United Nations FCCC/SBSTA/2011/INF.6

Framework Convention on Climate Change

Distr.: General
5 June 2011

English only

Subsidiary Body for Scientific and Technological Advice
Thirty-fourth session
Bonn, 6–16 June 2011

Item 6 of the provisional agenda
Research and systematic observation

Report on the workshop on the research dialogue

Note by the secretariat

Summary

This document contains the report of the Subsidiary Body for Scientific and Technological Advice (SBSTA) workshop on the research dialogue, which was held from 2 to 3 June 2011 in Bonn, Germany. The report summarizes the information provided by the representatives of international and regional research programmes and organizations, United Nations agencies, scientific experts and the Intergovernmental Panel on Climate Change, on recent developments in climate change research activities, as well as Parties' views on research needs and priorities to support the work of the Convention. The report also provides a summary of the main elements arising from the workshop for possible further consideration by the SBSTA.

Contents

		Paragraphs	*Page*
I.	Introduction	1–8	3
	A. Mandate	1–3	3
	B. Scope of the note	4	3
	C. Possible action by the Subsidiary Body for Scientific and Technological Advice	5	3
	D. Background	6–8	3
II.	Proceedings	9–17	4
III.	Summary of the presentations and discussions	18–101	5
	A. Setting the scene	19–23	5
	B. Session 1 – Understanding the science: recent climate change research findings and uncertainty management	24–68	6
	C. Session 2 – Communicating climate change science	69–86	13
	D. Session 3 – Building capacity for research in developing countries	87–101	16

I. Introduction

A. Mandate

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its thirty-second session, noted the need to further enhance interaction between the science and policy communities by strengthening the research dialogue between Parties and the regional and international climate change research programmes and organizations that is taking place under the SBSTA in the context of decision 9/CP.11.[1]

2. In this regard, the SBSTA requested the secretariat to organize a workshop, in conjunction with the thirty-fourth session of the SBSTA, subject to the availability of resources and under the guidance of the Chair of the SBSTA, to allow further in-depth consideration to be given to issues addressed in the research dialogue, and to prepare a report on the workshop to be made available for consideration by the SBSTA at its thirty-fourth session.[2]

3. The SBSTA further requested the secretariat to provide information to Parties prior to SBSTA 34 on the themes to be presented at the research dialogue meeting to be held at SBSTA 34 and at the workshop.[3] This information has been made available as document FCCC/SBSTA/2011/INF.1.

B. Scope of the note

4. This report has been prepared in response to the request in paragraph 2 above. It draws upon the information that was provided and the discussions that took place during the workshop, and provides brief summaries of the presentations as well as summaries of the main elements arising from the deliberations at the workshop.

C. Possible action by the Subsidiary Body for Scientific and Technological Advice

5. The SBSTA may wish to consider the information contained in this report with a view to determine appropriate actions arising from it.

D. Background

6. The Conference of the Parties, by decision 9/CP.11, requested the SBSTA to regularly consider research needs and systematic observation relating to the Convention in order to inform Parties about ongoing and planned activities of regional and international climate change research programmes, and to communicate Parties' views on research needs and priorities to the scientific community, as necessary. It further invited national, regional and international climate change research programmes and organizations to consider research needs, as viewed by the Parties and communicated to the scientific community by the SBSTA, and to communicate to the SBSTA how these programmes and organizations are addressing the research needs of the Convention.

[1] FCCC/SBSTA/2010/6, paragraph 48.
[2] FCCC/SBSTA/2010/6, paragraph 49(a).
[3] FCCC/SBSTA/2010/6, paragraph 50.

7. At its twenty-sixth session, the SBSTA agreed to develop and maintain a dialogue between Parties and the regional and international climate change research programmes and organizations, in the context of decision 9/CP.11, and invited relevant research programmes and organizations to regularly inform the SBSTA of developments in research activities relevant to the needs of the Convention, including:

(a) Emerging scientific findings;

(b) Research planning activities, including those undertaken in response to key uncertainties and research needs identified by the Intergovernmental Panel on Climate Change (IPCC) or raised by Parties;

(c) Research priorities and gaps in the implementation of these priorities;

(d) Research capacity-building activities, particularly in developing countries;

(e) Regional climate change research networks;

(f) Relevant communication issues.[4]

8. At its thirty-second session, the SBSTA noted the need to further enhance interaction between the science and policy communities by strengthening the research dialogue and identified possible ways to enhance its effectiveness in the future. In this regard, the SBSTA requested the secretariat to organize the workshop referred to in paragraph 2 above.

II. Proceedings

9. The secretariat organized the workshop on research in Bonn, Germany, from 2 to 3 June 2011, under the guidance of the Chair of the SBSTA, who also chaired the workshop.

10. Financial support was provided by the Governments of the United Kingdom and Switzerland. The workshop also benefitted from the participation of and information provided by scientists and experts from international and regional research programmes and organizations, United Nations agencies, and from Parties.

11. The workshop was attended by 69 participants, including 21 representatives of Parties not included in Annex I to the Convention (non-Annex I Parties) and 18 representatives of Parties included in Annex I to the Convention, as well as scientists, experts and representatives of the scientific climate change community, including from regional and international research programmes and organizations, and the IPCC.

