

Information on the seventh meeting of the research dialogue

Note by the Chair of the SBSTA

19 May 2015

I. Introduction

1. As requested by the Subsidiary Body for Scientific and Technological Advice (SBSTA) at their twenty sixth session, the secretariat will organize regular research dialogues in collaboration with invited research programmes and organizations to inform the SBSTA of developments in research activities relevant to the needs of the Convention.

2. At their fortieth meeting, the SBSTA invited submissions from Parties and research programmes and organizations on lessons learned and good practices for knowledge and research capacity building, in particular in developing countries. The SBSTA also invited submissions from Parties on possible topics for consideration as part of the research dialogue (RD), taking into account the findings of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC).¹

3. At their forty-first meeting, the SBSTA invited the IPCC and relevant international and regional research organizations to inform Parties about efforts undertaken to address the information gaps identified in the AR5, including in developing countries, especially in Africa, and on emerging issues, such as the links between climate change and desertification, for example, at the meeting of the research dialogue at SBSTA 42.²

II. Seventh meeting of the Research Dialogue

A. Goal of and general approach to the meeting

4. The foundation for the research dialogue was given in decision 9/CP.11³ and the focus identified at SBSTA 26,⁴ to invite relevant research programmes and organizations to regularly inform the SBSTA of developments in research activities relevant to the needs of the Convention. In 2011, recommendations from SBSTA 35 to the COP, resulted in decision 16/CP.17,⁵ which encouraged Parties, in particular developing country Parties, and regional and international research programmes and organizations active in climate change research to utilize the research dialogue as a forum for discussion and conveying research findings and lessons learned. Annex I to this note provides a brief analysis of the specific themes covered in presentations, as well as involvement of Parties and organizations, in research dialogues to date.

5. In response to the above mentioned mandates, the goal of this meeting is to address data and information gaps, including from the AR5, such as in regards to climate change and desertification; to identify good practices for knowledge and research capacity building, in particular in developing countries; and to better understand how findings from the AR5 can be used at regional and local level.

6. Building on the approach adopted at previous research dialogues, I intend to organize RD7 as a forum for exchange of information, new research developments, needs and lessons learned. Experts will be invited to provide focused presentations on relevant issues. Emphasis will be placed on enabling discussion between research programmes and organizations and Parties to elaborate on research findings and lessons learned so as to engage in an active dialogue.

7. After the dialogue, I will prepare a summary report, which will be made available on the research dialogue web page before SBSTA 43. This will include an update of the topics addressed by the research dialogue contained in Annex 1 of this document, and the potential themes for future research dialogues submitted by Parties.

¹ FCCC/SBSTA/2014/2, paragraphs 58–59.

² FCCC/SBSTA/2014/5, paragraph 31.

³ FCCC/CP/2005/5/Add.1, pages 19–20.

⁴ FCCC/SBSTA/2007/4, paragraph 47.

⁵ FCCC/CP/2011/9/Add.2, page 47.

8. Overall, emphasis will be placed at RD7 on moderated focussed discussions between experts and Parties on the significance of research findings, including on reflections from Parties on this matter. We therefore encourage participants to review the information available on needs and lessons learned as outlined in previous RDs, particularly presentations in regards to needs and lessons learned (see annex II to this note) as well as the gaps identified by Parties relevant to climate change research as outlined in the compilation and synthesis report of the sixth national communications of Parties included in Annex I to the Convention (Annex I Parties).⁶ Participants should come prepared with focussed questions and views that they would like to express and be ready to engage actively in the dialogue.

B. Organization of the meeting

9. RD 7 will consist of **two main parts** on the basis of the mandate and the submissions received (see paragraph 2 above). The consideration of both themes will involve short presentations of seven minutes⁷ by organizations and Parties and a discussion between Parties and experts. Some guiding questions for discussions in both parts of RD 7 are included in this note.

