Exploratory Workshop Scheme

Scientific Review Group for the Bio-Medical Sciences

Scientific Review Group for Life, Earth and Environmental Sciences

Scientific Review Group for Physical and Engineering Sciences

Scientific Review Group for the Humanities

Scientific Review Group for the Social Sciences

ESF Exploratory Workshop on

OCEANIC HEAT TRANSPORT TO FLOATING GLACIERS IN ANTARCTICA

Lerici (ITALY), May 12 - 15 2014

Convened by:
Anna Wåhlin, Stefano Aliani and Svein Österhus

SCIENTIFIC REPORT

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1. Executive summary

The meeting was held at CNR ISMAR Institute in Lerici (Italy) from 12 to 15 May 2014. The key outcome of the workshop was that although the national programs are active and conduct science of highest quality, the current activities are only a fraction of the enormous potential available should the European marine Antarctic Research be coordinated. A large portion of the cost for the science is presently spent on logistic support and infrastructure. The scientific outcome will likely be much enhanced if existing logistic support and infrastructure is used in an efficient way to support new European science initiatives.

The workshop agreed on the following three recommendations

**** Europe should contribute to the world ocean observing network. We propose to form a European consortium for Marine Antarctic research. We stress the need of a full COST action programme.***

**** Europe should build a European facility that coordinates large Antarctic infrastructure. We need to pool European ice capable vessel resources. A ship-time pooling programme should be long term and not project based.***

**** Europe should facilitate the career for young scientists in marine Antarctic Science. This could be done by making ship time and other infrastructure available to young scientists and organizing the European marine Antarctic research in a consortium that encourages active involvement of young scientists.***

All practical arrangements about the meeting including meeting room facilities, accommodation and meals were taken care of by the host institution and Dr. S. Aliani with the administrative and logistical assistance of Dr. Laura Barbieri. Planning of travel was undertaken by participants themselves to better fit their personal needs.
Most of participants arrived in Lerici on May 12th in the late afternoon. The last participant left Lerici on May 15th. After participants registered at the hotel that CNR had booked for them, an informal meeting was held to advise on travelling to the institute, and give logistical details and the schedule. A dedicated bus service was made available for travelling between the hotel and institute. Participants arrived at CNR Institute and registered at 9 o'clock on 13th May. The workshop followed immediately, according to the schedule. The presence of participants at the meeting was certified each day by signing a form.

The workshop was organized in four sessions spread over two days. Three of these sessions were dedicated to defining the research front and identifying knowledge gaps in the three areas of (i) Ocean circulation in the ice-shelf cavity; (ii) Ocean circulation and water mass modifications on the shelf and how it affects transfer of properties between ocean and glacier, and (iii) transport across the shelf break and how it affects transfer of properties between ocean and glacier. Every session included presentations on the state of the art, recent findings, and a discussion. The final session was focused on summarising major points that arose during presentations and discussions, and focussed on future activities and actions to be taken. A poster session had been planned, and during coffee breaks participants convened for discussions near the posters.

An opening talk was given by I. Ambar, ESF, who presented ESF and provided an outline of ESF rules and opportunites. Dr. A. Vetrano from CNR Institute presented the latest news on Eurofleets 2 EU project, and asked for the workshop's input regarding the demand of European research for ship time and icebreakers and suggestions for how to formulate a survey that would capture that demand.

The meeting gathered people from seven European countries with a common interest in Antarctic oceanography. Some participants had already collaborated in common projects but others did not know each other and all appreciated the opportunity to join and contribute to a very active and growing scientific community. The resulting general atmosphere was positive and creative. The topics addressed were interesting enough for two non-European partners to join the workshop at their own expense, providing a valuble update on some of the non-European contribution to Antarctic oceanography.

One representative of APECS (Association of polar early careeer scientist) was also present, who reported the young scientists' point of view and plans. She will also inform APECS people of results of the workshop.