12. The workshop and its preparations were informed by Parties' views on issues related to the research dialogue[5] and a summary of proposed themes for the research dialogue meeting and the related workshop[6] as well as updates on developments in research activities relevant to the needs of the Convention provided by regional and international climate change research programmes and organizations.[7]

13. An introductory session provided information on the objectives and scope of the workshop and background information on the research dialogue under the SBSTA. Information was also provided by the IPCC with regard to IPCC policy-relevant information for supporting the UNFCCC process and to its activities in communicating climate change science.

[4] FCCC/SBSTA/2007/4, paragraph 47(a–f).
[5] FCCC/SBSTA/2010/MISC.12 and FCCC/SBSTA/2011/MISC.1.
[6] FCCC/SBSTA/2011/INF.1.
[7] FCCC/SBSTA/2011/MISC.4.

14. The workshop was organized in three sessions, according to the following major themes:

(a) Session 1: Understanding the science: recent climate change research findings and uncertainty management;

(b) Session 2: Communicating climate change science;

(c) Session 3: Building capacity for research in developing countries.

15. Session 1 was held on 2 June and facilitated by a representative of Italy. Sessions 2 and 3 took place on 3 June, and were facilitated by a representative of the International Geosphere–Biosphere Programme (IGBP) and a representative of Belize, respectively. A scientist from Oxford University, United Kingdom, served as the rapporteur.

16. Presentations were followed by and question-and-answer sessions and drafting groups were established to identify the main elements emerging from the presentations and discussions and to summarize the main findings. Participants actively and in an open manner shared their views during each of the sessions, thereby allowing in-depth consideration of the information provided.

17. The closing session of the workshop concluded with summaries of the main elements emerging from each of the sessions.

III. Summary of the presentations and discussions

18. The following section provides, in a summarized form, information provided by the presenters of the workshop with the aim of providing an indication of the main topics addressed at the workshop. Full information on the content of the presentations and related background information can be obtained from the UNFCCC website.[8]

A. Setting the scene

19. A representative of the IPCC underlined the role of the IPCC Assessment Reports in defining the Convention and its Article 2, the provisions of the Kyoto Protocol, and in creating a strong basis for a post-2012 agreement. He stressed the greater certainty in the attribution of natural and anthropogenic climate change and presented the main impacts of climate change as a result of an increasing global average temperature.

20. He explained that in the IPCC Fourth Assessment Report (AR4) stabilization scenarios were classified in terms of long-term carbon dioxide (CO_2) and greenhouse gas (GHG) concentrations, peaking year, changes in global emissions in 2050 and equilibrium temperature, with some limitations.[9] The forthcoming IPCC Fifth Assessment Report (AR5) includes many climate simulations and studies on the associated socio-economic conditions, conducted in the framework of new representative concentration pathways (RCPs) selected to investigate a wide range of possible futures. Other features of the forthcoming AR5 include: better integration of mitigation and adaptation; an improved approach to risk management; the inclusion of regional information where available; sustainable development and equity aspects; the comprehensive treatment of economic and cross-cutting issues; the handling of emerging issues; and the improved handling and communication of uncertainties.

[8] <http://unfccc.int/methods_and_science/research_and_systematic_observation/items/6032.php>.

[9] Only best-estimate climate sensitivity analysis is shown; an equilibrium temperature may be approached, depending on the evolution beyond 2100.

21. He emphasized that the IPCC post-InterAcademy Council is stronger than ever due improved governance and procedures, the policy on conflict of interest (principles agreed) and the communication strategy (principles agreed). He underlined several ways of improving the policy-relevance of IPCC information, including by: investing in research and observation; improving participation in the IPCC process across disciplines and countries; and improving the diffusion and usage of IPCC products.

22. Another representative of the IPCC made a presentation on communicating climate change science. She provided examples of challenges in explaining scientific information and underlined the role of the IPCC in communication. Additional new features of the AR5 include: addressing, in addition to sectors, systems that people can relate to (e.g. food production and food security); more attention to regional matters; cross-cutting themes (e.g. Article 2 of the Convention, costing and economic analysis); going from addressing adaptation, mitigation and sustainable development to integration with other environmental and development issues; and moving from climate change box to true integration.

23. The new IPCC policy on communication addresses issues relating to the communication framework and its scope and interaction with the media. It will result in an enhanced communication of uncertainties, thus improving the confidence in the validity of findings. This confidence will be qualitatively expressed, based on the type, amount, quality and consistency of the evidence and the degree of agreement. A likelihood scale will be used for quantified measures of uncertainty and will be expressed in probabilistic terms, based on the statistical analysis of observations, model results or expert judgement.

B. Session 1 – Understanding the science: recent climate change research findings and uncertainty management

1. Summary of presentations

Global impacts

24. Two scientists presented, on behalf of the Arctic Monitoring and Assessment Programme (AMAP) of the Arctic Council, the main findings of the Snow, Water, Ice and Permafrost in the Arctic (SWIPA)[10] assessment on climate change in the cryosphere. The SWIPA results show that there is evidence on the interaction of snow and sea ice in the Arctic with the climate system. Some of the findings of the assessment include: the faster rise of temperatures in the Arctic; the acceleration of sea ice decline and the fact that sea ice is getting younger and thinner.[11] In addition to global impacts, all these changes will have an impact on Arctic endemic species and local communities, shipping and navigation, resource extraction and tourism among others. The results underlined by the scientists also included an acceleration of mass loss in Greenland ice sheet, mountain glaciers and ice caps with potential sea level rise contributions. The study found also more winter snow in some places, but earlier spring melt and permafrost warming and thawing, which could have a potentially large positive feedback from loss of carbon dioxide storage.

