

**SCOPING MEETING FOR AN
IPCC SPECIAL REPORT ON
EXTREME EVENTS AND DISASTERS:
MANAGING THE RISKS**

23-26 March 2009
Oslo, Norway

PROCEEDINGS

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INTRODUCTION

At the 29th session of the Panel (31 August - 4 September 2008 • Geneva, Switzerland), Norway introduced a proposal, prepared in collaboration with the UN International Strategy for Disaster Reduction (ISDR), for a Special Report on extreme events and disasters, with an emphasis on risk management. The Panel agreed to further develop the concept. It also requested that the Norwegian delegation revise its proposal for further consideration by the Bureau. At the 38th session of the IPCC Bureau (24-25 November 2008 • Geneva, Switzerland), a revised proposal was presented. The Bureau requested that Working Group II take the lead on organizing a scoping meeting, in collaboration with Working Group I.

A call for expert nominations was issued to Governments and Observer Organizations on 8 December 2009, and a Science Steering Group (listed as editors of these Proceedings) assembled to evaluate submissions, identify gaps, recommend additional candidates, and assemble the most noted experts in the field to invite to the scoping meeting, which was conducted 23-26 March 2009 [hosted by the Norwegian Pollution Control Authority (SFT) in Oslo, Norway].

The principal objectives of the scoping meeting were to foster collaboration and discussions between climate science researchers spanning all three IPCC working groups (science, impacts, adaptation, mitigation) and colleagues in the disaster preparedness and risk management communities. After securing needed context on the first day, subsequent days were devoted to plenary and breakout groups to develop a structure for the proposed Special Report and an annotated outline, using the Norwegian proposal as a starting point.

These Proceedings compile the documentation used to inform the Panel’s decision to undertake the Special Report on “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation” – taken at the 30th session of the IPCC (21-23 April 2009 • Antalya, Turkey). Much more information on the scoping meeting – including abstracts of invited presentations, the presentations themselves, speaker biographical sketches, the aforementioned Norwegian pre-proposal, and a provisional development schedule – can be found on the IPCC Working Group II Technical Support Unit web site: <http://ipcc-wg2.gov/AR5/extremes-sr/Index_extremes.html>.

The bulk of this document is devoted to recapturing the scoping meeting breakout group discussions, which served as basis for the annotated outline endorsed by the Panel in Antalya. It is worth noting that the scoping meeting agenda provided for six breakout groups, two of which merged during the course of the meeting, hence only five synopses provided on pages 14-23. That larger breakout group (originally groups 4 and 5) provided the input that resulted in three chapters on risk management (scaled and integrated). The scoping meeting participants as a whole agreed upon the need for a chapter on case studies.

A scoping paper describing process and objectives, and providing the resultant proposed outline, was prepared and distributed in advance of the 39th session of the Bureau and the 30th session of the IPCC. The document was discussed at length at the Bureau and Panel sessions, and a decision was taken on 23 April 2009 to prepare the Special Report, following IPCC procedures

and with the involvement of ISDR. It was further decided that Working Group II oversee preparation of the assessment. The IPCC issued a press release announcing these decisions (see the 23 April 2009 entry at <<http://www.ipcc.ch/press/press-releases.htm>>).

Very slight modifications were made to the outline presented to the Panel as part of the Scoping Paper (see pages 29-30) – specifically to the subheadings of Chapter 3, as follows:

3. Changes in climate extremes and their impacts on the natural physical environment
 - Weather and climate events related to disasters
 - Climate extremes and impacts: past and current changes
 - The causes behind the changes
 - Climate extremes and impacts: projected long-term changes
 - Confidence in the projections

Refer to <http://ipcc-wg2.gov/AR5/extremes-sr/approved_outline.html> for the final outline approved by the Panel.

The IPCC Working Group II management team extends its sincere appreciation to the Norwegian Government and SFT for hosting the scoping meeting, in particular Dr. Øyvind Christophersen and Ms. Kristin Rostad. The facilities, organization, and amenities were all excellent. Gratitude must also be extended to the meeting participants themselves. The broad range of perspectives that emerged was a natural by-product of the many disciplines represented, and resulted in very rich and constructive discussions. It is our hope that the summary that follows captures the depth and complexity of the issues to be addressed in the Special Report.