Lunches took place at the Institute cafeteria during a 1-hour break. The informal and friendly atmosphere helped helped discussions, and informal discussions continued during lunchtime before afternoon sessions. As all participants dined in the same venues in Lerici discussions went on into the evenings, outside the meeting schedule.

ESF travel reimbursment was granted to all participants who claimed it and presented travel documents. Some participants covered travel expenses with their own funds. Accommodation costs were granted to all participants. One participant had to cancel at the last-minute but was able to contribute by having a colleague give his presentation at the workshop.

General remarks

The workshop was very successfull and contributed to focus new research topics and initiate a new consortium of marine scientists working on Antarctica. A description of new findings in glacier-ocean interaction processes as well as a review of available hystorical data were provided. This allowed a joint critical discussion about unsolved detailed questions in Antarctic research.

All participants are now well aware of key scientific questions and agreed to converge and collaborate at addressing these critical research objectives. A review paper is in preparation summarizing the results.

In particular all agreed that glacier ocean interaction processes are critical in global change scenarios but still need exploration. At present we have the technology and the expertise to do it at local scale, but not at panantarctic scale yet. Deeper coordination among EC Antarctic scientist will amplify European scientific potential.

2. Scientific content of the event

2.1 Summary of the talks

Isabel Ambar

Presentation of ESF and other EC opportunities for science.

Session 1. OCEAN CIRCULATION IN THE ICE SHELF CAVITY

Pierre Dutrieux: Sub-glacier ocean circulation: lessons learned from the Amundsen Sea, West Antarctica
Mass/Meltwater budget, 2009 vs 1994 evidenced >50% increased melting from 1994 (-50±7 Gt/yr) to 2009 (-85±6 Gt/yr). Causes of increase? CDW temperature rise of 0.2°C? Strengthened baroclinic flow. A complex bathymetry/ocean/ice coupling.

Keith Nicholls: Measuring the rate of ice shelf basal melting at high temporal resolution
Changes in melt rates affects ice-shelf geometry and also Antarctic Bottom Water formation: there is an urgent need to be able to predict interaction between ice shelves and the Southern Ocean. Data are needed to provide validation and control of numerical models, and also a means of improving the models' physics. These can be obtained using instrumentation deployed via hot-water drilled access holes, and also Autonomous vehicles. Melt rates provide a good indicator of sub-ice shelf conditions, with time series of melt rates being an excellent diagnostic for models. Capable equipment is now available in the form of phase-sensitive radar systems.

Adrian Jenkins: Exploring the ocean cavity beneath Pine Island Glacier with Autosub3 (Poster)
This poster presented data from the first successful Autonomous Underwater Vehicle missions beneath Pine Island Glacier. The data demonstrate the huge potential for such technology in providing completely new insight into the processes operating beneath ice shelves that cannot be gained in any other way. Results from these missions are already changing the way we think ocean driven change in the Antarctic Ice Sheet.

Adrian Jenkins: Phase sensitive radar observations of strain and compaction in Dry Firn (Poster)
This poster presented data collected on Filchner-Ronne Ice Shelf using a phase-sensitive ice-penetrating radar system. Although the main focus of this presentation was the observation of processes operating in the upper layers of firn, the same technique can be used to make high-precision measurements of ice shelf basal melt rates. The technique lies behind the plans for a "Necklace" of such observations on Antarctic ice shelves.

Adrian Jenkins: Convection-driven melting near the grounding lines of ice shelves and tidewater glaciers (Poster)
This poster discussed how the basal melt rate of an ice shelf in the region immediately downstream of the grounding line is influenced by the outflow of sub-glacial meltwater at the grounding line. A simple model of the process was presented based on the theory of buoyant plumes. Freshwater outflow at the grounding line increases ice shelf melting because it enhances the buoyancy-driven circulation that brings ocean heat to the ice.

