MEMBER COUNTRY: NORWAY
National Report to SCAR for year: 2011-2012

Activity	Contact Name	Address	Telephone	Fax	Email	web site
National SCAR Committee						
The Norwegian National Committee on Polar Research	Ingrid Berthinussen	The Research Council of Norway, P.O. Box 2700 St. Hanshaugen, 0131 Oslo, Norway	4722037273	4722037278	bei@forskningsradet.no	http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1231229969357&p=1231229969357&pagename=polarforskning%2FHovedsidemal
SCAR Delegates						
1) Delegate	Jan-Gunnar Winther	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	winther@npolar.no	www.npolar.no
2) Alternate Delegate	Bo Andersen	Norwegian Space Centre, P.O. Box 113 Skøyen, 0212 Oslo, Norway	4722511800	4722511801	bo@spacecentre.no	www.spacecentre.no
Standing Scientific Groups a)						
Life Sciences						
2)	Torkild Tveraa	Norwegian Institute for Nature Research, Fram Centre, 9296 Tromsø, Norway	4777750406	4777750401	torkild.tveraa@nina.no	www.nina.no
3)	Kit Kovacs	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	kovacs@npolar.no	www.npolar.no
Geosciences						
1)	Yngve Kristoffersen	University of Bergen, Department of Earth Science, Allegaten 41, 5007 Bergen, Norway	4755583407	4755583660	yngve.kristoffersen@geo.uib.no	www.geo.uib.no
2)	Yngve Melvær	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	melvaer@npolar.no	www.npolar.no
3)	Synnøve Elvevold	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	synnove.elvevold@npolar.no	www.npolar.no
Physical Sciences						
1)	Jan-Gunnar Winther	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	winther@npolar.no	www.npolar.no
2)	Tor Gammelsrød	University of Bergen, Geophysical Institute, Allegaten 70, 5007 Bergen, Norway	4755582602	4755589883	tor.gammelsrod@gfi.uib.no	www.uib.no
a) Note that Norway is currently conducting a full review of its membership of the various Standing Scientific Groups. Currently the members listed above have been **released from their duties** and the new set of representatives is expected to be in place by the end of April 2012.						
Scientific Research Program						
AGCS						

1) (ITASE)	Elisabeth Isaksson	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	isaksson@npolar.no	www.npolar.no
ACTION GROUPS						
Ocean Acidification						
1)	Richard Bellerby	Bjerknes Centre for Climate Research, Uni Bjerknessenteret Postboks 7810, 5020 Bergen, Norway	4755589803	4755584330	richard.bellerby@uni.no	http://www.bjerknes.uib.no/default.asp?lang=2
EXPERT GROUPS						
Human Biology and Medicine						
1)	Holger Ursin	Unifob helse, University of Bergen, 5009 Bergen, Norway	4755586227	4755589872	h.ursin@uib.no	www.uib.no
Expert Group on Birds and Marine Mammals (EGBAMM)						
1)	Kit Kovacs	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	kovacs@npolar.no	www.npolar.no
Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED)						
1)	Richard Bellerby	Bjerknes Centre for Climate Research, Uni Bjerknessenteret Postboks 7810, 5020 Bergen, Norway	4755589803	4755584330	richard.bellerby@uni.no	http://www.bjerknes.uib.no/default.asp?lang=2
Operational Meteorolgy in the Antarctic						
1)	Eirik Førland	Norwegian Meteorlogical Institute, PO Box 43 Blindern, 0313 OSLO, Norway	4722963000	4722963050	eirikjf@met.no	www.met.no/English
IPICS						
1)	Elisabeth Isaksson	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	isaksson@npolar.no	www.npolar.no
SCADM						
1)	Stein Tronstad	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	tronstad@npolar.no	www.npolar.no
SCAGI						
1)	Ynge Melvær	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	melvaer@npolar.no	www.npolar.no
2)	Oddveig Øien Ørvoll	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	oddveig.orvoll@npolar.no	www.npolar.no
NATIONAL ANTARCTIC DATA CENTRE						
Norwegian Polar Institute	Stein Tronstad	Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway	4777750500	4777750501	tronstad@npolar.no	www.npolar.no
SCAR DATABASE						
Not applicable						
A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS*:						