10. In preparing the guiding questions below, I took into consideration: the submissions from Parties and organizations; experience from previous research dialogues (see annex II); and relevant information from other work under the Convention. The latter included: the systematic observation agenda item of the SBSTA; the outcomes of the structured expert dialogue on the 2013–2015 review;⁸ and the recent workshop “Enhancing observations to support preparedness and adaptation in a changing climate – learning from the IPCC Fifth Assessment Report”, organized by GCOS in collaboration with the IPCC and the UNFCCC;⁹ the Durban Platform on Capacity Building;¹⁰ and the compilation and synthesis of sixth national communications and first biennial reports from Parties included in Annex I to the Convention.¹¹

Part 1: Addressing data and information gaps including from AR5

11. Part 1 will involve presentations on recent developments and relevant emerging scientific findings. An overview from the IPCC on data and information gaps from AR5 will then be supported by contributions from organizations including the World Climate Research Programme (and on behalf of Future Earth collaboration partners DIVERSITAS, International Geosphere–Biosphere Programme (IGBP) and International Human Dimensions Programme on Global Environmental Change (IHDP)), particularly in regards to work under their five grand challenges,¹² United Nations Convention to Combat Desertification (UNCCD), CORDEX,¹³ the Atmosphere and Ocean Research Institute in the University of Tokyo and the Netherlands Meteorological Institute in regards to the KNMI Climate Explorer¹⁴.

12. Contributors are invited to keep their presentations and interventions succinct so that at least half the time during the meeting can be dedicated to discussion. The presentations will be followed by a **discussion** among Parties and experts.

13. The guiding questions for part 1 include:

- (a) What is the role of the ocean in the climate system and climate change? This includes timely science on oceanic climate change, climate change impacts on the ocean, ocean ecosystems and human food chains. Examples of issues to address could include; ocean heat content change and its significance for climate change trends; factors contributing to sea level rise including marine ice sheet instability; and regional sea level rise, ocean acidification and other drivers of impacts on marine ecosystems.

⁶ See annex III to this note and FCCC/SBI/2014/INF.20/Add.2.

⁷ A longer presentation and additional supporting material can be uploaded on the RD 7 website as required by the presenter.

⁸ FCCC/SB/2015/INF.1.

⁹ <<http://www.wcrp-climate.org/ipcc-wcrp-about>>.

¹⁰ FCCC/SBI/2014/2, paragraphs 43–46.

¹¹ Compilation and synthesis of sixth national communications and first biennial reports from Parties included in Annex I to the Convention. Note by the secretariat. Addendum: Vulnerability, impacts and adaptation; research and systematic observation; and education, training and public awareness (FCCC/SBI/2014/INF.20/Add.2).

¹² <<http://www.wcrp-climate.org/grand-challenges>>.

¹³ <<http://www.cordex.org>>.

¹⁴ <<http://climexp.knmi.nl/start.cgi>>.

(b) What are the links between climate change and desertification? This includes associated impacts and risks including on biodiversity, health as well as possible feedback of dust particles on climate change.

(c) What experience has been gained from global and regional initiatives to support regional assessment of climate change, its risks and impacts, including to support effective adaptation responses? This includes detection and attribution and the emerging science of probabilistic event attribution; and comparing regional differences with global averages.

Part 2: Lessons learned and good practices for knowledge and research capacity building, in particular in developing countries.

14. Part 2 will involve presentations on recent developments and relevant emerging scientific findings with contributions from the European Commission (EC) in regards to the Copernicus project, Inter-American Institute for Global Change Research (IAI), the Global Climate Observing System (GCOS), Asia Pacific Network for Global Change Research (APN), Caribbean Community Climate Change Centre (CCCCC) and the German Federal Ministry of Education and Research (BMBF).

15. The presentations will be followed by a **discussion** among Parties and experts. In this part, contributors are again invited to keep their presentations and interventions succinct so that at least half the time during the meeting can be dedicated to discussion.

16. The guiding questions for part 2 include:

(a) How can access to scientific data and information be improved to enhance research and innovation capacity?

(b) How can regional and local capacity be improved to support decision making?

(c) What are the opportunities for delivering consistent data and model outputs to support decision making?

C. Date and venue

17. The seventh meeting of the research dialogue will take place in Bonn, Germany, on Thursday, 4 June 2015 from 3 p.m. to 6 p.m., during SBSTA 42. All efforts will be made to webcast the meeting.