25. Another scientist, representing the International Association of Cryospheric Sciences (IACS) presented highlights of the results of the International Polar Year relating to ice changes in Antarctica, the Himalayas and other mountain glacier regions. He underlined the mass changes in west and east Antarctica, measured from satellites, which suggest a slight acceleration in loss. Most of these losses are taking place in west Antarctica

[10] This report has been approved by all eight Arctic Council Governments during the Arctic Council Ministerial Meeting in Nuuk, Greenland, on 12 May 2011.

[11] Loss of sea ice and snow in the Arctic enhances climate warming by increasing the absorption of the sun's energy.

and although there are uncertainties, the study found 0.5–0.6 mm contribution to sea level rise (SLR) equivalent per year.

26. This loss is occurring almost solely from increased ice discharge into the ocean. Causes include a warmer ocean or changed ocean circulation, extensive subglacial water in the form of lakes and active drainage systems (not yet clear). An acceleration of the rate of loss from Antarctica over the next century is a strong possibility.

27. A contribution of glaciers to sea level rise of 1.2 mm SLR per year was mentioned, most of it coming from glaciers in Antarctica, Arctic Canada and Alaska, and Svalbard. The data on Himalayan glaciers are scarce and data collection is a challenge. The impact on regional water supply was also presented.

28. An expert who participated on behalf of the Seventh Framework Programme (FP7) of the European Union presented recent results from the European Project on Ocean Acidification (EPOCA). She explained the causes of ocean acidification (an increase in CO_2 emissions in the atmosphere leading to higher uptakes of CO_2 by oceans) resulting in measurable changes in ocean chemistry and pH, and the effects of decreases in ocean calcium carbonate concentrations for the shell-producing capacity by marine organisms and consequences for the base of the food web. She highlighted results from early ocean acidification projections in high latitudes, indicating corrosion in the oceans in those regions, observational data showing steady decline in pH, and other effects related to warming and acidification of the oceans, for example increased oxygen loss.

Regional impacts

29. An scientist from the Inter-American Institute for Global Change Research (IAI) provided results from recent studies which highlight possible impacts of land-use changes on the regional and global climate in South America due to biophysical effects. Research findings from IAI collaborative research in the Americas further suggests that changes in land use, in addition to having an effect on the net carbon balance, also result in biophysical changes, in particular on surface roughness, albedo and heat transfer rates, which can off-set carbon stocks in semi-arid and sub-humid regions. Integrating these biophysical effects to the biochemical effects (GHGs) is hence critical to mitigation efforts in the land-use and forestry sectors (e.g. afforestation, reducing emissions from deforestation and forest degradation in developing countries).

30. The impacts of climate change on farming systems and food production was presented by a scientist on behalf of the Earth System Science Partnership (ESSP). The presentation underlines the need to produce 60–70 per cent more food by 2050 while, due to climate change, crop suitability will fall in many areas and irrigation will be impacted. As a result food prices, for example rice, wheat, maze and soybeans, will increase and could result in a 20 per cent increase in malnutrition for children by 2050. Adaptation in agriculture will be needed and is already happening. Sometimes this can drive increases in emissions.

31. The presenter suggested that: the multiple roles of agriculture in adaptation, mitigation and food security should be recognized in the UNFCCC process; the proposed SBSTA work programme on agriculture should be initiated; and that it is feasible to incentivize agriculture and reduce deforestation.

32. An expert who participated on behalf of the FP7 of the European Union presented ongoing activities of a recently started project on climate change predictions of Sub-Saharan Africa (ClimAfrica) with a focus on impacts and adaptation. The main objectives of this project include developing improved climate predictions on seasonal to decadal timescales, assessing climate impacts and evaluating vulnerabilities to inter-annual and decadal variations, especially on water and agriculture and ecosystems and livelihoods,

with the aim of developing monitoring and forecasting warning systems, and analysing potential adaptation measures. He highlighted the urgent need for improved observations in the African continent, especially for assessing models and supporting research.

Socio-economic impacts

33. Another expert who participated on behalf of the ESSP, presented results from studies on the effects of GHG reduction strategies on public health, highlighting examples from household energy, urban transport, food and agriculture and electricity generation, both in developed and developing countries (e.g. the Indian stove programme). He concluded that many climate change mitigation strategies can result in major benefits for public health (e.g. decreases in premature deaths), and that these co-benefits can, at least partly in some countries, offset the costs of such strategies. However, a prior assessment of the impacts of mitigation strategies is needed.