Adrian Jenkins: Scaling laws for the melt rate and overturning circulation beneath ice shelves derived from simple plume theory

This presentation discussed the application of plume theory to the melt-driven circulation throughout the whole ice shelf cavity. The behaviour is governed by a few relatively simple physical scales determined by the ice shelf geometry and ocean temperature. Such scaling laws provide a powerful tool to understand more complex models and observations and provide the basis for a versatile parameterisation of the processes suitable for use in large-scale models where smaller ice shelves may be unresolved.

Stefano Aliani: Ross Ice Shelf interaction with ocean at intermediate depth
Ross Ice Shelf- ocean interactions are poorly studied if compared to other glaciers. Path of ISW from glacier's front to the shef break has been reported. Cascading of ISW takes place at 180 ° but there are few information on CDW input there.

Session 2: OCEAN CIRCULATION AND WATER MASS MODIFICATIONS ON THE SHELF AND HOW IT AFFECTS TRANSFER OF PROPERTIES BETWEEN OCEAN AND GLACIER

Michael Dinniman: Outstanding Issues in modeling aspects of the open continental shelf circulation that affect Antarctic ice shelves
Overview of outstanding issues related to modeling heat transport across the continental shelf, including: accurate bathymetry, atmospheric forcing (including horizontal resolution), ocean model resolution (eddy resolving on continental shelf?), long time series measurements for comparison, influence of tides, difficulties in keeping "warm-water" shelves warm, vertical mixing parameterizations and shelf break processes. Besides determining how much heat gets onto the continental shelf from deep waters (covered at this meeting by others), processes at the shelf break can also influence mixing and advection of heat a significant distance back from the shelf break, e.g. observed (Jensen et al., 2013) and modeled (Marques et al., 2014) topographic vorticity waves

Elin Darelius: Circulation and hydrography in the Filchner Depression, Antarctica
Based on observations and numerical modelling we suggest a revised circulation scheme with outflow of cold ISW along the eastern flank of the Filchenr Depression. Observations suggest a) a seasonal signal in outflow properties and b) interannual variability of ISW properties in the depression that are potentially linked to a reorganisation of the flow in the cavity.
Open questions. How does the densest ISW/HSSW get light enough to escape the cavity? How much ISW spills over the sill? What is the cause of the interannual variability? Is it due to a reorganisation of the flow below the cavity? How much MWDW/heat enters the continental shelf? The ice shelf cavity? Today? In the future? What processes influence the inflow and how does the ISW outflow influence the dynamics? «Division» of coastal current /ASF where the continental shelf opens up - how much water goes where? What is the role of the inflow at 43W?

Mike Meredith (absent, presentation given by Adrian Jenkins): Spatial and temporal changes in the freshwater inputs to the ocean west of the Antarctic Peninsula
This presentation discussed measurement of the stable isotopes of oxygen in seawater to the west of the Antarctic Peninsula. These data allow the freshwater inputs to the ocean to be quantitatively separated between meteoric sources (precipitation and melting of land ice/ice shelves) and sea ice melt. In the surface layers the concentration of meteoric freshwater is decreasing, despite increasing

precipitation and continuing deglaciation, suggesting that changes in ocean climate are progressing even faster.

Verena Haid: On-shelf processes related to coastal polynyas in the Weddell Sea
In the WS 10-20 % of heat flux is compensated by oceanic heat at coastal polynyas (30-50 % outside polynyas) but high variability, interannual and even more on shorter time scales is involved Topography enables effective heat transport across the continental shelf. Simulated on-shelf circulation highly dependent on forcing data.

Dorotea Iovino: Climatically driven changes of Antarctic sea ice and their role in the climate system
The sea ice model LIM2 and how it is coupled to the ocean component of the NEMO system in the global sea ice-ocean 1/16° configuration has been described. Global coupled models with eddy permitting (typically ¼°) and eddy resolving resolutions have been used for regional studies at high latitude. Physical processes acting on sea ice (thermodynamic processes, which involve the transfer of heat or radiation, and dynamic processes, which move and deform the ice have been presented.

