ACCESS
Arctic Climate Change
Economy and Society

Project no. 265863

ACCESS

Arctic Climate Change, Economy and Society

Instrument: Collaborative Project

Thematic Priority: Ocean.2010-1 "Quantification of climate change impacts on economic sectors in the Arctic"

D8.01 – Final report on the conclusions/perspectives of the External Boards about the ACCESS activities

Due date of deliverable: **28/02/2015**

Actual submission date: **11/06/2015**

Start date of project: **March 1st, 2011** Duration: **48 months**

Organisation name of lead contractor for this deliverable: **UPMC**

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Contents

Final report on the conclusions/perspectives of the External Boards about the ACCESS activities

In preparation of the ACCESS final General Assembly in Vilanova i la Geltru (Spain) on February 25-27, 2015, the ACCESS consortium prepared and circulated a draft version of the ACCESS synthesis report (not yet finalized). We asked the ACCESS Advisory Board members to provide comments and general remarks concerning ACCESS conclusions and perspectives based on the ACCESS synthesis report in particular.

The ACCESS synthesis report and the ACCESS scenarios

A full synthesis ACCESS report (over 130 pages) is in preparation and will be submitted for publication in a near future. This ACCESS synthesis report is structured in 7 different chapters. Following an introduction (chapter 1), chapter 2 concerns Climate change and the Arctic Environment (20 pages) and chapter 3 concerns Marine transportation, Fisheries & Aquaculture and Resource extraction (30 pages). Chapter 4 is related to ACCESS cross-sectoral activities including Arctic Indigenous Peoples, Marine Protected Areas in the Arctic Ocean, Arctic infrastructure and Pollution (30 pages). Chapter 5 concerns Governance aspects for all activities in the context of climate change in the Arctic related to global changes (20 pages). Chapter 6 concerns ACCESS management tools including Marine Spatial Planning MSP, Ecosystems Based Management (EBM) and Indicators for sustainable development in the Arctic as a legacy of ACCESS (15 pages). Finally Chapter 7 is related to Observations on sustainable development in the Arctic (10 pages)

In addition, three scenarios were selected by the ACCESS steering committee based on the best predictions in three domains representative of the ACCESS main activities for the next 30 years.

The first scenario concerned the Marine transportation along Northern sea routes based on 1/ a possible sea-ice development assumed to have taken place regarding climate change and Arctic sea-ice prediction until 2040and 2/ on future development and infrastructure and global demand for transporting goods in transit from Europe to Asia across the Arctic Ocean and/or exporting Arctic resources such as minerals, oil and gas towards developed countries.

The second scenario concerned the Arctic seafood production in the context of a rising global population and an increase in food supply taking into account the impacts of climate change on global food production and market values.

The third scenario concerned oil spill risks and contingency in sea ice covered waters based on an increasing global demand for oil and gas and a fluctuating market value in the context of climate change taking into account an increasing ship traffic and risk of collision or grounding.

ACCESS has been actively interacting with stakeholders by invitation to many workshops dedicated to shipping, oil & gas extraction, changes, challenges and livelihoods of local communities and on Indigenous Peoples perspectives on climate change consequences in the Arctic. An ongoing post ACCESS activity will be the preparation of a synthesis report which highlights key results of the sectors investigated but also emphasizes the cross-sectoral aspects of the ACCESS project. We expect this report to be finalized until end of 2015.

The ACCESS Advisory Board

The ACCESS Advisory Board was presented in the ACCESS newsletter N°2 in February 2012. It was composed of five experts on Arctic issues

Professor Oran Young is at the Bren School of Environmental Science & Management, University of California, Santa Barbara, USA. Professor Young specializes in the analysis of environmental institutions with particular reference to international regimes. He has served as Vice President of the International Arctic Science Committee (IASC), Chair of the board of Governors for the University of the Arctic and co-Chair of the Arctic Human Development report. He is the author of "Institutional dynamics: emergent patterns in international environmental governance" (2010).

Honourable Inuuteq Holm Olsen has served as Deputy Minister for the Department of Foreign Affairs of Greenland since July 2006. He was appointed Private Secretary to the Premier from 1997 through 1999. He was posted at the Danish Foreign Ministry in Copenhagen and was at the Greenland representation in Brussels from 2000 through 2003. Minister Holm Olsen earned a BA in political sciences from the University of Alaska Fairbanks in 1994 and a MA in International Affairs from the George Washington University in 1996.