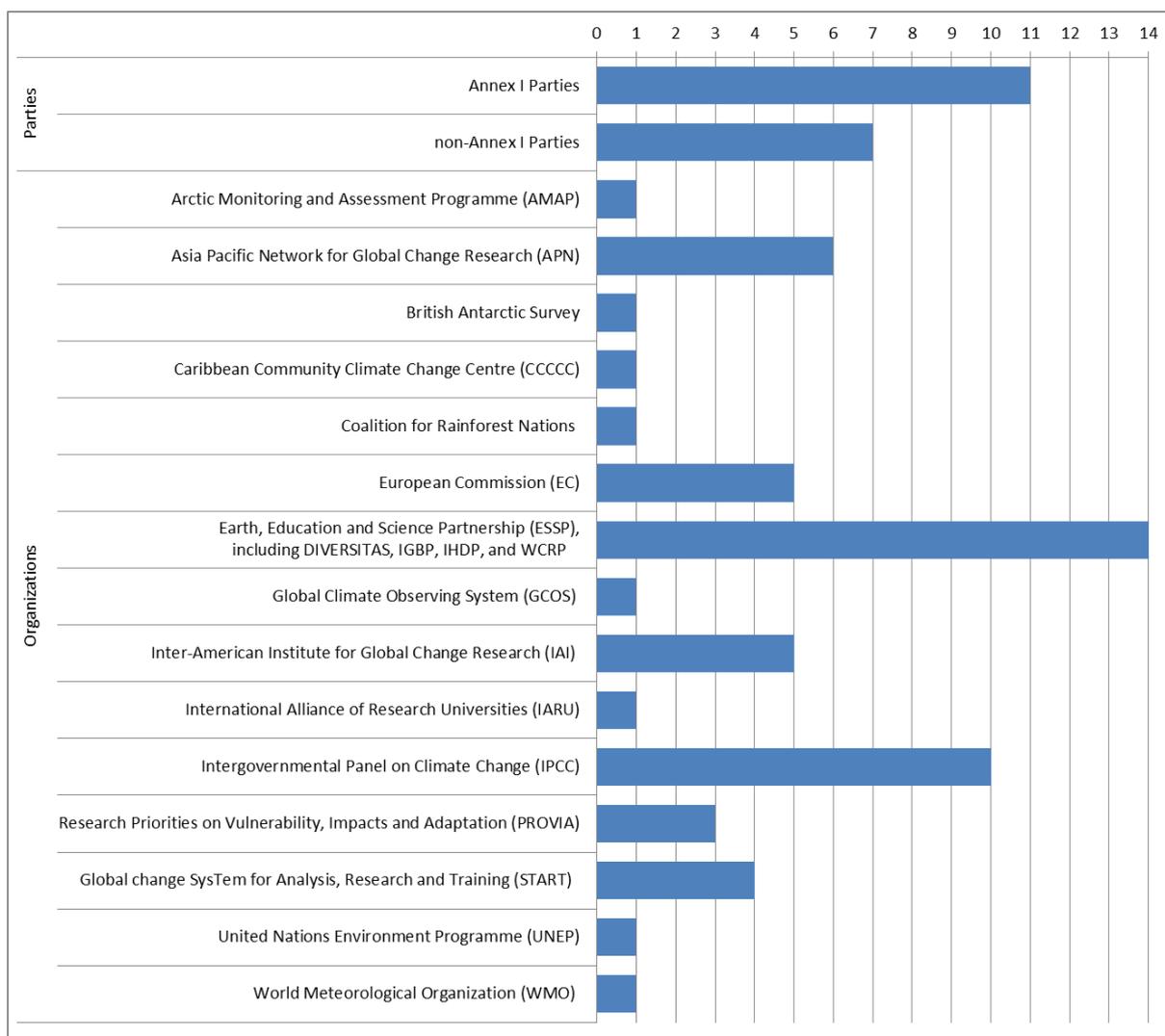
Annex I

Analysis of the presenters, topics and presentations in research dialogues 1–6

A. Presenters

1. At SBSTA 26,¹ the SBSTA invited relevant research programmes and organizations to regularly inform the SBSTA of developments in research activities relevant to the needs of the Convention.
2. An analysis of the number of presentations given by representatives from both Parties and international organizations at previous research dialogues (RDs 1–6) is provided in Figure 1.