Marie-Noelle Houssais: Circulation and water mass formation off Adelie Land, East Antarctica
HSSW production in Commonwealth Bay : mooring observations (2008-2012) in suggest that year-to-year changes of the summer properties of the dense waters reveal changes in previous winter convection activity. The memory is due to the presence of a bathymetric reservoir. Conversely, the reservoir effect allows the interannual winter convection variability to be partly controlled by the late summer stratification. Can such local observations be extended to the entire Adelie shelf ?
Fresh water budget on the shelf: link to DSW formation and Mertz Glacier polynya activity (2004-2012) : A robust link is found between the dense water properties in the Adelie depression and the polynya activity. The link was highlighted by the major Mertz calving event in 2010. The latter led to polynya closing and cessation of the winter bottom water renewal which resulted in a large (exceeding the range of interannual variability) increase in the fresh water content of the depression.
Are such causal links between glacier ice tongues and sea ice distribution a recurrent feature of glacier calving events ? Impact of Mertz Glacier Tongue variability on MGP and DSW formation (1750-present) : sediment analyses suggest multidecadal cycles (advance and calving) of the Mertz Glacier over the past 250 years which could have impacted the dense shelf water production.
Circulation on the Adélie Land - George V Land shelf based on mooring observations during ALBION reveal short term variability which is still to be understood. The averaged summer picture based on geostrophy is a cyclonic circulation of the MCDW guided by topography. Robustness of the picture is still to be assessed.

Sang Hoon Lee: Flux and fate of photosynthetised carbon in the Amundsen shelf waters
Fate of photosynthetised carbon has been presented. The main Korean activities in Antarctica and infrastructures were also presented, incuding Araon icebreaker. The importance of multidisciplinary perspective has been highlighted.

Louise Biddle: Ocean2ice: Processes and variability of ocean heat transport toward ice shelves in the Amundsen Sea Embayment

In AS thermocline now is deeper than 2009; not a lot of meltwater detected except at glacier front compared to previous years. Datasets of moorings, CTDs, VMP, radiosondes, Seagliders and Autosub. Two Seaglider deployments collected >50 dives data
Very cold winter 2012, from 5 years of data at BSR5/iSTAR9 mooring location
meltwater mixes very quickly, high rates of turbulent dissipation in areas of high meltwater concentration. Model runs show correlation between CDW flux on shelf and SAM oscillations
14 seals tagged and sending back data in front of PIG, hopefully continue through winter.

Session 3: TRANSPORT ACROSS THE SHELF BREAK AND HOW IT AFFECTS THE TRANSFER OF PROPERTIES BETWEEN GLACIERS AND OCEAN

Adrian Jenkins: Oceanographic observations at the shelf break of the Amundsen Sea, Antarctica (Poster)
This poster presented oceanographic data collected at a shelf edge trough in the Amundsen Sea. The data reveal a current of warm Circumpolar Deep Water that flows on-shelf within the trough and is fed by an eastward flowing undercurrent that follows the shelf break. Such undercurrents seem to be robust features of numerical models run at a range of scales, although their significance for the on-shelf flow a warm water has not been discussed before.

Karen Assmann: Shelf break exchange in Antarctic Marginal Seas: Processes, large-scale circulation and variability.
Tour of shelf break exchange in the Antarctic marginal seas. Bellingshausen: focus on UCDW eddies, because of nutrient transport. Transport facilitated by eastward ACC jet sitting on the shelf break (direction of current at shelf break matters!) Amundsen Sea, ACC north of shelf break, but westward surface current has underlying eastward undercurrent that appears to be temporally persistent on the central shelf break. Thermocline depth co-varies between on interannual time scale between shelf break and inner shelf in east-central Amundsen, and on seasonal timescales at the shelf break between west and central AS. Driving mechanism for thermocline variability unclear. Current variability driven by winds, but thermocline depth and currents not well correlated. Ross and Weddell Sea show the importance of upstream changes in source water mass characteristics and buoyancy forcing on the shelf on shelf break exchange.