Glaciology-Oceanography by/on the Fimbul Ice Shelf: Since 2009, Norwegian Antarctic Research Expedition has maintained field-oriented program in the vicinity of the Fimbul ice shelf, Dronning Maud Land (DML). The DML coast is characterized by ice shelves extending over more than 1000 km, fed by outlet glaciers and punctuated by numerous ice rises. Mass balance of the upstream ice sheet largely depends on the dynamics of this inter-connected system at the coast. The close proximity of the DML ice shelf to the margin of the continental shelf could potentially allow relatively warm water from the abyssal plains to circulate under the shelf, leading to enhanced sub-shelf melting. The DML coast and the upstream ice sheet are therefore intrinsically sensitive to changes in the ocean, as is roughly half of the present-day Antarctic coastline. Extensive oceanographic and glaciological fieldwork has been made on the ice shelf, aiming towards improving our understanding of ice-shelf-ocean interaction in this region of Antarctica. During the 2009/10 austral summer, 3oceanographic mooring systems were deployed below the Fimul Ice Shelf through holed drilled with hot water drilling system. Two years of data from these oceanic moorings show cold cavity waters, with average temperatures of less than 0.1 °C above the surface freezing point. This suggests rather low basal melt rates, consistent with a separate estimate using remote sensing techniques We are now working to determine the spatial variability of the surface and the basal mass balances of the ice shelf using a ground-based phase sensitive radar, geodetic GPS techniques, and dating shallow radar reflectors using ice cores. A new project “ICE RISES” was started June 2011 to investigate grounded ice masses (ice rises), such as isles and promontories. During the 2011-12 field season, we investigated two ice rises using geodetic GPS and ice-penetrating radar techniques. Summits of these ice rises are 200-300 m higher than the ice-shelf surface, and the grounded ice maintains its own local flow field. Our key findings, so far, include upward arches (Raymond Bumps) underneath the ice-rise summits, evidence of the stability of these ice rises over millennia, and downward arches near the grounding line, inferring large sub-shelf melting localized at the grounding line. Publications 2011

• Anschütz, H., A. Sinisalo, E. Isaksson, J. R. McConnell, S.-E. Hamran, M. M. Bisiaux, D. Pasteris, T. A. Neumann, and J.-G. Winther (2011), Variation of accumulation rates over the last eight centuries on the East Antarctic Plateau derived from volcanic signals in ice cores, J. Geophys. Res., 116, D20103, doi:10.1029/2011JD015753.

• Bindschadler, R., Choi, H., Wichlacz, A., Bingham, R., Bohlander, J., Brunt, K., Corr, H., Drews, R., Fricker, H., Hall, M., Hindmarsh, R., Kohler, J., Padman, L., Rack, W., Rotschky, G., Urbini, S., Vornberger, P. & Young, N. 2011. Getting around Antarctica: new high-resolution mappings of the grounded and freely-floating boundaries of the Antarctic ice sheet created for the International Polar Year. The Cryosphere, 5, 569–588.

• Langley, K., Kohler, J., Matsuoka, K., Sinisalo, A., Scambos, T., Neumann, T., Muto, A., Winther, J-G. & Albert, M.. 2011. Recovery Lakes, East Antarctica: Radar assessment of sub-glacial water extent. Geophys. Res. Lett., (38) L05501, doi:10.1029/2010GL046094.

• Matsuoka, K., F. Pattyn, D. Callens, and H. Conway. 2012. Radar characterization of the basal interface across the grounding zone of an ice-rise promontory in East Antarctica, Ann. Glaciol., 53(60), doi: 10.3189/2012AoG60A106.

• Matsuoka, K. 2011. Pitfalls in radar diagnosis of ice-sheet bed conditions: lessons from englacial attenuation models, Geophys. Res. Lett., 38, L05505, doi:10.1029/2010GL046205, 2011.

• Nøst, O. A., M. Biuw, V. Tverberg, C. Lydersen, T. Hattermann, Q. Zhou, L. H. Smedsrud, and K. M. Kovacs (2011), Eddy overturning of the Antarctic Slope Front controls glacial melting in the Eastern Weddell Sea, J. Geophys. Res., 116, C11014, doi:10.1029/2011JC006965.

• Schlosser, E., Anschütz, H., Isaksson, E., Martma, T., Divine, D., and Nøst, O-A. Surface mass balance and stable oxygen isotope ratios from shallow firn cores on Fimbulisen, East Antarctica. Annals of Glaciology 53(60) 2012 doi: 10.3189/2012AoG60A102.