Figure 1
Affiliation of presenters and number of presentations given in research dialogues 1–6



*Subjects not mutually exclusive

Abbreviations: IGBP = International Geosphere–Biosphere Programme, IHDP = International Human Dimensions Programme on Global Environmental Change, WCRP = World Climate Research Programme.

¹ FCCC/SBSTA/2007/4, paragraph 47.

B. Topics

3. Analysis of research dialogues (RD 1–6) identified three main topics. The first two topics, (a) and (b) below, are those highlighted in decision 16/CP.17.² A further important element of the research dialogues is a cross cutting issue, highlighted in the conclusions from SBSTA 26,³ and is topic (c) below.

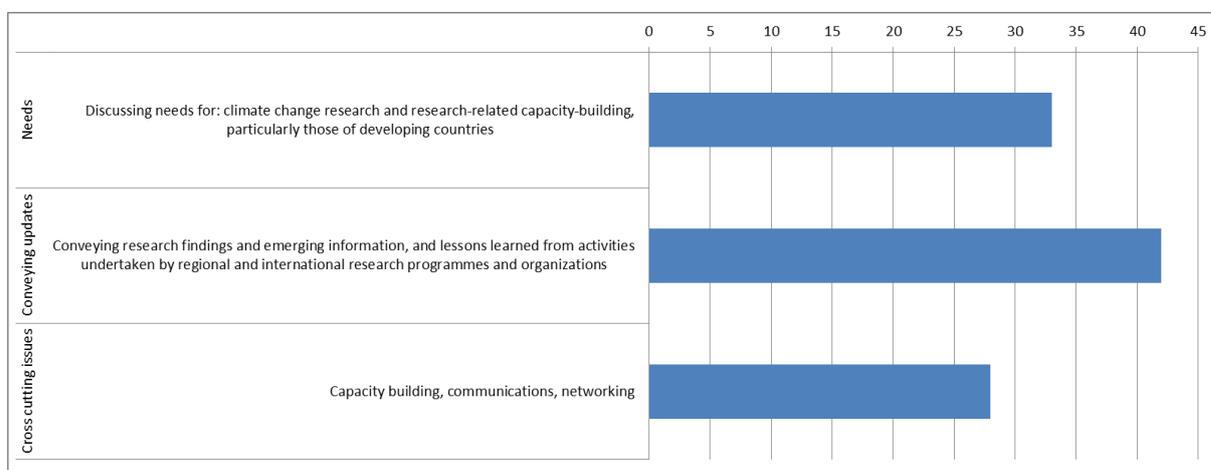
(a) **Discuss needs** for climate change research and research-related capacity-building, particularly the needs of developing countries, to support the work of the Convention;

(b) **Convey research findings, emerging information and lessons learned** from activities undertaken by regional and international research programmes and organizations of relevance to the Convention.

(c) **Capacity building, communications and networking**

4. Figure 2 provides an analysis of the number of times these three topics have been covered in presentations. In figure 2, any one presentation can make reference to more than one of the three topics.

Figure 2
Topics covered in presentations in research dialogues 1–6*



* Total number of presentations in RD 1–6 = 72. Presentations can make reference to more than one of the three topics.

² FCCC/CP/2011/9/Add.2.

³ See FCCC/SBSTA/2007/4, paragraph 47.

C. Presentations

5. This section shows the full list of presentations **for all** research dialogues (**RD 1–6**). **Table 1 provides a summary of all** presentations identifying the presenter and their affiliation, topics covered (as per section B) and general overview. In all dialogues, updates were given on the three topics as highlighted in section B above. In RD 4–6 a greater focus has been made on specific issues, which include:

- (a) RD 4: Emission pathways, new scenarios and recent global and regional emission trends; and Coastal and marine ecosystems: Greenhouse gas sources, sinks and reservoirs
- (b) RD 5: Ecosystems and GHG emissions and removals from sources, sinks and reservoirs, including terrestrial ecosystems;
- (c) RD 6: The polar regions.