Yoshihiro Nakayama: Data analysis and modeling of the Amundsen sea embayment.
The Amundsen Sea is now well-reproduced in FESOM. Inflowing CDW properties are close to the observations. The undercurrent transports CDW onto the continental shelf. Melting of Pine Island and Getz ice shelves are successfully simulated. Horizontal resolution of ~5 km is required to simulate realistic CDW intrusion. Cold bias in NCEP forcing results in deeper convection, which cools the CDW intrusion by ~ 1°C.

Marcello Magaldi: Hydrostatic and non-hydrostatic simulations of dense waters cascading off a shelf: the East Greenland case

Topographic steering is essential for bringing AW near the fjords. Horizontal resolution: cascading is not modeled if DSO cyclones are not resolved. Vertical parameterizations: a good job has been done on cascading process (Ri dependence) and the missing route is geostrophic eddies impinging on topography and GW generation.

Ole Anders Nöst: Parameterization of eddy transports over sloping topography
Key question is how well does models reproduce the slope front in the Eastern Weddell sea? Need to explore parameterizations of eddy transport across continental slopes

Giuseppe Aulicino: Estimation of sea-ice thickness and ocean-ice-atmosphere heat exchanges in the Ross and Weddell Seas and more
In the last decade: Freshening of the HSSW in the Terra Nova Bay polynya has been recorded. Warming of the ISW close to the shelf break was found at the GCT. Less ISW (in %) and more HSSW was in front of the RIS as well as a general freshening of water column in front of the RIS. No significant trend in sea ice thickness variability (neither in Weddell region)in a growing sea ice extent scenario. Opposite / synchronous evolution of sea ice thickness and heat budget in the Ross and Weddell Seas were found (linked to signature of ENSO and SAM). Less heat lost by the ocean to the atmosphere in the Ross and Weddell Seas (pending comparison to model reanalysis and in situ data). More CDW was found entering the Ross shelf region.

Anna Vetrano: EUROFLEETS2 2013-2017 New operational steps towards an alliance of European research fleets.
Topics addressed were determining the available capacities of Polar Research Vessels and comparing that with the scientific demand, in accordance with IASC (International Arctic Science Committee) and SCAR (Scientific Committee on Antarctic Research), for research in the Polar Oceans. Establishing models for optimization of this fleet by better coordination of the vessels' scheduling and by harmonizing the deployment of ice-strengthened research vessels with heavy icebreakers has been discussed.

Anna Wåhlin: Getz ice shelf - the opportunity to study on of the largest ice shelves in Antarctica before it starts to break up
Open questions have been highlighted: Long-term time dependence (to get the forcing factors and climate variation, e.g. SAM and El Nino).
Large-scale circulation - how are the Antarctic shelf seas connected to each other??
Two pristine areas remain in West Antarctica: Bellingshausen and area west of Getz. Bellingshausen appear more accessible and logistically simpler, but Getz is perhaps more interesting in a climate perspective

Nathalie Morata and Guiseppe Aulicino
Representative of young polar scientists association APECS (Association of Polar Early Career Scientists). http://www.apecs.is. Problems and perspective of young polar researchers have been presented.

2.2. Synopsis of the discussions

Besides the immediate discussions taking place in direct connection with the presentations, dedicated time (1 - 2 hours per session) was allocated to achieve consensus about the knowledge gaps and identify where European reasearch is in relation to these gaps. The key points agreed upon in the discussions were:

A) European Antarctic oceanographic research is strong and encompasses the whole continent.