Honourable Hannu Halinen was Ambassador for Arctic Affairs at the Ministry for Foreign Affairs of Finland. He was also a Senior Arctic Official for the Arctic Council and for the Nordic Council of Ministers as well as a member of the Committee for the Barents Euro-Arctic Council. Ambassador Halinen has provided leadership in many diplomatic arenas such as Permanent Representative of Finland to the United Nations Food and Agriculture Organization, Representative of Finland to the UN Human Rights Commission, Ambassador of Finland in Hungary and Egypt among other postings.

Professor Hajo Eicken is at the Department of Geology & Geophysics, University of Alaska, Fairbanks USA. His research interests include the growth, evolution and properties of sea-ice. He is particularly interested in determining how microscopic and macroscopic properties affect sea-ice processes and the climate system. Professor Eicken's team also investigates different uses of sea-ice in Indigenous communities, the private sector and the public at large to help decision makers adapt to a changing Arctic. Professor Eicken chairs the Science Steering Committee for the study of Environmental Arctic Change (SEARCH) project.

Dr. Adele Airoldi has a master in polar studies from the Scott Polar Research Institute in Cambridge UK. She worked in the secretariat of the European Union Council of Ministers in Brussels from 1981 until 2004, mainly on environmental issues. During that period, she assisted Denmark and Greenland Foreign Affairs in preparing the 2002 Ilulissat conference. Since 2004 she is active in the field of Arctic Affairs. She is the author for the Nordic Council of Ministers of a report on the European Union and the Arctic (2008), updated in 2010 and 2014.

Comments on ACCESS Synthesis Report by Professor Oran Young

Let me say at the outset that this is an impressive document. It is clear that ACCESS has done a great deal of work regarding the impacts of climate change in the Arctic and the various specific points elaborated in Chapters 2-5 of the ACCESS synthesis report. But the value of comments is to identify issues where there is room for improvement. So let me come right to the point. I can summarize my reactions to the draft in four main points.

1. Chapter 2: What we need is some way to single out and highlight the contributions of ACCESS to our understanding of the impacts of climate change on the biophysical components of the Arctic system and more specifically Arctic sea ice. It would help to proceed through the following steps: (i) start with a baseline or point of departure regarding Arctic sea ice such as the findings elaborated in ACIA (2004) or in IPCC AR4 (2007), (ii) then summarize what we know now that we did not know at the time of the baseline, and (iii) then highlight how much of the new knowledge can be attributed persuasively to the work of ACCESS. In terms of new knowledge, it makes sense to start with descriptive material. For example, what new information do we have about the annual cycle of thawing and freezing of sea ice in the Arctic Basin? Do we have new information about the volume of sea ice in the Arctic Basin? Then, the question is how much progress have we made in explaining the changes we are able to describe? Lots of people are working on these issues, and there is a constant stream of new data pertaining to them. What I am recommending is that it would be helpful to find a clearcut procedure for highlighting the contributions of ACCESS in this realm and showing how these contributions fit into the bigger picture of knowledge relating to impacts of climate change in the Arctic.

2. Chapters 2 and 3: The issue here centers on the impacts of climate change on various socioeconomic activities in the Arctic. The emphasis is on shipping, energy development, seafood production, and living conditions. The problem here is that there are numerous drivers of developments regarding such matters, and it is essential to figure out what proportion of the variance in this realm can be attributed persuasively to the impacts of climate. Consider some examples. Commercial shipping using the NSR has not come close to reaching the level achieved in the

1980s prior to the collapse of the Soviet Union and priori to changes in sea ice conditions. There are clearly factors other than climate change that are determining the extent to which the NSR is used for commercial navigation. The current view is that the NSR is not likely to become a major sea route for container ships during the foreseeable future for reasons that have little to do with climate change. In this realm, great expectations spawned by the impact of climate change seem likely to be disappointed. In the case of energy development, other factors like the rise of hydraulic fracturing and the drop in world market prices are clearly relevant and probably considerably more important than the impacts of climate change. Climate change may make some reservoirs more accessible, but this doesn't mean that they can be developed profitably. With regard to living conditions in the Arctic, most residents of Arctic communities emphasize a range of factors other than climate change as the most important determinants of changes in living conditions. None of this is to argue that the impacts of climate change are unimportant with regard to socioeconomic developments in the Arctic. But it seems clear that climate change is only one of a number of factors and that it may account for a relatively small proportion of the variance in this realm. These chapters need to recognize this fact and to discuss explicitly methods of separating out the impacts of climate change from the impacts of a variety of other factors.