Table 1
 Analysis of presentations from research dialogues to date (RD 1–6)

SBSTA	RD	Description	Themes	Title	Presenter	Organization	Needs ¹	Convey updates ²	Cross cutting ³
30	1	Conveying emerging research findings and activities and research-related capacity building activities	Emerging scientific findings	Emerging Scientific Findings and Activities Relevant to UNFCCC	Rik Leemans	ESSP		√	
30	1			Climate Change: global risks, challenges and decisions	Katherine Richardson	IARU		√	
30	1			IPCC: Towards AR5	Jean-Pascal Van Ypersele	IPCC		√	
30	1		Research-related capacity-building activities and activities in the regions	START's input to the SBSTA 30 Research Dialogue	Jon Padgham	START			√
30	1			Climate change research and observations in the FP7: Results, planning, activities, research needs	Elisabeth Lipiatou	FP7		√	
30	1			IPCC-WG2 - Future Research Needs	Holm Tiessen	IAI	√		
30	1			Developments in Climate Change (16849 kB)	Andrew Matthews	APN			√
		Total					1	4	2
32	2	Conveying emerging research findings and activities, research-related capacity-building activities and research needs and priorities	Emerging scientific findings	What is dangerous climate change?	Rik Leemans	ESSP		√	
32	2			Climate information for decision making	Ghassem R. Asrar	WCRP		√	
32	2			Ocean acidification	Sybil Seitzinger	IGBP		√	
32	2		Research-related capacity-building activities and activities in the regions	IPCC AR5: Innovations and cooperation among WGs	Ottmar Edenhofer	IPCC		√	
32	2			Asia-Pacific Network for Global Change Research	Andrew Matthews	APN			√
32	2			Climate change research in the 7th Framework Programme: Results and new initiatives	Elisabeth Lipiatou	FP7		√	√
32	2			Science-policy dialogues on climate change	Jon Padgham	START	√		√
32	2		Overview presentations by Parties and panel discussion on climate change research needs and priorities in support of the Convention	Research needs and priorities to support UNFCCC	Ann Gordon	Belize	√		
32	2			Science and an effective response to climate change	David Warrilow	European Union	√		√
32	2			Challenges and needs in research	Hiroki Kondo	Japan	√		
32	2			Needs for research and systematic observation in Africa	Birama Diarra	Mali	√		
32	2			Perspectives from the United States	Benjamin Zaitchik	United States of America	√		√
32	2		Total					6	5
34	3	Conveying emerging research findings and activities, research-related	Overview of recent key findings from regional and international climate change research	Summary of main scientific findings presented at the SBSTA workshop on research	Sergio Castellari	Italy	√		
34	3			Emerging results from global climate change research	Guy Midgley	ESSP		√	
34	3			Findings from UNEP/WMO Integrated	Drew Shindell	UNEP		√	

