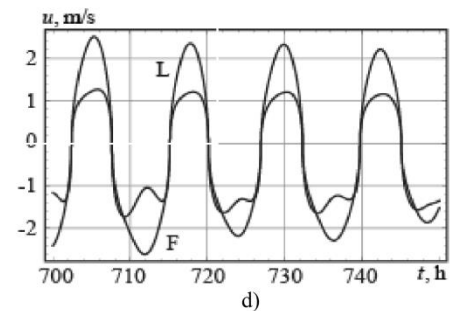

a)

b)

b)

d)

Locations of installed pressure cells on the walls of the cofferdam (a), data uploading (d), time series of the ice pressure (c) on the cofferdam and the ice temperature (d)
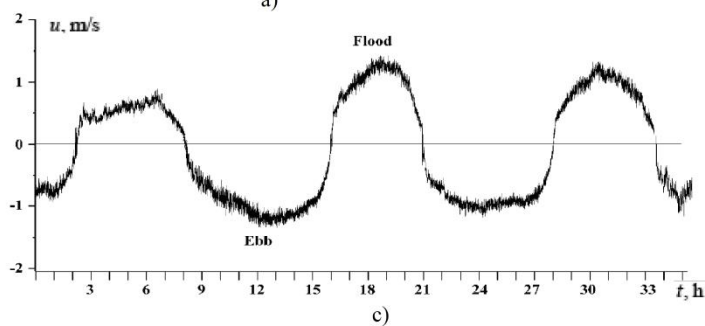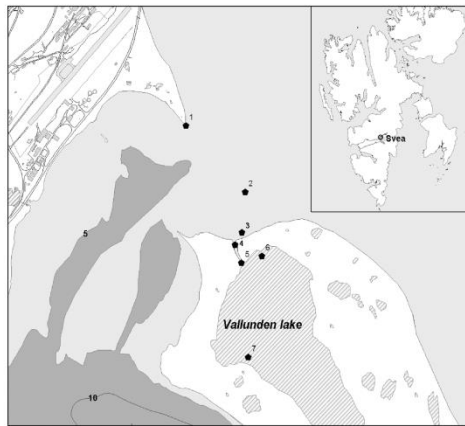
Locations of water level and sea current speed measurements in the Svea Bay (a), channel from Svea Bay into Vallunden lake (b), measured (c) and simulated (d) current speed in the channel

Example of sea currents speeds measured in Van Mijen Fjord on the phase of maximal tide

Work Package 2: Material Modelling

Briefing on Activities:

All four PhD candidatess (Kulyakhtin, Bekele, Pustogvar and Pavlov) are in good progress with their courses and their scientific work. Kulyakhtin and Bekele work on implementing the first version of their material models. Kulyakhtin works with a Cam-clay model and Bekele with the initial Thermo-mechanical model. Pustogvar works with the equipment in the lab to do both shear box and oedometer tests. She is now ready to carry out shear box tests to study the effect of the block size / box size. Both Kulyakhtin and Pustogvar will participate in the SAMCoT cruise to the Fram Strait in August-September. Pavlov works with the theoretical/numerical foundation for his numerical model. During the SAMCoT workshop in February the main approach of the different task was discussed and the main conclusion was that the discretizised models should consider carefully which properties or physical mechanisms it includes. The models should incorporate as many physical mechanisms as possible, but also consider which one that can be measured.

Achievements:

1. All submitted papers (POAC (6), one COUPLED and two DEM) are accepted, either as they were submitted, or with minor changes.
2. Laboratory experiments can be carried out with applying a constant piston velocity through a closed-loop feed-back system.
3. Polojärvi defended his PhD thesis with success 12th of April in Aalto, Finland