34. An expert who participated on behalf of FP7 of the European Union, in collaboration with an expert who participated on behalf of the IGBP, outlined socio-economic aspects of ocean acidification. Compared with the chemistry of ocean acidification, which is considered relatively certain, the socio-economic impacts of ocean acidification have been less well studied; especially the economic valuation of the marine ecosystem and goods and services is challenging and requires further research. She highlighted, however, the growing concern for food-producing organisms, for the world's fisheries hot spots, and possible impacts on future food security. Possible options presented to address ocean acidification and its possible socio-economic impacts include cuts in human-made CO_2, reduction of other pressures on the oceans, assessment of vulnerabilities, and others.

35. The main outcomes of the 2010 report on the state of the Arctic coast were presented by a scientist on behalf of AMAP of the Arctic Council. The objective of the report was threefold: to review the state of physical and ecological systems and human communities and activities on the Arctic coast; to identify knowledge gaps and research priorities relevant to Arctic coastal vulnerability; and to develop a road map for an integrated approach to research on coupled social–ecological–physical systems on the circumpolar Arctic coast. The report includes a thematic assessment from physical and ecological perspectives and from coastal ecosystems; and from social, economic and institutional state of the circum-Arctic coast perspectives. It also includes an integrated assessment of: costal changes; monitoring, detecting and modelling change; vulnerability, adaptation, adaptive capacity and resilience; and governance and adaptation.

36. The report stressed that many Arctic coastal communities are experiencing vulnerabilities to decreased or less reliable sea ice, greater wave energy, rising sea levels, changes in winds and storm patterns, storm-surge flooding or coastal erosion, with impacts on travel, subsistence hunting, cultural resources and housing and infrastructure in communities.

Temperature stabilization scenarios and associated emission trajectories and responses of carbon sources and sinks

37. An expert from the Netherlands Environmental Assessment Agency summarized the ongoing work on scenario development for the AR5, including on scenarios for stabilizations at low-level GHG concentration and temperature. The next generation of scenarios for climate change research and assessment, which includes both baseline and mitigation scenarios,[12] is under development and it is coordinated by the scientific community, instead of the IPCC. A parallel approach rather than a sequential approach is used.

[12] Special Report on Emissions Scenarios only included baseline scenarios.

38. The presentation underlined that significantly more stabilization scenarios for stabilization at low GHG concentration and temperature will be available for the AR5 than for the AR4. According to the presenter, the following elements are needed for a likelihood greater than 66 per cent to maintain the global average temperature under 2 °C: peak emissions between 2010 and 2020; an emission level in 2020 of 44 Gt CO_2 eq/year (39 to 44 Gt CO_2 eq/year, and 66 per cent post-2020 reduction rate of 3.0 per cent (2.2 to 3.1 per cent). For a likelihood greater than 66 per cent to maintain the global average temperature increase under 1.5 °C: peak emissions between 2010 and 2020; emission levels in 2020 of 44 Gt CO_2 eq/year and most likely below; a post-2020 reduction rate of 3 to 5 per cent; and deep net negative CO_2 emissions.

39. One such new scenario and model was presented by a representative of Japan. An Earth system model (MIROC-ESM) has been developed by integrating biogeochemical and other process models into a climate model, including a vegetation model where species compete with each other to attain a balanced distribution.

40. Emerging new scientific findings using this model include: the CO_2 emission rate from fossil fuel estimated as necessary to cause a RCP concentration scenario smaller than that estimated in RCP scenarios and is almost zero at the middle of the twenty-first century; the CO_2 concentration from RCP emission rate is larger than the respective RCP concentration; a 300-year projection under RCP4.5 with constant concentration beyond 2200 shows a long-term still rising steady tendency in global mean surface temperature beyond 2200; and most boreal–deciduous forests transform into boreal–evergreen forests in 300 years, while most tropical forests remain the same.

41. The issue of cumulative carbon emissions and their implications for the future climate was addressed by an expert from Oxford University. He said that cumulative limits matter for how we cut carbon emissions but also for how we balance effort on CO_2 with effort on short-lived climate forcing agents. He stressed that the cumulative emissions of CO_2 are the principal determinant of dangerous climate change and that, most likely, peak warming is strongly determined by cumulative CO_2 emissions to 2200. In his view, most likely, peak warming is determined only weakly by the CO_2 budget of 2010–2050.

42. In his presentation, the expert underlined that, to avoid dangerous climate change, there is a need to limit the total amount of CO_2 released into the atmosphere to a total that is substantially less than fossil carbon reserves. A long-term vision must address the fate of fossil carbon that cannot be released into the atmosphere; measures to slow the emission rate by 20 or 50 per cent can defer dangerous climate change but we also need a plan to reduce emissions to zero. Furthermore, emissions of short-lived agents only affect peak warming under conditions in which CO_2 emissions are already falling rapidly or are close to zero.