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SBSTA	RD	Description	Themes	Title	Presenter	Organization	Needs ¹	Convey updates ²	Cross cutting ³
		capacity-building activities including developments towards AR5, and research needs and priorities and communication activities		Assessment of Black Carbon and Tropospheric Ozone					
34	3			Arctic Council Assessment of Regional and Global Climate Change Impacts on Snow, Water, Ice and Permafrost in the Arctic	Morten Skovgård Olsen	AMAP	√	√	
34	3		Developments towards preparation of the AR5	IPCC, Article 2, Sea-level rise and Scenario Development	Jean-Pascal van Ypersele	IPCC		√	
34	3			New features in IPCC AR5	Renate Christ	IPCC	√	√	
34	3		Research needs and priorities to support emerging issues under the UNFCCC: views by Parties	Needs for research and systematic observation	Birama Diarra	Mali on behalf of LDCs	√		
34	3			AOSIS concerns and issues for consideration	Clifford Mahlung	Jamaica on behalf of AOSIS	√		
34	3			Overview of Research Needs to address Climate Change: The case for Botswana	David Lesolle	Botswana	√		√
34	3			Blue Carbon: Consideration in SBSTA	Federica Bietta	Papua New Guinea	√		
34	3			Policy-making relevant questions to the socio-economic scientific community	José Romero	Switzerland	√		√
34	3		Good practices and challenges in communicating climate change research results	Developments on the Global Framework for Climate Services: Communicating climate information	Mannava Sivakumar	WMO	√	√	√
34	3			Communicating climate science to policy makers: A success story from the IAI collaborative research in the Americas	Ione Anderson	IAI			√
34	3			Communicating scientific knowledge and needs for research on vulnerability, impacts and adaptation	Cynthia Rosenzweig	PROVIA	√		√
34	3		Collaboration with and opportunities for building research capacity in developing countries	Enhanced research capacity building in developing countries in the Asia-Pacific: Success stories	Andrew Matthews	APN			√
34	3			Capacity building for adaptation research: START's African Climate Change Adaptation Fellowship Programme	Jon Padgham	START			√
34	3		Needs and priorities for enhanced research capacity and for enhanced science-policy dialogue: views by Parties	Enhanced science-policy dialogue and communication	Katrine Krogh Andersen	Denmark			√
34	3		Total					10	6
36	4	Conveying emerging research	Research findings: updates from recent climate change	Low stabilization and new long term scenarios from the IPCC special report on renewables	Jan Minx	TSU Head of WGIII of the		√	

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SBSTA	RD	Description	Themes	Title	Presenter	Organization	Needs ¹	Convey updates ²	Cross cutting ³
36	4	findings and activities including on: emission pathways, new scenarios and recent global and regional emission trends; coastal and marine ecosystems; greenhouse gas sources, sinks and reservoirs; and capacity building	research on aspects relevant to the long-term global goal – emission pathways, new scenarios and recent global and regional emission trends	(SRREN) State of the community driven scenario process: New framework for future scenario development for the AR5	Tom Kram	IPCC		√	
36	4			Results from research by the Earth System Science Partnership (ESSP) programmes (ESSP, WCRP, IGBP, IHDP, DIVERSITAS) of relevance to the long term global goal	Rik Leemans	ESSP		√	
36	4			Some results from the WCRP on climate modelling	Adrian Simmons	WCRP		√	
36	4			Impacts and costs of climate change under different scenarios: results from selected FP7 projects (ClimateCost, IMPACT2C, etc.)	Luca Perez	FP7		√	
36	4		Research findings: Coastal and marine ecosystems: Greenhouse gas sources, sinks and reservoirs	Technical and scientific aspects of sources, sinks and reservoirs of all GHGs for coastal and marine ecosystems (mangroves, tidal salt marshes, wetlands and sea grass meadows)	Boone Kauffman	Coalition for Rainforest Nations	√	√	
36	4			Development of marine sciences in South America: Ocean, climate and fisheries - the Patagonia Shelf case	Alberto Piola	IAI		√	
36	4			Results from research by the ESSP and its partner programmes (ESSP, WCRP, IGBP, IHDP, DIVERSITAS) on coastal and marine ecosystems -related research	Rik Leemans	ESSP		√	
36	4		Updates from recent climate change research: Other areas of relevance to the Convention, including research-related capacity building	Overview of recent results from research by the ESSP and its partner programmes (ESSP, WCRP, IGBP, IHDP, DIVERSITAS and START)	Rik Leemans	ESSP		√	√
36	4			New Climate Change Synthesis Report for policy makers in Asia-Pacific Region and initiatives for capacity development	Andrew Matthews	APN		√	√
36	4			Observed changes in the climate system. Global sea-level rise and permafrost thawing: results from Ice2Sea and outlook to PAGE21	Luca Perez	FP7		√	
36	4			GHG monitoring from outer space: current outcome and future perspective	Tatsuya Yokota	Japan		√	√
36	4			Atmospheric measurements for emission estimation: real-world emission verification of halogenated greenhouse gases	Brigitte Buchmann	Switzerland		√	√
36	4			Needs for research on slow onset events, e.g. sea level rise	Malia Talakai	Nauru, on behalf of AOSIS	√		
36	4			Priorities for vulnerability, impacts and adaptation research	Cynthia Rosenzweig	PROVIA	√		√