European researchers are performing top quality research in marine Antarctic science and many are without doubt among the world leaders in their field. Europe has two of the world's largest national centers for Antarctic marine research (AWI and BAS) and several medium-sized and smaller. All these national programs are supporting science around the whole continent of Antarctica, which is unique. Although the national programmes are active and conduct science of highest quality, the current activities are only a fraction of the enormous potential available should the European marine Antarctic Research be coordinated. A large portion (over 2/3) of the cost of the science is presently spent on logistic support and infrastructure. There is potential to increase the amount of science we get if the existing logistics and infrastructure is used in an efficient way to support new European science initiatives. A challenge is to involve the disciplines of marine biology, marine chemistry and marine geology more actively in the many oceanographic programmes taking place in Antarctica, and get a stronger interdisciplinary focus on the research questions.

B) Challenges and strengths of infrastructure and logistic support

European institutions operate a number of large infrastructure assets in the Southern Ocean such as ice breakers, coastal field stations in Antarctica, underwater observatories and underwater vehicles (gliders, ROVs and AUVs). Very few of these are coordinated at a European level. An example where European coordination is conducted is the underwater observatories that are operated in the southern Weddell Sea. The systems build upon techniques and methods developed over several decades and have a proven record of high data return. The observatories will now be extended, better integrated and operated as a common effort between three European countries (Germany, UK, and Norway). One of the observatories, the S2 observatory at the Filchner sill offers Trans National Access (TNA) to the European research community as a deliverable to the FP7-funded project FiXO3. Through the TNA it is open for European researchers to add instruments to the observatory.

The national Antarctic programmes in Europe spend the larger parts of their budgets on supporting logistic and infrastructure in Antarctica. Through better coordination of these resources a significantly more cost-effective use of the existing infrastructure would be achieved. This is true for ice-capable ships as well as bases and observatories. Europe has the capacity to have annual cruises to Southern Ocean shelf seas if the national programs would collaborate efficiently. There are initiatives, such as BARTER, but these do not encompass the full European capacity. There is also frequent bartering over ship time that takes place amoung individual research groups and national programmes, but this is only possible if the researchers are firmly embedded within a European network. With structured coordination and shared responsibility for Southern Ocean research it would be also possible for young researchers and researchers that do not have access to a network to take advantage of the infrastructure. Presently the only European programme that supports ship time

exchanges is Eurofleets 2, which has very limited opportunities in the Southern Ocean, low flexibility with regard to research area, and generally too few days allocated for science to be able to facilitate a European cruise to any of the Antarctic shelf seas. While the framework for Eurofleets appears to be appropriate for research cruises in open water and even to some of the Arctic regions it has clearly not succeeded in coordinating the resources needed to conduct European research on the Antarctic shelf seas. The typical duration of an expedition to any of the Antarctic shelf sea regions is about 2 months, and requires an icebreaker. During the discussions at the workshop it was agreed that if even only 6 months of icebreaker time annually was available as a coordinated resource for European researchers it would be a vast improvement.

C) Recruitment

While there is currently a good age spread with a comparatively large portion of young scientists in this research field, there is a challenge in getting the young scientists involved in field projects and in creating their own field programmes. Field work is expensive and hence requires large grants that the young researchers often cannot successfully bid for as they are competing with significantly more senior reserachers.

D) Suggested activities that are affordable and effective

* Creating a consortium of European Antarctic shelf sea researchers. Not only will this help to coordinate the research activities but it will be a tool for policy makers and a contact point.
* Supporting circum-antarctic infrastructure to be made available to European researchers. This can be cheap, easily deployable instrumentation that can be deployed by ships-of-opportunity and transmit data via satellite link to the data host. Two examples of such infrastructure where European researchers are involved are ice radars and bottom landers. This type of infrastructure can be European contributions to the Southern Ocean Observing System.

3. Assessment of the results, contribution to the future direction of the field, outcome

Three critical research objectives were identified as a result of the workshop and are summarized as (i) What are the boundary conditions and external forcing for ocean circulation in the ice-shelf cavity; (ii) What processes control ocean circulation and water mass modifications on the shelf and how does this affect the boundary conditions for the circulation in the sub-ice cavity (iii) Can we quantify the different processes (eddies, wind forcing and forcing by large-scale current system offshore) active for across-shelf transports.