43. Another topic addressed was the response of the carbon sinks to recent climate change, and current and expected emissions in the short term from fossil fuel burning and land use. The presentation, by a scientist who participated on behalf of the ESSP, underlined persistent growth in fossil fuel emissions of about 3 per cent per year since 2000 and that CO_2 intensity of the economy is improving more slowly. She presented the following distribution of anthropogenic CO_2 emissions for the period 2000–2009: 47 per cent into the atmosphere; 27 per cent sinks in natural land; and 26 per cent sinks in oceans and suggested that during 1958–2008 the size of the natural sinks has grown but at a slower pace than emissions have grown, although year-to-year variability is large.[13] This implied a decline in the efficiency of the sinks in removing atmospheric CO_2 over time, a trend

[13] Airborne fraction grew from 40 per cent in 1959 to 45 per cent in 2010.

expected to continue in the future. Models suggest that CO_2 sinks could be responding to climate change and variability.[14]

Emerging issues

44. An expert who participated on behalf of the United Nations Environment Programme (UNEP) outlined the main results of the UNEP/World Meteorological Organization (WMO) Integrated Assessment of Black Carbon and Troposhperic Ozone,[15] highlighting the relationship between measures to improve air quality and those to mitigate climate change in the near term. She outlined the impacts of black carbon and tropospheric ozone on air quality as well as on global and regional climate in the near term, and the benefits that could be achieved from reductions in those non-CO_2 agents not only for air quality but also for the climate (immediate relative reductions in temperature given the short lifetime), human health and food security.

45. An expert who participated on behalf of the IGBP provided an overview on current knowledge on ocean fertilization, a geoengineering technique intended to reduce CO_2 by enhancing its uptake in the oceans. He provided information from experiments undertaken, which indicated that only a few of them conclusively demonstrated the desired effect on CO_2. He further highlighted a number of uncertainties and unresolved issues, such as regarding the effectiveness and permanence of carbon sequestration, the impacts of increased ocean acidification and possible increases in methane and nitrous oxide in mid/deep waters, as well as questions on verification, unintended side effects and risks, political acceptability, governance issues and costs.

46. A representative of the International Human Dimensions Programme on Global Environmental Change (IHDP) reported on the contributions that social sciences can make to climate change research, which could have a major impact on the way climate change is being addressed. She highlighted the results of a study by Whitman College on the behaviours of people with regard to climate change as well as the results of a social sciences survey. The latter indicated a high level of support for a social sciences assessment, which may address linkages between beliefs and values, socio-economic structure, and societal transitions in the context of global environmental changes.

Views from Parties on research needs and priorities

47. A representative of China outlined a number of questions and priorities for further research from a national perspective, such as regarding the climate system (e.g. thresholds) and the causes of climate change, the relationship between climate change and extreme events, dangerous GHG stabilization levels, issues relating to adaptation, and GHG control technologies. She highlighted the need for comprehensive, objective and clear information from the scientific community to support correct, balanced and effective national-level climate change responses.

48. Major policy research needs were outlined by a representative of the United Kingdom, who highlighted major overarching questions, such as what is dangerous climate change and what emissions pathways could be implemented to avoid it, as well as how such pathways could be achieved. Specific policy needs include greater clarity on risks and scale of climate change, including on tipping points and rapid and irreversible climate change and its impacts, as well as improved climate predictions at the regional and global levels.

[14] This conclusion is still under consideration.

[15] The UNEP/WMO Integrated Assessment of Black Carbon and Troposheric Ozone includes input from over 50 scientists and dozens of experts from government agencies and research groups. The summary of this assessment for decision makers was presented at the twenty-sixth session of the Governing Council of the UNEP/Global Ministerial Environment Forum (GC/GMEF), which was held from 21 to 24 February 2011 in Nairobi, Kenya.

He further highlighted the need for improved assessments of emission reduction options and advice on geoengineering proposals, as well as improved methodologies for developing adaptation responses.

49. A representative of South Africa presented national research needs and priorities on adaptation, which poses additional challenges for research due to the fact that adaptation is more difficult to quantify and subject to higher uncertainties. Further research is needed in particular on the quantification of the cost of the impacts, avoided damages and adaptation actions, and on how to integrate the effects of extremes and semi-decadal change into climate change impact assessments. Impact assessment approaches are needed that would reflect and quantify climate change impacts on the poor and most vulnerable.

2. Summary of the main elements emerging from discussions

50. This section summarizes the main elements emerging from the workshop based on the discussions that took place between the Parties and the representatives of the scientific community.

51. The presentations and discussions in this session allowed for in-depth consideration of developments in research activities by the scientific community and of recent climate change research findings relevant to the Convention since the publication of the AR4.

` *Highlights from the discussions on recent climate change research findings*

52. The observational data and recent scientific findings on present and projected impacts and emission scenarios, as presented in session 1 of the workshop, confirm and reinforce the results of the AR4, providing additional scientific information and bringing up new topics and areas of concern, such as multiple impacts of ocean acidification, extensive and rapid changes in the cryosphere, new estimates of projected global sea level rise, and effects of black carbon and tropospheric ozone.

53. Furthermore, impacts on several sectors are becoming increasingly visible and there is increasing scientific evidence that climate change may happen faster than projected by the AR4 or may have more severe impacts in this century than expected.

54. The main observed and projected impacts at the global scale regarding the cryosphere as presented by AMAP of the Arctic Council include the following:

(a) Changes in the Arctic, Antarctic and mountain glacial regions are accelerating;

(b) The summer sea ice decline is accelerating, sea ice is thinning and ice sheets are losing mass at a faster pace than expected in the Arctic;

(c) There is likely to be an acceleration in the rate of mass loss from Antarctica over the next century (e.g. marine ice sheet instability); however, accurate projections cannot be made without a better understanding of some of the dynamic processes;

(d) The above changes have implications for sea level rise and there will be better estimates, compared with the AR4, of the contributions of the Arctic and the Antarctic to the global mean sea level rise: SLR could be 1 m or larger by 2100; estimates are now much higher than in the AR4[16] due to the possible large contribution of melting of the ice sheets.