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SBSTA	RD	Description	Themes	Title	Presenter	Organization	Needs ¹	Convey updates ²	Cross cutting ³	
36	4	Total					3	13	5	
38	5	Conveying research findings and emerging information including on: IPCC; ecosystems and GHG emissions and removals from sources, sinks and reservoirs, including terrestrial ecosystems; and needs for climate change research and developments in research-related capacity-building	Science updates: Recent developments in global climate information	Towards the Fifth Assessment report of the IPCC	Jean-Pascal van Ypersele, Vice Chair	IPCC		√		
38	5			Global science updates from international research programmes and organizations - Including on global carbon budget, regional temperature timelines, sea-level rise, climate predictions, black carbon	Sybil Seitzinger	IGBP and WCRP		√		
38	5		Emerging scientific findings: ecosystems and GHG emissions and removals from sources, sinks and reservoirs, including terrestrial ecosystems	Management of different terrestrial ecosystems under a changing climate	Dmitry Zamolodchikov and Andrey Sirin	Russian Federation	√	√		
38	5			Estimation of carbon and their fluxes in tropical peatlands: Results from a Japan-Indonesia joint project	Mitsuru Osaki	Japan		√		
38	5			Overview of findings and results from international research programmes and organizations, including on terrestrial and coastal and marine ecosystems - Including on seagrass habitats and their decline; integration of biodiversity and ecosystems into climate change modelling	Sybil Seitzinger	IGBP, IHDP, DIVERSITAS		√		
38	5			Carbon fluxes in tropical dry forests and savannahs: Human, ecological and biophysical dimensions	Arturo Sanchez-Azofeifa	IAI	√	√		
38	5			Needs for climate change research and developments in research-related capacity-building	Regional capacity development, new opportunities on adaptation	Andrew Matthews	APN	√		√
38	5				Regional capacity development and use of regional climate information - Including on downscaling (CORDEX, Africa), use of climate information for agriculture; START capacity-building workshops and activities	Sybil Seitzinger	IGBP, WCRP and START	√		√
38	5			Research priorities for vulnerability, impacts and adaptation	Cynthia Rosenzweig	PROVIA	√		√	
38	5		Total					5	6	3
40	6	Conveying research findings and emerging information including on: global climate information and scientific findings	Science updates: recent developments in global climate information	Tropical Dry Forest Resilience and Water Use Efficiency	Arturo Sanchez-Azofeifa,	IAI	√	√		
40	6			Emerging research findings: Extreme events	Sybil Seitzinger/Vladimir Ryabinin	IGBP / WCRP		√	√	
40	6			Report from the Joint GCOS/ Global Observation for Forest Cover and Land Dynamics (GOFC/GOLD) Workshop on 'Observations for	Carolin Richter	GCOS	√	√		

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SBSTA	RD	Description	Themes	Title	Presenter	Organization	Needs ¹	Convey updates ²	Cross cutting ³
40	6	in the polar regions; and needs for climate change research and developments in research-related capacity building	Emerging scientific findings: the polar regions	Climate Change Mitigation'					
				New approaches in climate prediction for better adaptation: near-term prediction and high-resolution ensembles	Masahide Kimoto	Japan	√	√	
40	6			IPCC WGI findings on the polar regions: warming and polar amplification, permafrost, and sea ice changes	Paul Hezel	IPCC		√	
40	6			IPCC WGII findings on the polar regions: ecosystem impacts of ocean warming and acidification	Hans-Otto Pörtner	IPCC		√	
40	6			Arctic Change: A need for multi-sector collaboration	Jeremy Wilkinson	British Antarctic Survey	√	√	√
40	6		Integrated biodiversity and climate scenarios	Sybil Seitzinger	DIVERSITAS		√		
40	6		Needs for climate change research and developments in research-related capacity building	Knowledge gaps identified in AR5	Renate Christ	IPCC	√		
40	6			Caribbean Regional Climate Centre	Carlos Fuller	CCCCC	√		√
40	6			Climate change research & innovation in the Horizon 2020 programme	Serena Pontoglio	EC, DG Research & Innovation	√		√
40	6			New capacity building programme for APN	Andrew Matthews	APN	√		√
40	6	Total					8	8	5
TOTAL for topics covered by presentations in RD 1–6							33	42	28
42	7	Addressing needs in regards to the role of the ocean, climate change and desertification and downscaling; conveying findings and lessons learned to enhance capacity and support decision making	Addressing data and information gaps, including from AR5, on: the role of the ocean in the climate system and climate change; the links between climate change and desertification; and regional assessment of climate change and its impacts, including for adaptation responses						
42	7		Lessons learned and good practices for knowledge and research capacity building, in particular in developing countries						
Future Dialogues			Top-down, independent verification of carbon sinks						