Christopher Field
IPCC WG2 Co-Chair
USA

Vicente Barros
IPCC WG2 Co-Chair
Argentina

CALL FOR NOMINATIONS OF EXPERTS

No.: 5450-08/IPCC/WGII

To designated IPCC Focal Points and
Ministries of Foreign Affairs
(if no focal point has been designated)

Attachment: (i) BUR-XXXVIII/Doc.6
(ii) Nomination Form

Geneva, 8 December 2008

Sir/Madam,

I have the honour of inviting you to nominate experts to participate in a scoping meeting being organized by the Working Group II Technical Support Unit. The purpose of this meeting is to assess the feasibility and likely utility, as well as to scope the structure and development schedule, of a proposed Special Report on “Extreme events and disasters: Managing the risks.” The Norwegian Pollution Control Authority has graciously offered to host the meeting in Oslo, Norway, from 23-26 March 2009.

At the 29th session of the Panel (31 August – 4 September 2008 • Geneva, Switzerland), Norway introduced a proposal, prepared in collaboration with the International Strategy for Disaster Reduction (ISDR), for a Special Report on extreme events and disasters, with an emphasis on risk management. The Panel agreed to further develop the concept, through convening a scoping meeting early in 2009. It also requested that the Norwegian delegation revise its proposal for further consideration by the Bureau.

At the 38th session of the IPCC Bureau (24-25 November 2008 • Geneva, Switzerland), the revised proposal (attached) was presented. After deliberation, the Bureau decided to move ahead with the scoping meeting, to provide support for a future decision on whether to endorse the Special Report. The Bureau requested that Working Group II take the lead on organizing the scoping meeting. It also requested that the meeting produce a white paper describing process, objectives, and an annotated outline of the proposed Special Report. The outcome of the meeting should provide guidance to the 39th session of the Bureau and the following 30th session of the IPCC (21-23 April 2009 • Antalya, Turkey). A formal decision on undertaking the proposed Special Report will be rendered at the 30th session of the IPCC.

To meet the ambitious timetable for planning a scoping meeting, a Science Steering Group (SSG) has been approved by the IPCC Bureau. The SSG, with consultation from the Bureau, will decide on a participant list but welcomes the input of Governments to ensure the appropriate disciplinary and regional expertise. A nomination form is attached. Please refer to the attached proposal (Attachment I, <Scoping Mtg SR extreme events.pdf>) for guidance in the identification of suitable experts.

Relevant expertise for the scoping meeting will be diverse, as the proposed Special Report will integrate information and perspectives across the domains of all three working groups.

Participants in the meeting should collectively have expertise in the following areas:

- climate modeling
- climate observations
- downscaling
- hydrology and water management
- severe storms and extreme temperatures
- humanitarian consequences, including displacement and poverty
- human health
- socioeconomic consequences
- agriculture and food security
- ecosystems, wildfire
- infrastructure
- risk assessment
- adaptation
- insurance
- integrated assessment modeling
- policies, measures, and tools, including risk management and disaster risk reduction strategies
- planning
- land use change and coastal planning
- early warning systems and emergency management (preparedness, recovery and rehabilitation)
- cost and options for financing responses
- integration of disaster risk across sectors and regions
- climate change mitigation and development strategies

A description of the preparation of IPCC reports and the roles and responsibilities of authors and editors can be found at Appendix A to the Principles Governing IPCC Work (<http://www.ipcc.ch/about/how-the-ipcc-is-organized.htm>).

Given the tight schedule, nominations must be made by completing the attached nomination form (Attachment II, <extremes scoping nomination form 12-5-08.xls>), and e-mailing it to the Working Group II Technical Support Unit at <ipcc-wg2-tsu@usgcrp.gov> by close of business **19 January 2009**. Returning the form as an Excel spreadsheet will allow the TSU to transfer the nominations automatically to a database.

I thank you for your prompt attention to this matter, and apologize for the near-term deadline, especially with the holidays looming.

Sincerely yours,

(Renate Christ)
Secretary of the IPCC

SCOPING MEETING INVITATION

4 February 2009
2 PAGES

We have the honor of inviting you to a scoping meeting for a possible IPCC Special Report on “Extreme Events and Disasters: Managing the Risks,” to be held from Monday 23rd to Thursday 26th March 2009, at the Norwegian Pollution Control Authority (SFT) Conference Centre located at Strømsveien 96, Helsefyr, Oslo, Norway.

At the 38th session of the IPCC Bureau (24-25 November 2008 • Geneva, Switzerland), a Norwegian proposal to undertake a special report on Extreme Events – stressing risk assessment and management – was presented. After deliberation, the Bureau decided to conduct this scoping meeting, to provide support for a future decision on whether to endorse the Special Report. The Bureau requested that the meeting produce a white paper describing process, objectives, and an annotated outline. The outcome of the meeting will provide guidance to the 39th session of the Bureau and the 30th session of the IPCC (20-23 April 2009 • Antalya, Turkey). A formal decision on undertaking the proposed Special Report will be rendered at the 30th session of the IPCC.