After making progress on these objectives we will understand how oceanic heat flux affects the floating parts of Antarctica's glaciers, which is paramount to understand how, where and why ice sheets lose mass - one of the six key research questions recently identified in the SCAR horizon scan (Kennicutt II et al, 2014. Six priorities for Antarctic Science, Nature 512).

During the discussion in the workshop we agreed on a common strategy and series of actions in order to address these research questions. A common set of recommendations for the EU research body was also agreed upon.

Strategy: In order to address the research question we need to collect European marine Antarctic research in a consortium. We also need to get the projects of national programmes working together under an EU umbrella.

Actions and follow up:
1) Publish a review paper about the oceanic heat flux to the floating glaciers in Antarctica, to be completed during 2015 (ESF remaining funds have been allocated for open source publication)
2) Submit a COST application (due March 2015)
3) Apply to form SOOS working groups for circum-Antarctic ice radar (Necklace) and bottom landers. To be completed during 2014.
4) Foster Marie Curie actions or other career-building projects
5) Include APECS representatives in all the above activities

4. Final programme

Monday, 12 May 2014

Afternoon	*Arrival*
19:00	*Informal meeting in Lerici*

Tuesday, 13 May 2014

09.00-09.10	**Welcome by Convenor Anna Wålin**
09.10-09.30	**Presentation of the European Science Foundation (ESF) Isabel Ambar**
09.30-12:00	**Morning Session: Sub-glacier circulation**
09.30-10.00	**Overview "Sub-glacier ocean circulation: lessons learned from the Amundesen Sea, West Antartica" Pierre Dutriex**
10.00-11.00	*5-6 highlights, 10 minutes each* *Measuring melt rates at an ice shelf base at high temporal resolution* **Keith Nicholls** *Scaling laws for the melt rate and overturning circulation beneath ice shelves derived from simple plume theory* **Adrian Jenkins** *Ross Ice Shelf interaction with ocean at intermediate depth* **Stefano Aliani**
11.00-11.10	*Coffee / Tea Break*
11.10-12.00	**Discussion**

12.00-13.30 *Lunch*

13.30-18.00 Afternoon Session: Ocean circulation on the shelf

13.30-14.00 **Overview "Ocean circulation on the shelf and how it affects transfer of properties between glacier and ocean"**

Mike Dinniman

Observations from the Filchner Depression: a new circulation scheme

14.00-15.30 **Elin Darelius**

Freshwater inputs to the ocean west of the Antarctic Peninsula spatial and temporal changes

Mike Meredith (absent, presentation given by A. Jenkins)

On-shelf processes related to coastal polynyas in the Weddel Sea

Verena HAid

Climatically driven changes of Antarctic sea ice and their role in the climate system

Dorotea Iovino

Circulation and water mass transformation on teh shelf off Adelie Land

Marie-Noelle Houssais

Flux and fate of photosynthetised carbon in the Amundsen shelf waters

Sang Hoon Lee

Ocean2Ice: processes and variability of ocean heat transport toward ice shelves in teh Amiunsden Sea Embayment

Louise Biddle

15.45-16.00 *Coffee / tea break*

16.00-18.00 **Discussion**

20.00 *Dinner*

Wednesday, 14 May 2014

09.00-11:00 Morning Session: Transports across the shelf break

09.00-09.30 **Overview "Transports across the shelf break and how it affects transfer of properties between glacier and ocea" Karen Assman**

10.00-11.00 *Data Analysis and modelling of the Amundsen Sea Embayment*

Yoshihiro Nakayama

Hydrostatic and not hydrostatic simulations of dense waters cascading off a shelf: east Greenald case