[16] The 18 to 59 cm sea level increase in 2090–2099 relative to 1980–1999 projected by the AR4 for the SRES scenarios did not take into account future rapid dynamical changes in ice flow associated with melting of ice sheets.

(e) Arctic permafrost is warming and thawing and is associated with a potentially large positive feedback from the loss of carbon storage;

(f) Extinction of some Arctic endemic species is highly likely if current trends in sea ice decline continue;

55. As presented by the expert from FP7, oceans are affected by GHGs, especially CO_2, in multiple ways: ocean acidification; ocean warming; and ocean de-oxygenation.

56. There is mounting evidence that these changes may have, in most cases, damaging impacts on key organisms, the ocean food chain, and fishery and future food security. Increased attention needs to be given to ocean acidification and the need to sustainably reduce anthropogenic CO_2 emissions in the atmosphere (even by stabilizing atmospheric CO_2 concentrations at 450 ppm ocean acidification will have profound impacts on many marine systems).

57. Although large uncertainties still exist on the amplitude of some feedbacks in the climate system, there is evidence on the direction of these feedbacks; that is, most feedbacks will enhance warming (e.g. carbon cycle feedbacks related to melting of the permafrost and losses in ice sheet mass).

58. Uncertainties and research gaps still exist with regard to tipping points and future feedbacks, both of which are difficult to project with the use of current models.

59. As presented by the expert from the ESSP, anthropogenic annual global CO_2 emissions in the atmosphere are rising faster than in previous decades (approximately 3 per cent per year since year 2000) and since 2000 are near the upper end of IPCC SRES emission scenarios.

60. An increasing number of scenarios (e.g. low stabilization scenarios) require net negative emissions in the second half of the century.

61. According to the presentation by the expert from Oxford University, United Kingdom, to avoid dangerous climate change, there is a need to limit net cumulative CO_2 emissions, because the total amount of carbon that is put into the atmosphere is the most important factor for the peak global temperature, not emissions in a given year.

62. There is still a strong need to maintain systematic observations on a continuous basis, including collection and analysis of historical data, to support research on climate change and on adaptation. This also includes the need for continued observations, by satellites complemented with a ground observation network for validation. Improved coverage of observations is needed, especially in areas where the number of measuring stations and data availability is scarce (e.g. the Himalayas, Africa).

63. As presented by the IAI, biophysical effects resulting from changes in land cover, such as surface roughness, albedo and heat transfer rates, can have important impacts on global radiative forcing and regional climate. These biophysical effects need to be taken into account when designing adaptation and mitigation measures, especially in the area of land use changes (such as afforestation, REDD).

64. New results are emerging from recent advanced global modelling efforts (CMIP5) with an Earth system model (MIROC-ESM) by integrating substantial biogeochemical and other processes into a climate model to provide more realistic global projections.

65. Recent results presented by the representative of UNEP[17] on other matters related to climate change, especially black carbon and tropospheric ozone and other short-lived

[17] The presentation focused on the UNEP/WMO Integrated Assessment of Black Carbon and Tropospheric Ozone.

climate forcers, demonstrate complementarity and the importance of taking into account such results in climate change mitigation approaches. For example, reductions in tropospheric ozone and black carbon could help to slow the current rapid rises in temperature, especially in regions such the Arctic and the Himalayas but only when in concert with CO_2 reduction.

66. As outlined by the expert from IGBP, experiments on geoengineering in the oceans (e.g. ocean fertilization) demonstrate the limitations of such technologies, especially with regard to efficiency, costs and availability of sufficient space for applying such technologies on long-term time frames and at large scales.

67. As presented by the IHDP, increased consideration needs to be given to social sciences, in particular as part of inter-and multidisciplinary research, in order to help address the barriers encountered in efforts to mitigate and adapt to climate change and support policymaking. There is a need for more research on human behaviour evolution, scenarios of how societies will develop in the future and other social sciences topics.

Possible elements for future policy-relevant research

68. Areas for further policy relevant research, as highlighted by Parties, include:

(a) The relationship between climate change and extreme weather and climate events;

(b) Ways to achieve low emission pathways, technically, economically and socially, which would allow the world to avoid dangerous climate change taking also into account differences in the stages of development of countries.

C. Session 2 – Communicating climate change science

1. Summary of presentations

69. A short introductory session included views from participants on the most relevant issues in communicating climate change science. The main views expressed include the importance of reaching the general public as well as policymakers in communicating climate change science; the role of the IPCC in this regard, and how regional briefing sessions and the IPCC national focal points could be utilized as channels for communication; as well as the challenge of translating scientific findings into the language of the policymakers and subsequently into policies.

70. The session further considered good practices and lessons learned in communicating climate change research results from the scientific community to the policymakers, including existing challenges.