3. Chapter 5: The discussion of governance and governance systems relevant to the Arctic seems disappointing to me. The chapter does a nice job of identifying and describing the array of existing governance arrangements that have some relevance to what goes on in the Arctic. But the chapter is neither particularly sophisticated in theoretical terms nor informed by a deep understanding of the politics of governance in the Arctic. There is little engagement with the concerns of the mainstream theorettical literature on governance. For example, the literature places great emphasis on ways to measure and explain the effectiveness of governance systems. But this chapter does not make a concerted effort to apply the general work in this area to the issue of assessing the effectiveness of existing arrangements in the Arctic, such as the Arctic Council. Similarly, the chapter introduces the idea of a spectrum from fragmentation to integration regarding governance systems. This is in fact a topic of considerable interest in the general literature on governance. But the chapter makes little systematic effort to link the discussion of Arctic governance to the more general debate about fragmentation-integration. When it comes to the assessment of options for addressing governance challenges arising in the Arctic today and likely to arise in the near future, the chapter does a credible job of identifying and describing the major ideas under consideration. But most of what it has to say on this topic is familiar from the work of others, and there is little effort to demonstrate how our theoretical understanding of governance systems can be brought to bear in thinking about the future of Arctic governance systems. At the same time, the analysis presented does not appear to be based on any deep understanding of the politics of Arctic governance surrounding issues such as the role of observers in the Arctic Council or the role of the Arctic Economic Council. I don't

want this criticism to sound too harsh. I know that Lindsay and his team have worked hard on this theme, and they have certainly done a credible job in canvassing the state of play regarding Arctic governance. On a more specific point, I have corresponded separately with Lindsay about the effort in this chapter to develop and operationalize a set of indicators of governance that can be used to assess the state of play in the Arctic and elsewhere.

4. A general observation: It would be useful to combine an account of the major contributions of ACCESS in various areas with a discussion of the cutting-edge questions about these matters that come into focus as a result of the work of ACCESS. Successful research projects always lead to the identification of new research challenges that arise from the insights generated by the work carried out. I would advocate doing this in tabular form. There is no need to address this matter at great length. But it would help to know what ACCESS has to say about the next major challenges that arise regarding the issues dealt with in Chapter 2-5.

Comments from Dr. Adele Airoldi

It was clear from the beginning that ACCESS was meant to represent a significant departure from the "traditional" research on Arctic issues financed by the EU.

The main novelty was twofold.

First, ACCESS was tasked to integrate research on Arctic physical science with research on socio-economic issues. This meant to study and predict as accurately as possible the effects of climate change on the physical characteristics of the Arctic Ocean and on this basis assess the impact on the main economic activities, shipping, fisheries and extraction of hydrocarbons, on a 30-year horizon.

Second, ACCESS was tasked with providing elements which could assist EU policy-makers in their continuing consideration of how best to address and develop a position on Arctic issues. To this end, ACCESS was to research governance in the Arctic and to identify the best avenues to be supported to ensure sustainability. In fact, ACCESS is concluding its work at a time when the EU Commission and External Action Service have been instructed by the Council to elaborate "proposals for the further development of an integrated and coherent Arctic policy", due by the end of 2015.

These tasks were ambitious and difficult in many ways.

One first obvious difficulty was the geographical scope, the Arctic Ocean in general. It is a truism that there is not one Arctic, but many "Arctic" - various parts of the Arctic Ocean have different physical characteristics, and are very different for economic, social and political conditions.

Moreover, while the working groups studying the different aspects have done an impressive work, researchers have had to make a special effort to gain greater awareness of cross-sectoral implications, as well as of the implications of their findings for the shaping of future policies, and to bring them to light. In short, they had to find a new dimension to their research and even a new language to express the results, making them "useful".

Research on governance was also a difficult matter. While ACCESS has given an exhaustive description of the situation, identifying gaps and considering possible avenues, the situation is in constant flux and strongly impacted by political developments, in part unexpected or even unforeseeable.

Evaluating the outcomes of ACCESS against the aims pursued and in the light ofthe above considerations, some remarks come to mind.

First of all, it would be important to make it clearer what is the added value brought by ACCESS, in general and in the different sectors studied, i.e. which of the results achieved add to knowledge, and how they can be used.

In particular, it would be important better to detail furtherwhich are the new findings on the effects of climate change on the Arctic ecosystemand how they are relevant for the economic sectors identified.