	Marcello Magaldi
	Eddy exchange across shelf break
	Ole Anders Nost
	Sea ice thickness and ocean seaice atmosphere heat exchanges in teh Ross Sea from remote sensed data
	Giuseppe Aulicino
11.00-11.10	*Coffee / Tea Break*
11.10-12.00	**Discussion**
12.00-13.30	*Lunch*
13.30-17.00	**Final Session: Planned field activities and projects**
14.00-15.30	Building an European Antarctic Consortium for Horizon 2020
	Svein Osterhus
	Other topics:
	EUROFLEETS project, ESF-funded projects,
	Icebreakers and shiptime, Gliders, AUV. capacity building
	planning the ESF report and the review paper
15.30-17.30	**Discussion on follow-up activities/networking/collaboration**
17.30	*End of Workshop*

Poster session during coffe- and lunch breaks

5. Final list of participants

Aliani, Stefano. CNR Institute Marine Science
Ambar, Isabel. ESF
Assmann Karen. University of Gothenburg
Aulicino, Giuseppe. APECS representative
Laura Barbieri. CNR Institute Marine Science
Biddle, Luise. University of East Anglia
Darelius, Elin. University of Bergen
Dinniman, Mike. Old Dominion University, USA
Dutrieux, Pierre. British Antarctic Survey
Houssais, Marie-Noelle. University Pierre and Marie Curie (UPMC)
Haid, Verena. Alfred Wegener Institute
Iovino, Dorotea. Euro-Mediterranean Center on Climate Change
Jenkins, Adrian. British Antarctic Survey
Lee, Sang Hoon. Korea Polar Research Institute
Merdith, Mike (absent). BAS
Morata, Natalie. French National Center for Scientific Research. APECS representative
Magaldi, Marcello. CNR Institute Marine Sciences
Nakayama, Yoshihiro. Alfred Wegener Institute
Nicholls, Keith. British Antarctic Survey
Nøst, Ole Anders. Akvaplan NIVA
Vetrano, Anna. CNR Institute Marine Sciences

Wåhlin, Anna. University of Gothenburg
Østerhus, Svein. UNI Research

6. Statistical information on participants

Gender balance: 12 males and 11 females

Age balance: 7 participants above 50 years of age, 10 participants of age 35 - 50 years, and 6 participants that were younger than 35

Institutions from nine countries (of which 2 were not European) were represented. The table below shows the spread of countries that were represented.

Summary: There is a good age balance, and a good gender balance in this community.

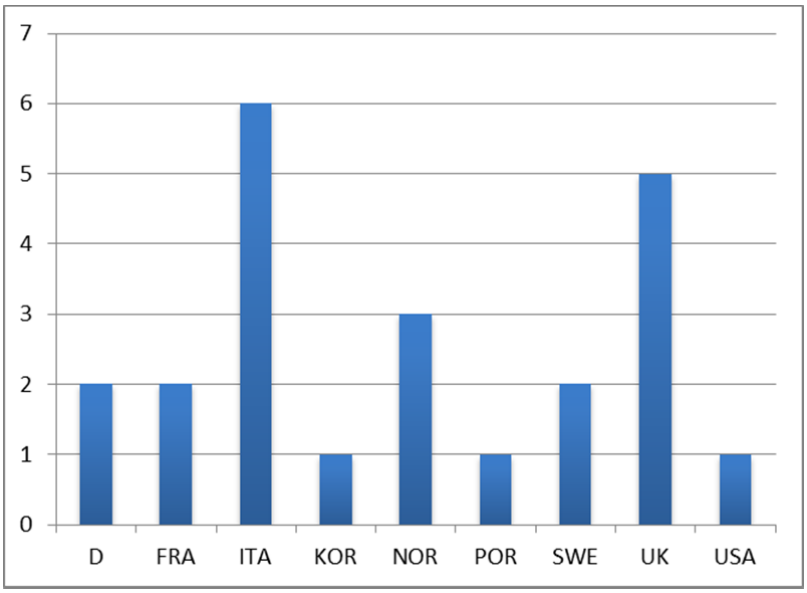

Fig.1 – Number of participants per country