Responses of Antarctic seabirds to a changing environment - from oceanographic conditions to foraging behaviour and demography: Changes in sea-ice dynamics are expected to mediate changes in krill abundance and distribution, and influence the entire Antarctic ecosystem. To elucidate the concequences of changes in sea-ice dynamics on top predators such as seabirds is challenging. However, recent technological advances to monitor animal spatial dynamics (e.g. miniturized global positioning systems), diet (e.g., analysis of stable isotopic rations) and environmental conditions (e.g., remote sensing of sea-ice cover now offer the potential to address such questions. The IceBird project (2011-2014) aims to combine detailed individual monitoring of Antarctic petrels spatial dynamics, diet and demography using cutting edge technolgy and modeling to assess and predict how this seabird responds to changes in se-ice dynamics. The researhc is taking place at the Svarthamaren Antarctic petrel colony, which is the largest know inland seabird colony on the Antarctic;: this colony constiutes a large portion of the global population of Antarctic petrels. This project will improve our understanding of the functional processes of the Southern Ocean ecosystem and of the impact of climatic changes on Antarctic seabirds

A permanent seismic station at Troll: In 2011, NORSAR received funding to install a permanent broadband seismic station at Troll within the Norwegian Antarctic Research Expedition (NARE) Program of the Norwegian Polar Institute. During autumn 2011, the technical details of the new station were carefully planned and some equipment tested, and in the first week of February 2012, the station was installed. Contrary to many other seismic stations inside the Antarctic continent, the new seismic sensor could be installed on bedrock (migmatite), on a hill at about 500 m distance from the main buildings of the Troll research base. A bedrock installation has the advantage that seismic signals are not disturbed by multiples due to the thick Antarctic ice shield. The equipment mainly consists of a Streckeisen STS-2.5 broadband sensor and a Quanterra Q330HR 26 bit digitizer. Since 5 February 2012, all data are transferred in real time via a satellite link to NORSAR for analysis and further distributed to the European data center ORFEUS, where they can be accessed by the whole seismological community. The new seismic station is registered as TROLL in the international registry and has the geographic coordinates 72.0082 degrees South, 2.5300 degrees East, 1399 m above mean sea level. Data analysis is currently in its initial stages.

Launch of controlled meteorological balloons: A meteorological field campaign lead by the Norwegian Meteorological Institute (met.no) was carried out from 23 December 2011 to 13 January 2012 at the Troll Research Station in Antarctica. Six Controlled Meteorological Balloons (CMET)were used to study the strong katabatic and convective flows at the edge of the Antarctic plateau. The free-flying CMET balloons measured vertical profiles and trajectories on command, quantifying temperature, pressure, relative humidity, and GPS winds from the surface to as high as 5500 m agl with flight durations of up to 20 hours. The CMET balloons are particularly suitable for validation of meteorological mesoscale models at atmospheric transport models and more information can be found at http://www.science.smith.edu/cmet/. In addition a SUMO (Small Unmanned Meteorological Observer) and several radio-controlled aircraft derived from the CMET payload were used to measure atmospheric profiles. The balloon and aircraft data are now being compared with mesoscale model simulations. The project was sponsored the the Research Council of Norway and was lead by Dr. Lars R. Hole of met.no in collaboration with Prof. Paul Voss of Smith College, MA, USA. Hole and Voss were joined by MSc student Aurora Stenmark of the Geophysical Institute, University of Bergen

Atmospheric research and monitoring at Troll--- a long-term observational program: The Troll Atmospheric Station in Antarctica was established and put into operation in early 2007. The main foci of the measurement programme are pollution and aerosols in the transition zone between the coastal zone and the inland ice plateau, complementing existing observation programmes along the Antarctic coast and on the Antarctic Plateau.