The principal objective of the scoping meeting is to explore the feasibility and likely impact of a special report. Registration will start at 8:00 on Monday 23rd March, and the meeting will end at 13:00 on Thursday 26th. After securing needed context on the first day, subsequent days will be devoted to plenary and breakout groups to develop a picture of the proposed audience, a structure for the proposed Special Report, and an annotated outline. A small group will convene on the afternoon of the last day to consolidate inputs into the aforementioned white paper. The provisional agenda is appended, and additional information can be obtained by visiting the following closed web site:

<http://www.ipcc-wg2.gov/extremes-sr/>
username = <deleted>
password = <deleted>

This web site will be populated with the following information, and will be updated on a regular basis as materials become available:

- Pre-registration form
- Provisional agenda
- Invitation list
- Norwegian pre-proposal
- Speaker abstracts
- Logistics package.

The closed web site provides a link that will help you determine if a visa is required. The local host will provide a logistics package containing accommodation and transportation details, cost, and other conference details. A broadcast will be sent to all Invited Participants alerting them

when this package is posted. Note that you will be responsible for making your own hotel reservation. Be sure to mention “IPCC” and “SFT” when booking a room to secure the negotiated rate. You are encouraged to make your reservations as soon as possible after receiving the logistics announcement broadcast to guarantee the discounted rate.

You are also encouraged to complete the Pre-Registration Form, as only 1 hour is devoted to registration on the morning of the first day. This can be done either on-line via the closed web site or by downloading and completing the posted PDF (sending via fax or return e-mail, as indicated on the hardcopy form). Completing this form in advance will help meeting organizers plan allocation of breakout space.

For nationals of developed countries and/or individuals representing international organizations, their governments are expected to cover all the costs of scoping meeting participation. For nationals of developing countries, and countries with economies in transition, application must be made to the IPCC Trust Fund, administered by the IPCC Secretariat. The IPCC Working Group II Technical Support Unit (TSU) has sent a list of all Trust Fund-eligible invitees to the IPCC Secretariat. Contact information for the Secretariat has been provided within the e-mail serving as cover to this attached invitation, for those invitees eligible for Trust Fund support.

Finally, please confirm your participation in this scoping meeting by sending a reply to the IPCC Working Group II TSU at <ipcc-extremes-RSVP@usgcrp.gov> by **25 February 2009**. Of course, if you have any questions or need further information, please do not hesitate to contact the TSU.

Yours sincerely,

Vicente Barros (Argentina)
IPCC Working Group II Co-Chair
Extremes Scoping Meeting Steering Group Chair

Christopher Field (USA)
IPCC Working Group II Co-Chair

Attached:

<ExtremesSR_Agenda.pdf>

SCOPING MEETING AGENDA

**IPCC Working Group II Scoping Meeting:
Possible Special Report on
“Extreme Events and Disasters: Managing the Risks”
Oslo, Norway • 23-26 March 2009**

Monday, 23 March 2009

08:00 **Registration**

09:00 **Welcoming Remarks**

- **Erik Solheim**, Minister of the Environment and International Development
- **Margareta Wahlström**, UN Assistant Secretary General for Disaster Risk Reduction
- **Ellen Hambro**, Director of the Norwegian Pollution Control Authority (SFT)
- **Renate Christ**, Secretary of the Intergovernmental Panel on Climate Change
- **Øyvind Christophersen**, Senior Advisor for Climate and Energy (SFT)

09:30 **Background and Goals for the Meeting**

- **Vicente Barros**, IPCC Working Group II Co-Chair
and Chair of Extremes Scoping Meeting Science Steering Group

09:45 **Framing the Science**

- *Disaster Risk Reduction Strategies: The United Nations Perspective*
Andrew Maskrey, UN International Strategy for Disaster Reduction
- *Weather and Climate Extremes: How Can We Improve Our Understanding?*
David Easterling, NOAA / National Climatic Data Center

10:30 **Coffee Break**

11:00 **Framing the Science (continued)**

- *Social, Institutional, and Human Context*
Karen O’Brien, University of Oslo,
Global Environmental Change and Human Security Project
- *Panel Discussion*

11:45 **Session 1: Current Status of International Frameworks -
Expectations for a Special Report**

- *UNFCCC Post-2012 Negotiations and the Nairobi Work Programme on Adaptation*
Youssef Nassef, UNFCCC Secretariat,
Adaptation, Technology, and Science Program
- *Lessons Learned on Risk Management and Data Availability*
Maarten van Aalst, International Red Cross / Red Crescent Climate Centre
- *Discussion*