To this end, comparable presentations could be an advantage, such as, for instance, for each economic sectorresearched, a summary of findings, followed by conclusions and outlook, which would pay special attention interactions with other sectors. In this context, it should be made clearer to which extent the outcomes reflect the intention to give an integrated view, highlighting where and how links have been established, and if relevant difficulties encountered when doing so.

The integration instruments, MSP, ecosystem based management, indicators are management tools which could be of great use, but, again, it would be important to stress their potential utility for decision making, as well as their added value following research in ACCESS.

In summary, the main effort would be to present results in a manner which is as short, clear and as forward-looking as possible. An important legacy of ACCESS, beyond the scientific results obtained, will be to have inaugurated a new, different, more interdisciplinary method of working, which will be continued by its successor ICE ARC.

One could imagine in this context a special meeting or at least an exchange of views aiming at identifying and assessing the problems encountered by ACCESS in integrating the different tasks, and at finding elements and suggestions for future work.

General comments from the ACCESS consortium

Since the ACCESS final publishable report is largely based on the ACCESS synthesis report and also on remarks provided by the ACCESS Advisory Board members during the

ACCESS final GA and just following the ACCESS final GA in Spain, hereafter we selected some major conclusions and ACCESS results from the ACCESS final publishable report.

The ACCESS main achievements

ACCESS explored the actual climate variability of the Arctic Ocean subjected to profound and significant changes occurring at the planetary scale. Following the previous DAMOCLES tradition, that implied deep insights of the interactions between the Arctic Ocean, the Arctic Atmosphere and the Arctic Sea-Ice. These investigations were based both on new and traditional observations and on models in order to establish some reliable predictions for the next 30 years. 22 deliverables were submitted to the EU Commission ranging from in situ and space observations to numerical models climate projection into the next 30 years and weather forecasts improvements; from quantitative network design to quality control, cal/val and accuracy of space observations; from in situ sea-ice thickness observations from AUV and submarines, to melt onset, break-up and freeze-up of sea ice; from reanalysis of historical data, to data assimilation in numerical models and short range weather forecasting.

ACCESS explored three major domains of human activities in the Arctic impacted by climate change.

Marine transportation across the Arctic Ocean including transportation of goods from East to West and West to East, exportation of Arctic mineral resources (oil & gas) and living resources (seafood) and Arctic tourism transporting passengers. 25 deliverables were submitted to the EU Commission ranging from navigation along the Northern Sea Route impacted by climate change, to current and future monitoring and forecasting for navigation at high latitudes; from rules and regulations for Arctic shipping, to infrastructure needs for polar navigation in ice infested waters; from identification of governance related issues on Arctic shipping and tourism, to indicators for a sustainable development of marine transport and tourism in the Arctic; from threat by icebergs and ice massifs to Arctic shipping, to design and fabrication of lateral stress sensor measuring lateral stresses in Arctic ice

Arctic seafood production involving fisheries and aquaculture in a local, regional and global context impacted by global changes. 12 deliverables were submitted to the EU Commission ranging from economic settings, societal and cultural priorities in the fishery and aquaculture sectors, to international and national fishery from climate change and aquaculture, to market responses to climate change; from climate change impacts and human responses affecting traditional whaling, to indicators for sustainable development in the Arctic fisheries sector.

Offshore extraction of oil & gas, pollution and protection of the marine environment. 21 deliverables were submitted to the EU Commission ranging from oil spill response capabilities and technologies in ice-covered waters, to emission of a large set of atmospheric compounds in gas/oil extraction facilities; from implications of Arctic energy supply for European policies, to management and adaptation practices and strategies versus climate-related issues; from identification of ecologically vulnerable areas, to safety zones and noise exposure criteria for marine mammals exposed to anthropogenic noise; from

recommendations on future Arctic observing systems for safe resource extraction to indicators for sustainable development of the offshore oil & gas extraction; from iceberg remote sensing detection, trajectory forecasting and tracking, to report on rescue and evacuation systems;

ACCESS dedicated a lot of attention to management and governance related to economical, geopolitical and cultural relevant issues in each of these specific domains of human activities and proposed new tools for dealing with each of them. 11 deliverables were submitted to the EU Commission ranging from scientific and ethical evaluation of the impact of indigenous seal hunting, to operational conditions of an effective participation of Arctic indigenous peoples in the future Arctic governance; from conditions for an integrated ecosystem based management in the Arctic, to the development of marine spatial planning concept and principal framework; from assessment regarding climate change effects and impacts on regulatory systems, to a cross-sectoral synthesis of economic, policy and governance options for sustainable development. New tools were produced in this context (Marine Spatial Planning MSP, Ecosystems Based Management EBM and Indicators) to help not only for the synthesis and integration of ACCESS results but also for future applications dealing with Arctic issues similar to those explored during the ACCESS project. This is a remarkable ACCESS legacy.