Horizontal and vertical thin sections of model saline ice prepared by initial spraying
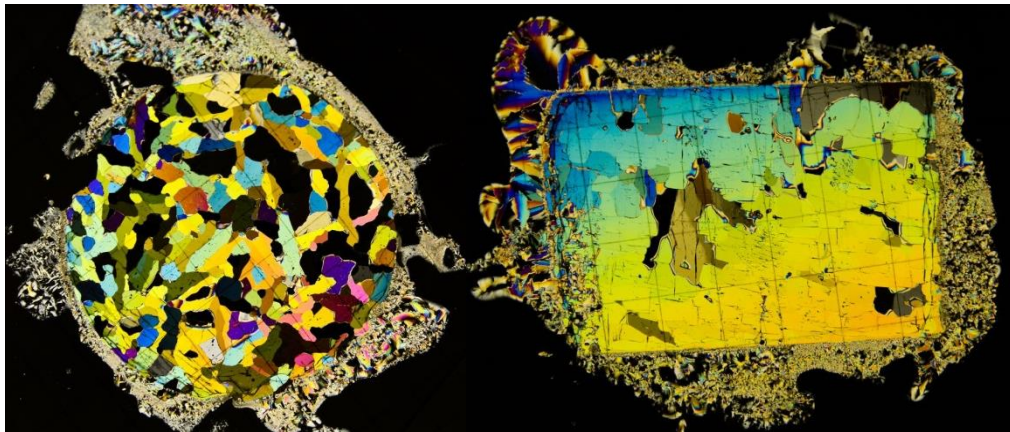
Photos taken by A. Pustogvar during the shear box and oedometer tests.

Testing rig
constant piston speed

Oedometer testing device

Work Package 3: Fixed Structures in Ice

Briefing on Activities:

1. The PhD candidates (Torodd Nord and Hayo Hendrikse) continue their scientific analyses; Nord mostly with system identification and Hendrikse with development of a numerical model

2. Nord and Hendrikse have participated in field work on Svalbard within the UNIS courses AT-211 (Ice Mechanics, Loads on Structures and Instrumentation) and AT-307F (Arctic Offshore Engineering – Fieldwork). Nord also taught in the AT-211 UNIS course as a part of his PhD teaching duties. Both PhD candidates now have good field experience, and will participate in the scientific SAMCoT cruise to the Fram strait in August-September 2013 where their aim is to investigate spatial variation of thermo-mechanical properties of old ice.

3. New experiments with dynamic ice-structure interaction are being planned for 2014. Nord, Määttänen, Øiseth, Hendrikse and Metrikine have been working with the test structure design and a reasonable solution seems to have been achieved. During the SAMCoT workshop in February we discussed the probability of success with the proposed experimental set-up and gained increased confidence in success.

Achievements:

1. All 6 POAC papers are accepted either as they were submitted or with minor changes.
2. A solution for the design of the test test-up for the planned ice-structure interaction experiments is almost ready.
3. Nord and Hendrikse have gained valuable field experience.

Kapp Amsterdam in Svea Bay at Spitsbergen.
PhD candidate Hendrikse taking measurements of the ice bustle.
PhD candidate Torodd Nord coring from an ice bustle.


Photos: Tatjana Zmushko

Work Package 4: Floating Structures in Ice

Briefing on Activities:
In the table below you find the accumulated list of priorities based on the feedback in the SAMCoT Workshops in 2012 and 2013.

Univ.	Name	Start End	Topic (Green colour: External funded PhD)
NTNU/WP4/PhD	Ekaterina Kim	2010.01 2014.01	An integrated finite element analysis of iceberg-structure interaction
NTNU/WP4/PhD	Martin Storheim	2011.08 2015.11	Vessel response to extreme ice events
NTNU/WP4/PhD	Wenjun Lu	2010.08 2014.07	Floater-level ice interaction, waterline processes
NTNU/WP4/PhD	Sergiy Sukhorukov	2009.03 2013.02	Sea ice friction
NTNU/WP4/PhD1	Andrei Tsarau	2012.09 2015.08	Floater-level ice interaction, hydrodynamics
TU Delft/NTNU/ WP4/PhD2	Chris Keijdener	2013.01 2015.12	Stationary dynamic regimes of ice-floater interaction