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			and sources, including new developments, possibilities and limitations related to observational techniques, measurement networks and inverse modeling of GHG sources and sinks						
			Possibilities, challenges and role of cities and regions in climate mitigation and adaptation efforts, including climate proofing urban and regional development						
			Economic aspects of addressing climate change (cost estimates of climate change impacts, mitigation and adaptation, and related costing uncertainties)						

¹ Discussing **needs** for: climate change research and research-related capacity-building, particularly the needs of developing countries.

² **Conveying research findings, emerging information and lessons learned** from activities undertaken by regional and international research programmes and organizations.

³ **Capacity building, communications and networking.**

Abbreviations: AMAP = Arctic Monitoring and Assessment Programme, APN = Asia Pacific Network for Global Change Research, CCCC=Caribbean Community Climate Change Centre, EC = European Commission, ESSP = Earth, Education and Science Partnership, FP7 = EU's Seventh Framework Programme, GCOS = Global Climate Observing System, IAI = Inter-American Institute for Global Change Research, IARU = International Alliance of Research Universities, IGBP = International Geosphere–Biosphere Programme, IHDP = International Human Dimensions Programme on Global Environmental Change, IPCC = Intergovernmental Panel on Climate Change, PROVIA = Research Priorities on Vulnerability, Impacts and Adaptation, START = Global change SysTem for Analysis, Research and Training, UNEP = United Nations Environment Programme, WCRP = World Climate Research Programme, WMO = World Meteorological Organization.

Annex II

Key gaps relevant to climate change research, as identified by Annex I Parties, in their sixth national communications

Table 1 provides a summary of research gaps, identified by Parties, compiled according to the typology of research topics provided in the UNFCCC reporting guidelines on National Communications.

Table 1

Gaps relevant to climate change research, as identified by Annex I Parties, in their sixth National Communications

Topic	Identified gaps in knowledge and research needs
Climate processes and climate system studies	<ul style="list-style-type: none"> • Further research needs include refining understanding of how the climate system works; • Fostering new research at the interface between the study of the physical climate system and the biological sciences; • Enhancing understanding of past climate trends and variability and their causes; • Oceanic and atmospheric chemistry.
Modeling and prediction	<ul style="list-style-type: none"> • Further research needed on modeling future climate change; • Recognizing the interplay between climate change and other dimensions of global change such as land-use change, alteration of biogeochemical cycles, pollution and biodiversity loss; • Regional climate modeling, predictions and projections.
Impacts of climate change	<ul style="list-style-type: none"> • Gaps in understanding regional impacts of climate change; • Direct impacts of CO₂ on ecosystems; • Improving understanding of climate system extremes, thresholds and tipping points; • Assessing the vulnerability of sectors, regions and populations and supporting iterative risk management of these vulnerabilities through adaptation and mitigation responses.
Socio-economic analysis	<ul style="list-style-type: none"> • Need to demonstrate how access to energy can be improved and how to grow economies while keeping carbon emissions low in the long term; • Consequences of carbon management activities; • Adaptation options; • Need to coordinate researchers from natural and social sciences to address societal concerns; • Improving integration of the social, behavioural, and economic sciences; • Community resilience and human health.
Mitigation and adaptation technologies	<ul style="list-style-type: none"> • Urgent need for information and tools to enable coping with impacts of climate change; • Ways to improve access to sustainable energy; • Enhancing carbon sequestration, including forest sinks and soil carbon.

Note: for details see FCCC/SBI/2014/INF.20/Add.2.