ACCESS communications, dissemination and outreach activities were exemplified by 27 deliverables of WP6 (the most prolific ACCESS work package) related to the ACCESS newsletters (11), the ACCESS Policy Briefs (4), the ACCESS summer schools (2) as already reported but also by the active participation of ACCESS partners to many conferences (including press conferences during the four annual ACCESS General Assemblies) and international meetings of importance such as the Arctic Science Summit Week (ASSW), the Arctic Frontiers, the Arctic Circle conference, the Arctic Observing Summit (AOS), the Sustainable Arctic Observing Network SAON and other Arctic Council working groups and task forces (AMAP/ACAA) to name a few.

One of the main conclusion of the ACCESS project concerns climate change aspects of the Arctic system and the impacts climate change might have in the next 30 years on human activities such as Arctic shipping, Arctic Fisheries and Arctic mineral Resources exploitation. Among all the elements of the Arctic climate system, sea-ice is the most affected by the change and everything depending on sea-ice is directly impacted. Within the coming 30 years one can predict with a high degree of certainty that Arctic sea-ice might melt almost entirely in summer some years. But still due to the natural variability of the Arctic climate system there will be years retaining some ice in summer. The whole Arctic Ocean would become a seasonal sea-ice area similar to the Antarctic Ocean and the Arctic multi-year ice would then disappear almost entirely. This will lead to profound transformation of the Arctic marine ecosystems, water mass distribution and vertical mixing. Polar Bears (not an ACCESS topics) will be strongly affected by the new Arctic sea ice seasonal cycle. But it seems like the most disturbing effect of this Arctic climate change manifestation would concern the mid latitude weather patterns due to a weakening of the Polar vortex, an amplification of the jet stream meandering activity, an increase in atmospheric blocking and cold air outbreaks. This aspect was not investigated during ACCESS but it is already attracting a lot of interest from the international scientific community.

The impact of Arctic climate change on human activities has also a focal point regarding sea ice and the way sea ice might or might not affect the development of human marine activities in the next 30 years. Surprisingly it does not seem like Arctic fisheries and aquaculture are deeply concerned today with climate change. The northern sea-ice retreat observed during recent years does not seem to have a deep impact on the actual fisheries and aquaculture in the Northern part of Europe. This is quite in contrast with what happened along the North East coast of the North American continent many years ago and more recently around Iceland. Regarding marine transportation along Northern Sea Route it is quite a different story. The sea-ice aspect has already and will have a deep impact on the future development of this activity but it is extremely important to note that climate change is not the only important and relevant "impact factor". Market values, global demand for renewable resources, infrastructure and technology development, Arctic governance at local, regional and international levels are all important parts of the puzzle.

Regarding oil & gas extraction it is important to separate inland and offshore oil & gas exploitation. There is already an intense activity developing on the Yamal Peninsula as far as oil & gas are concerned. There are several ice strengthened LNG ships in construction for exporting the gas from the Yamal Peninsula to Asia and Arctic climate change has certainly influenced the decision for intensifying this LNG ship development rather than the oil & gas extraction on the Yamal Peninsula itself. At the beginning of ACCESS there was a great hope that Shtokman gas field in the central Barents Sea will open before the end of ACCESS. But due to decision by the American administration to authorize the exploitation of shale gases, Shtokman closed. The economy for exploiting the offshore gas field at Shtokman was not right any more. Not the least failed attempts by Shell to exploit offshore oil & gas in the Barents Sea in 2012 demonstrated the challenging aspect for exploiting offshore oil & gas in the Arctic. Some giant oil companies have decided not to risk investing in this domain because the conditions are not met yet between advanced technology, environmental hazards, price markets based on global demand for energy and sources of production.