A logical flow (follow the arrows) of the present work in WP4 related to the PhD candidates Wenjun, Andrei and Chris can be found in the figure below.
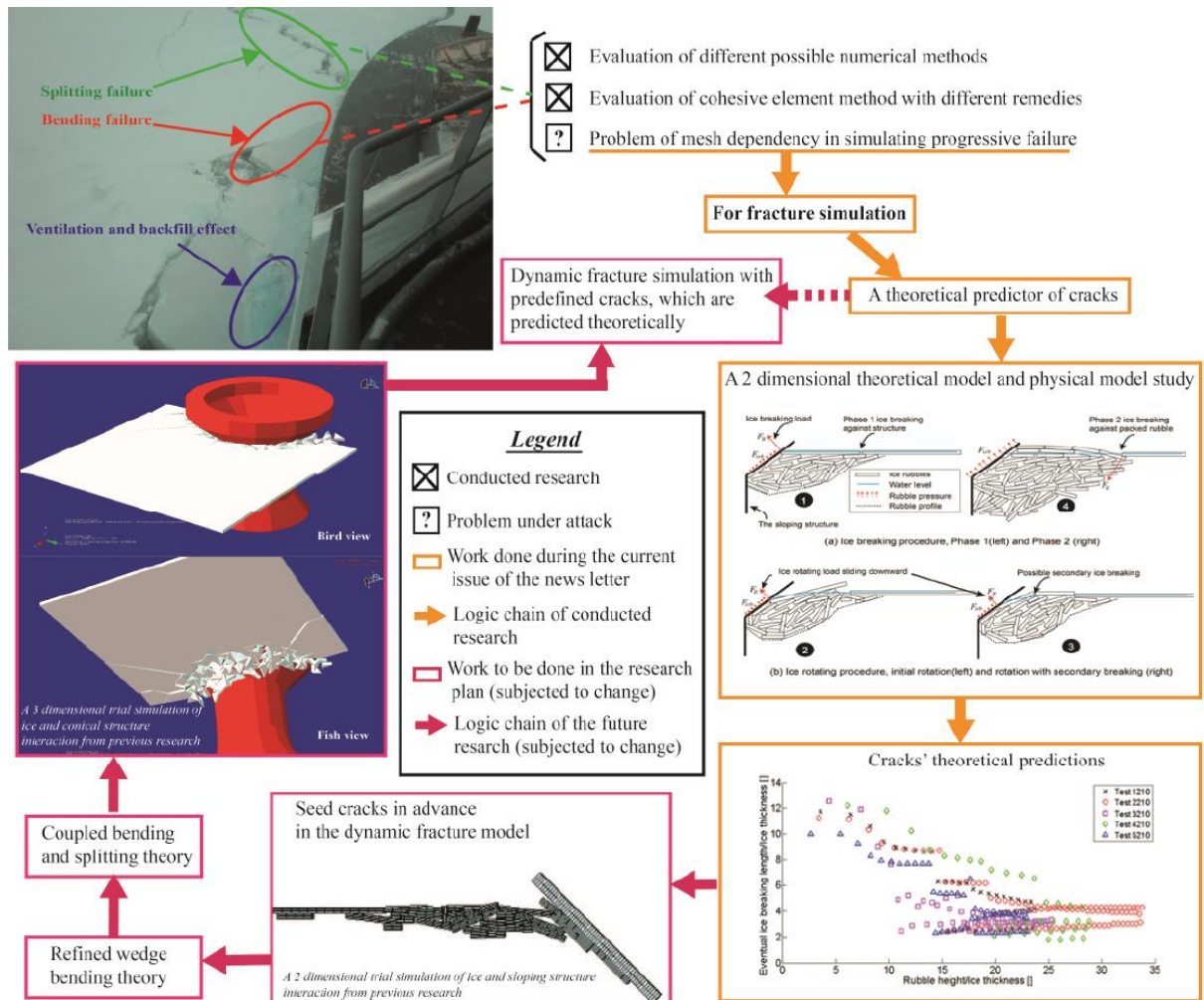
Ekaterina and Martin are working on the improvements of the iceberg-structure collision model. Currently the focus is on the material model of the ice. The suggested improvements can be arranged into three following groups:

1. Improvement of the physical plausibility of the failure criterion
2. Improvement of the fracture modeling technique
3. Improvement of the model description (reporting)

As example of improvements in Group 2: Combined finite element model and SPH is used to simulate the ice crushing process. This is illustrated below. In the earlier ice model the erosion function were used to remove from the calculus the finite elements that have reached the failure criterion based on effective plastic strain and hydrostatic pressure. The present idea is to replace the failed ice elements with SPH (crushed) particles whose behaviour is described by the flow rule. (In the provided example, for simplicity, the behaviour of the crushed particles, representing a protruding part of the iceberg, was chosen to be the same as that of the parent ice). Currently they are investigating the potential of this 'new' approach to simulate ice failure process.
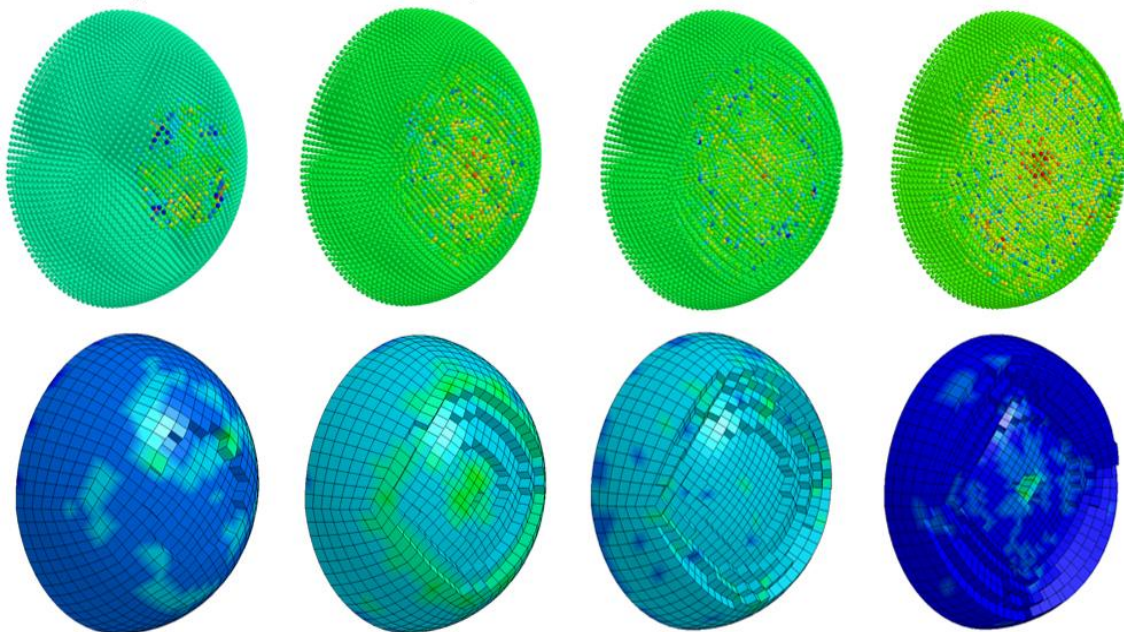
Achievements:
Deployment of an ice tracking drifter (ITD) in Storfjorden for the purpose of structure location.
Papers:

- Kim, E., M. Storheim, J. Amdahl and S. Løset (2013): *Laboratory experiments on accidental collisions of ice masses with a floating structure*. Cold Regions Science and Technology – Journal (submitted).
- Sukhorukov, S. and S. Løset (2013): *Friction of sea ice on sea ice*. Journal of Cold Regions Science and Technology - Journal (submitted).Lu, W., R. Lubbad, K. Høyland and S. Løset (2013): *Physical model and theoretical model study of level ice and wide sloping structure interactions*. Cold Regions Science and Technology – Journal (submitted).
- Kim, E. et al. (2013): *Drop tests of ice masses on stiffened panels with different structural flexibility*. International Conference on Collision and Grounding of Ships and Offshore Structures (ICCGS'13; accepted).
- Tsarau, A., R. Lubbad and S. Løset (2013): *Numerical studies of floating structures in broken ice*. Conference on Port and Ocean Engineering under Arctic Conditions (POAC'13; accepted).
- Lu, W., R. Lubbad, and S. Løset (2013): *A theoretical model investigation of ice and wide sloping structure interactions*. (POAC'13; accepted).