71. A representative of the Asia Pacific Network for Global Change Research (APN) provided examples from the Asia-Pacific region on promoting research and on enhancing the understanding of climate information through strengthening the science–policy interface. The speaker outlined experiences emerging from APN activities, which show the importance of involving scientists, governments as well as the local community in relevant projects to ensure the utilization of local, robust solutions to help design policies that work, and that have the necessary support for implementation. He provided examples of ways for raising awareness of society, including tools to support decision-making through integrated use of climate change scenarios; impact models; and interfaces to the end-users. Lessons learned highlighted the importance of ensuring that the information is relevant for the local communities and available in local languages.

72. A representative of the Global Change SysTem for Analysis, Research and Training (START) presented experiences from the science–policy dialogues of START at the national and regional levels. Some of the observations emerging include that knowledge gaps hinder decision-making, for example when baseline information is not available, and information dissemination pathways need to be strengthened, as not all research from developing countries is available for international assessment, such as by the IPCC. National policy priorities are important for shaping impacts on society, and some policies can magnify vulnerability to climate risks. Integrated intersectoral planning is essential. Investment and capacity-building needs include integrating information on climate change into education and the need to strengthen communication pathways. The need to incorporate national scientists into the dialogues and to engage them in the work of the IPCC was seen as an important element.

73. An expert representing the Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) presented this new initiative recently established under the auspices of UNEP. PROVIA is intended to respond to needs for a research programme with a focus on vulnerability, impacts and adaptation to climate change. The speaker highlighted the need to increase research capacity, particularly in developing countries, and to identify what are key issues in the light of supporting the policy process on climate change. The objectives of PROVIA also include communication of scientific information on vulnerability, impacts and adaptation to governments and international agencies, as well as building research capacity especially in developing countries.

74. An expert who participated on behalf of the FP7 of the European Union provided information on regional climate information and services. She highlighted the importance of observing climatic changes in regions in order to provide the basis for research and understanding the needs for adaptation. Climate services respond to the demand for bridging the gap between modelling and adaptation through providing tools to support policymaking. There is a need for a cross-cutting approach across the sectors to acknowledge the challenges and to realize the possible opportunities. In terms of scope, it is important to provide the information on the national or the regional level. Existing research potential to support development of climate services is substantial, but there is also a growing need for demand-driven research to support day-to-day decision-making as well as long-term strategies. The speaker indicated a concern that the move from curiosity-driven research towards demand-driven research would take longer than anticipated. The speaker also discussed the need for climate services to be agile when responding to the needs of the private sector.

75. A presentation by a representative of the European Union outlined suggestions for enhancing the effectiveness of the research dialogue, and how existing challenges could be overcome. He highlighted communication challenges in translating the scientific information for policy-makers, and the importance of providing regional and local information. He also highlighted elements on further enhancing communication, including the need to enhance the policy relevance of the information, as well as the need for more focused dialogue, for example through targeting groups and communities that are particularly vulnerable to climate change. Linkages to other activities under the UNFCCC, such as those linked to the implementation of Article 6 of the Convention, and those undertaken in the context of the Nairobi work programme on impacts, vulnerability and adaptation to climate change, should be explored and utilized.

76. A representative of Botswana highlighted activities on communicating climate change in the Kalahari, Botswana. He provided results of a multidisciplinary study carried out in the Kalahari on whether the local people perceive climate change as a risk to their natural environment and its sustainability. The outcome of the study showed that climate

change is a reality to the majority of the local population. Although communication of climate change can be a challenge in the local languages, a number of communication and outreach activities have been carried out, using various media, institutions and initiatives such as discussion forums.

2. Summary of the main elements emerging from discussions

77. The presentations and discussions on communicating climate change science highlighted the following lessons learned with regard to communicating climate change science and overcoming challenges, needs relevant to communication and ways to enhance the science policy dialogue under the Convention.

Lessons learned in communicating science and overcoming challenges

78. Communication of personal stories and linking models and scientific information to indigenous and traditional knowledge enhance understanding of the impacts of climate change by vulnerable communities. Availability of information in local languages is crucial for understanding the message.

79. Ensuring utilization of robust solutions and engaging local capacity is important for designing policies that work and to ensure the necessary support for implementation at the local level.

80. Good practices and expertise gained in regional projects can be utilized for the benefit of vulnerable groups across regional boundaries. To retain good practices, it is important to ensure continuity beyond project life cycles. Networking is essential, but strong networks can take decades to build.

81. Information on climate change is needed for both shorter and longer time horizons. Public perceptions may also have a strong impact on policies, and strengthening the flow of scientific information from the scientific community to the public is important in this regard.

Needs relevant to communication

82. Further integration of natural and social sciences was highlighted by several speakers as well as during the discussion. For example, more research on communication and behavioural change can help in finding ways to communicate climate change information more effectively. The use of communication specialists in disseminating scientific messages could be explored, and learning from advertisers was mentioned as one possibility to be explored further.

83. The need to communicate possible solutions to climate change and the implications of such solutions was emphasized, in order to create a positive message instead of only highlighting the problems.

84. Further needs indentified include a need to integrate climate change into education and the need to strengthen communication pathways, including across different sectors.