Physical Oceanography and process studies in the Weddell Sea: On the continental slope of the Weddell Sea, the potentially supercooled Ice Shelf water and the warmer off-shelf water masses interact and in part determine the depth of the Weddell Sea deep water which contributes to the Antarctic Bottom Water. The processes by which this warm water is transported on to the shelf need to be better understood. To address this point a group of UIB-scientists led by Ilker Fer (Geophysical Institute, UIB) has participated in cruises onboard RRS Ernest Shackleton in early 2009 and 2010 to conduct cruise-duration hydrography, current and turbulence measurements (in 2009) and deploy moored instruments at the continental rise. Additionally, the long-term monitoring station (S2) at the Filchner Sill was serviced. In 2009, 5 densely-instrumented moorings were laid; all recovered in 2010 returning one year-long time series. Another array of 3 moorings were deployed during the 2010 cruise two of which were recovered in early 2011 from RRS James Clark Rose. Time series measurements from the moored instruments show significant low frequency (i.e. sub-inertial) variability on the continental slope of the Weddell Sea. The data set is currently being analyzed, particularly testing the hypothesis that the coastal trapped waves can be responsible for this variability. Cruise time measurements of ocean microstructure collected at the continental rise support the indirect inferences of Daae et al. (2009) that mixing due to semi-diurnal period internal tides is important. Furthermore data were collected adjacent to Brunt Ice Shelf in the south-eastern Weddell Sea. Periods of in situ supercooled water extending as deep as 65 m were associated with ice nucleation and frazil formation at depth. Ascending ice crystals due to convection lead to increased dissipation rates. Our observations, reported in Fer et al. (2012) provide direct evidence for enhanced dissipation rates associated with the conditional thermohaline convection mechanism proposed by Foldvik and Kvinge (1974). The ice crystal formation at depth and its ascent to the surface will influence the local sea ice budget and contribute to underwater ice production.

• Daae, K. L., I. Fer, and E. P. Abrahamsen (2009), Mixing on the Continental Slope of the Southern Weddell Sea, J. Geophys Res., 114, C09018, doi: 10.1029/2008JC005259.
• Fer, I., K. Makinson, and K. W. Nicholls (2012), Observations of Thermohaline Convection adjacent to Brunt Ice Shelf, J. Phys. Oceanogr., 42, 502-508.
• Foldvik, A., and T. Kvinge (1974), Conditional instability of sea-water at freezing-point, Deep-Sea Res., 21, 169-174.

Sub-ice geology of the Dronning Maud Land continental margin. Cooperation during the 2009/10 and 2010-11 seasons between University of Bergen and the AWI project *Linking micro-physical properties to macro features in ice sheets with geophysical techniques* has facilitated the first use of vibrator for seismic exploration of the sub-surface of the Antarctic continent. Besides co-located imaging with microwave techniques, explosives and vibrator sources of the 900 m thick ice cover on Halvfar-ryggen, a 90 km transect from the grounding line of the Ekstrøm Ice Shelf to the ice shelf terminus north of Neumayer Station, image the sub-bottom sediment layering on the sub-ice continental shelf to about 2 km depth. The most significant result is the observed sub-ice outcrop of the landward boundary of a wedge of volcanic material previously outlined over a distance of about 1.700 km below the continental slope off Dronning Maud Land (20° E- 30° W) by marine multichannel seismic surveys. The vibrator as a seismic source is environmentally friendly and the vibrator/snow streamer combination presents almost an order of magnitude increase in efficiency compared to conventional approaches for seismic reflection surveys in Antarctica. This development has prompted German and US scientists to pursue the concept in the future.

• Eisen, O., Hofstede, C., Miller, H., Kristoffersen, Y., Blenkner, R., Mayer, C., and Lambrecht, A., 2010. A New Approach for Exploring Ice Sheets and Sub-Ice Geology. Eos, Transactions, Am. Geophys. Union, vol. 91, No. 46, p. 429-430.

A permanent, broadband, seismic station at the Troll research base -installation, data analysis and interpretation: In 2011, NORSAR received funding to install a permanent broadband seismic station at Troll within the Norwegian Antarctic Research Expedition (NARE) Program of the Norwegian Polar Institute. During autumn 2011, the technical details of the new station were carefully planned and some equipment tested, and in the first week of February 2012, the station was installed. Contrary to many other seismic stations inside the Antarctic continent, the new seismic sensor could be installed on bedrock (migmatite), on a hill at about 500 m distance from the main buildings of the Troll research base. A bedrock installation has the advantage that seismic signals are not disturbed by multiples due to the thick Antarctic ice shield. The equipment mainly consists of a Streckeisen STS-2.5 broadband sensor and a Quanterra Q330HR 26 bit digitizer. Since 5 February 2012, all data are transferred in real time via a satellite link to NORSAR for analysis and further distributed to the European data center ORFEUS, where they can be accessed by the whole seismological community. The new seismic station is registered as TROLL in the international registry and has the geographic coordinates 72.0082 degrees South, 2.5300 degrees East, 1399 m above mean sea level.