Work Package 5: Ice Management and Design Philosophy

Briefing on Activities:

In the table below you find the accumulated list of priorities based on the feedback in the SAMCoT Workshops in 2012 and 2013.

Univ.	Name	Start End	Topic (Green colour: External funded PhD)
NTNU/WP5/PhD	Farzad Faridafshin	Q3.2012 Q3.2015	Alternative methods for quantifying safety of offshore structures protected by IM
NTNU/WP5/PhD	NN	Q3.2013 Q3.2016	Safety and Reliability of Marine Systems for Arctic Operations
UNIS/WP5/PhD	Renat Yulmetov	Q1.2012 Q1.2015	Ice drift: iceberg towing in pack-ice
NTNU/WP5/PhD	Marat Kashafutdinov	2010 Q1.2014	Multi scale modelling of iceberg drift and its application for IM
NTNU/WP5/PhD	Petter Norgren	Q1.2013 Q1.2016	On application of Autonomous Underwater Vehicles (AUV) for operation under ice, subsurface monitoring of sea ice and icebergs

The PhD candidates Petter Norgren started in WP5 last March and his funding comes from NTNU. Petter will be workin in the field of Marine Arctic Control Engineering and the topic of his research in WP5 is "on application of Autonomous Underwater Vehicles (AUV) for operation under ice, subsurface monitoring of sea ice and icebergs".

The rest of the PhD candidates (Faridafshin, Yulmetov, and Kashafutdinov) are in good progress with their courses and their scientific work. Faridafshin is following the course "Risk Influence Modelling and Risk Indicators" at NTNU and meanwhile he is developing a model to assess the probablilty of failure in an ice management operation. Faridafshin is also invloved in the planning of the ice management tests during the research cruise OATRC2013. Yulmetov is currently studying the mechanics of contacts between ice floes and an iceberg trying to develop the right rheological model for the simulation of iceberg drift and towing in pack-ice. Yulmetov participated in field work on Svalbard within the UNIS course AT-307F (Arctic Offshore Engineering – Fieldwork) and he will participate in the research cruises with *RV Lance* later this month and with Oden (OATRC2013) in August. Finally, Kashafutdinov is making a good progress in modelling the thermodynamics of and iceberg which is an important step towards modelling the iceberg drift in the ocean scale.

Achievements:

1. All submitted papers (three POAC) are accepted, either as they were submitted, or with minor changes.

Daria Aleksuytina from MSU working with permafrost soil samples from Vestpynten at the UNIS laboratory

Work Package 6: Coastal Technology

Briefing on activities:

PhD candidate Daria Aleksuytina at Moscow State University has been visiting UNIS, meeting other SAMCoT-researchers from SINTEF and UNIS, and to have an impression of the Vestpynten research site.

PhD candidate Emilie Guegan has continued her observations of the influence of the snowbank on the thermal regime at the Vestpynten research site.

Arnstein Watn and Maj Gøril Bæverfjord have been visiting the research partners at Moscow State University planning the 2013 field work in the coastal permafrost research site of Baydara and the deliveries.

Focus has additionally been on defining clearly deliverables in the Tasks 6.2 and 6.3 on coastal structures and erosion protection and on landfalls and areas close to rivers.

Achievements:

POAC papers are accepted either as they were submitted or with changes
Field work at snowbank at Vestpynten coordinated by PhD candidate Emilie Guegan. The industry was represented in this occasion by Eric Cauquil (Total) who was invited to join the work of Emilie in his role as Co-supervisor.

PhD candidate Emilie Guegan during the field investigations and temperature measurements of the snowbank at Vestpynten, early April.

SAMCoT