As demonstrated by the Yamal Peninsula activities, marine shipping in the Arctic will strongly depend on Arctic resources being extracted and exported rather than ships transiting between East and West or the other way around for transporting goods from Europe to Asia (or Asia to Europe). Arctic tourism is a very special activity and will certainly grow quite significantly in coming years but not necessarily because of climate change although the accessibility of polar regions will be greatly improved with sea-ice retreating further North. The new Polar Code, long time expected, is precisely made for increasing safety for navigating in Polar Waters. The difficulty is now for implementing the Polar Code that will be put into force in 2017. This is the responsibility of the International Maritime Organization in cooperation with the Arctic Council as far as the Arctic Ocean is concerned.

In Summary**,** we selected **9 overall challenges** issued from ACCESS results

1/ **Climate change**. A real change is actually happening in the Arctic as testified by the spectacular Arctic sea-ice retreat occurring in summer 2007 and 2012. But the sea-ice

volume (75%) is more affected than sea-ice extent (50%) due to sea-ice thickness reduction as well. Milder winters are the dominant factors explaining most of the Arctic sea-ice reduction in addition to longer melting season related to earlier sea-ice break-up and later freeze-up events. First-year ice is dominating the Arctic sea-ice and the multi-year ice is disappearing. Snow is an important factor but still difficult to apprehend both from models and observations and improvements should be done. There is an increasing interest in understanding linkages, between the Arctic Climate system and the mid-latitudes weather systems involving Polar vortex weakening, jet stream meandering, atmospheric blocking and cold air outbreaks. As far as the Arctic is concerned, there is a need for improving weather forecasts in this polar region exposed to a growing interest for developing human activities.

2/ **Arctic Shipping**. On the short term Arctic shipping activities along Northern Sea route is very much weather rather than climate dependent (weather in a broad sense and from a navigational point of view is also including sea-ice and icing as well as winds and fogs, waves and currents). Improving weather forecast in the Arctic is a necessity. Specified shipping activities for exporting Arctic resources rather than ships transiting across the Arctic, are likely the main driving force. The key issue concerns infrastructure allowing a safe and sustainable development of marine shipping in the Arctic. Infrastructure for ship navigation in the Arctic represents by far the largest investment for the future of human activities in the Arctic involving the public and private sectors as well. Climate change is rather a long-term dominant factor for marine shipping at northernmost latitudes (Polar Route). Numerous safety and pollution related issues need to be tackled, enhancing the IMO Polar Code.

3**/ The Polar Code** is a long expected achievement but some urgent improvements are strongly needed for a better and more efficient implementation of the Polar Code such as air pollution due to ship emission, ship noise and marine protected areas, water ballast from ship in the Arctic Ocean. ACCESS provided new results regarding air pollution and ocean noise pollution.

4/ **Arctic seafood production**. Aquaculture is on the rise and might benefit more from climate change than fish landings. Climate change is not a central concern for Arctic fisheries except for extreme weather events increases related to climate change and better weather forecast for safe navigation in polar waters.

5/ **Oil & Gas**. Hydrocarbons exploitation is on the rise in the Arctic on land (Yamal) rather than offshore. This is more a result or consequence of the global market and shale gas exploitation than due to climate change. It is clear that current technology is not able to control potential oil spills that could occur in sea-ice infested waters.

6/ **Infrastructure** is a key issue for all kind of human activities development in the Arctic. It requires huge investments and represents the most challenging aspect for the future development of human activities in the Arctic. ACCESS defined what is urgently needed as far as infrastructure is concerned in the Arctic such as Search and Rescue facilities, bottom charts, operational observing system, satellites communication, weather forecast and ice pilot charts to name a few.

7/ Projects like ACCESS can help identifying and reducing **uncertainties** in order to facilitate decision making and policy making. Being aware of uncertainties in all related parameters is a prerequisite for the development of optimal experimental design for observing network as demonstrated in ACCESS as well as for a realistic estimation of the quality of projections or predictions.

8/ **Indigenous Peoples** are legitimately expecting a better share regarding human activities development in the Arctic. Human rights for Indigenous Peoples need protection simply because human activities in the Arctic are very influential regarding cultural and societal development. Arctic Indigenous Peoples will be strongly involved in future human activities development in the Arctic and this aspect deserves a lot of attention in future international programs dealing with Arctic research.

9/ with a growing population up to 10 billion human beings by the end of this century, **Arctic resources** exploitation and development of human activities in the Arctic are to be expected. This development needs to be kept under control in a sustainable way as far as possible. **Marine Spatial Planning** and **Ecosystem Based Management** are efficient tools to be promoted to aim for a more sustainable use of the Arctic Ocean resources to contribute to maintained or even improved welfare levels locally and globally if possible.