85. Climate services can be used for bridging the gap between modelling and adaptation through providing tools to support policymaking. There is a need for a cross-cutting approach across the sectors to acknowledge the challenges and realize the possible opportunities.

Enhancing the science–policy dialogue under the Convention

86. Participants identified the following possible ways for enhancing the science–policy dialogue in the context of the Convention:

(a) Involving more socio-economic researchers;

(b) Focusing on possible solutions;

(c) Enhancing the link between research dialogue and activities identified in Article 6 of the Convention on education, training and public awareness;

(d) More focus on specific areas such as adaptation and mitigation options;

(e) Reaching out and focusing on vulnerable groups, reaching beyond policymakers to the public;

(f) Engaging climate services initiatives;

(g) Improved communication of high risk/low probability events.

D. Session 3 – Building capacity for research in developing countries

1. Summary of presentations

87. This session focused on collaboration with developing countries in climate change research, including results, success stories, possibilities and needs for research capacity-building.

88. A representative of Mexico presented on research-related capacity-building needs in Mexico. Following the adoption of a special programme on climate change aiming at reducing the GHG emission of Mexico by up to 30 per cent with respect to the 'business-as-usual' scenario by 2020, there is a need for capacity-building with a range of activities with regard to development of a low carbon economy. Needs include, for example, establishing a low emissions development plan, establishing a centre for sustainable development and climate change and support to local and regional plans to address climate change. Research needs include socio-economic research on changes to patterns of consumption and addressing challenges of implementing low emission development plans.

89. A representative of Australia presented an overview of a climate change science programme in the Pacific, which is a partnership between Australian science agencies and 14 Pacific island countries and Timor-Leste, carried out in collaboration with Pacific regional organizations. The project has shown that recognizing existing strengths, incorporating traditional knowledge and aligning capacity-building activities to national policies and processes are essential factors in building respect and trust within the partnership. To ensure local ownership, planning and implementation of the activities must support local priorities, and local project leadership in the institutions involved is an important factor. Better coordination of synergies is needed to reduce the administrative burdens, and stronger links are needed between climate change and disaster risk reduction to ensure that local efforts and external support are not implemented in isolation.

90. A representative of the APN discussed funding opportunities in the APN for research and capacity-building activities, and gave examples and lessons learned in scientific capacity-building. The annual call for proposals was launched in May 2011, and projects eligible for funding should for example be participatory, strengthen the links between local science and policy, encourage initiatives from developing countries and align with other programmes of the global change community. Lessons learned include the importance of increasing capacity-building on existing local research and involving local scientists. Educational and training programmes are important to support more effective awareness-raising.

91. A representative of the FP7 presented information on the regional research programme of the European Union: funding opportunities for research actors from developing countries. FP7 (2007–2013) is implemented through annual calls for proposals,

operates on a competitive basis and is open to participation by research actors from anywhere in the world. The collaborative research area of the FP7 focuses on issues of importance to the developing world, and there is a strong developing country representation, with research carried out in developing countries. Mutual benefits include developing country contributions on essential knowledge and expertise of the local natural and political landscape. Joint projects also include components for knowledge transfer and capacity-building, and offer opportunities for increased visibility and integration into global research. There are funds available to support increased participation from research actors from the developing world in the FP7.

2. Summary of the main elements emerging from discussions

92. The presentations and discussions on this theme highlighted the following lessons learned from capacity-building activities in developing countries and collaboration in climate change research, needs relevant to research-related capacity-building and elements for enhancing developing country participation in climate change research.

Lessons learned and needs in building capacity for research and related activities in developing countries

93. The importance of involving stakeholders and local communities in the design of projects and tools, respecting local expertise and enhancing research capacity with a view to supporting local priorities and needs was highlighted by the participants.

94. Capacity-building is needed to support the operationalization of projects and activities already taking place in the developing countries. In this regard, better coordination of activities and realization of synergies is an important element. Further, engaging various institutions and networking was seen as essential for enhancing capacity. The benefits of building links between local research activities and the global change research community were emphasized.

95. Needs relevant to capacity-building identified by participants also included the availability of funding for activities to enhance research capacity; strengthening of the observation networks was identified as one important element in this regard. Further enhancing access to data and giving support to save historical data sets were emphasized.

96. There is a need for building capacity for research to support a range of activities with regard to realizing the possibilities and encountering the new emerging challenges associated with the new paradigm for development towards green economies.

Elements for enhancing developing country participation in climate change research

97. A need to gain better understanding of existing gaps in knowledge was identified, and a proposal was made for an analysis to be carried out, for example by the regional and international programmes involved in research capacity-building.

98. Examples of relevant activities introduced during the discussion include a new International Council for Science (ICSU) programme on global sustainability to be launched in 2012. The development of this overarching programme will include a gap analysis and will also refocus the existing global change programmes sponsored by ICSU towards more demand-driven research.

99. Participants also discussed the possibility of enhancing the extraction of needs included in national communications by non-Annex I Parties, with a view to enhancing the understanding of where needs for capacity-building are not yet met.

100. Enhancing south–south linkages between institutions were seen as useful in sharing experiences and supporting capacity-building.

101. In order to enhance the availability of research findings from developing countries, participants emphasized the need to enhance possibilities to publish and make available research results from developing countries and by developing country scientists.