12:30 **Lunch**

13:30 **Session 2: Climate Change and Disaster Risk**

- *Trends in Extreme Events*
Neville Nicholls, Monash University
- *The Detection and Attribution of Extreme Events Changes*
Francis Zwiers, Environment Canada
- *Projection of Changes in Extremes by Very High Resolution Atmospheric Models*
Akio Kitoh, Meteorological Research Institute
- *Discussion*

14:45 **Session 3: Impacts of Weather and Climate-Related Extremes**

- *Social and Economic Impacts*
Jose Marengo, INPE / Centro de Ciencias do Sistema Terrestre
- *Impacts on Agriculture, Food Security, and Ecosystems*
Jose Moreno, Universidad de Castilla – La Mancha
- *Impacts on Coastal Systems and Low-Lying Islands*
Roger McLean, University of New South Wales
- *Discussion*

16:00 **Coffee Break**

16:20 **Session 4: Risk Management – Adaptation and Disaster Preparedness**

- *Strategies for Reducing Risks – Lessons Learned from Africa*
Coleen Vogel, University of Witwatersrand
- *Insurance and Other Financing Responses*
Gordon McBean, The University of Western Ontario,
Institute for Catastrophic Loss Reduction
- *Disaster Management and Emergency Preparedness*
Franklin McDonald, University of the West Indies,
Institute for Sustainable Development
- *Adaptation and Poverty Reduction: Governance, Tools, and Practice*
Tom Mitchell, University of Sussex,
Institute of Development Studies
- *Discussion*

18:00 **General Discussion and Plan for the Rest of the Meeting**

- **Vicente Barros**, Chair of Extremes Scoping Meeting Science Steering Group

18:15 **Adjourn**

18:30 **Reception**

Tuesday, 24 March 2009

09:00 Introduction to Breakout Groups

1. Climate-related extreme events and future projections
2. Observed impacts of extreme events and future outlooks
3. Trends, distributions, and drivers of vulnerability to extreme events
4. Current practice in reducing vulnerability and disaster risk
5. Strategies for adaptation and for reducing the risks related to future extreme events
6. Towards a sustainable and resilient future

09:30 Breakout Groups

1. Climate-Related Extreme Events and Future Projections

- Issues concerning extreme events, climate variability, and severity of events
- Nature, frequency, intensity, and duration of present-day climate-related extreme events
- Trends in extreme events including regional distribution and disaster hotspots
- Statistical tools, data gaps, and proxy data
- Attribution of the observed changes
- Projections and uncertainties on future frequency and strength of extreme events, including new hazards, implications of climate variability, complex extremes, and regional differences
- Progress for downscaling on local level and extreme events projections

2. Observed Impacts of Extreme Events and Future Outlooks

- Links between extreme events, relevant hazard phenomena and disasters, and their impacts on ecosystems and the built environment
- Complex phenomena, non-linearity, and the role of scales
- Ecological, economic, and social impacts of climate-related disasters and wider implications for human security and assistance, development, and equity
- Relevant climate-related events (e.g., heat waves, droughts, bushfires, floods, and hurricanes)
- Projected trends in disaster occurrence and regional distribution
- Projected trends in key vulnerabilities of human and biophysical systems

3. Trends, Distributions, and Drivers of Vulnerability to Extreme Events

- The nature of the disaster process—social and institutional factors, in particular vulnerability arising from poverty, unplanned settlements, environmental degradation, etc.
- Vulnerability of ecosystems, natural resources, and human societies
- Future vulnerability related to development pathways
- Societal dimensions of risk, including spatial planning and land-use change
- Processes and patterns of risk accumulation
- Coping capacities and capabilities, perception of risk, multiple stressors
- Particular vulnerable groups, regions, sectors, and systems

4. *Current Practice in Reducing Vulnerability and Disaster Risk*
 - Policies, tools, and practices by governments and institutions (relevant sectors to include agriculture and food security, human health, water management, energy investments, settlements and infrastructure, coastal zones, urban areas)
 - Autonomous adaptation practices, including lack of sufficient documentation of ongoing work and means to address this limitation
 - Community-level risk reduction and adaptation by region, and experience with technologies and coping practices, local and traditional knowledge
 - Case studies from particularly vulnerable ecosystems, sectors, and communities by region
 - Assessment of adequacy of current practice
 - Assessment of costs of implementation of current practices

5. *Strategies for Adaptation and for Reducing the Risks Related to Future Extreme Events*
 - Planning and development (increasing resilience and capacity to cope and adapt, mapping of risks, sectoral and cross-sectoral approaches)
 - Disaster management and emergency preparedness, monitoring and early warning, recovery and rehabilitation
 - Lessons learned from current risk management and adaptation practices
 - Integrating risk reduction and adaptation at institutional, national, regional, and local levels
 - Measures by institutions and humanitarian organizations
 - Costs, benefits, social and environmental consequences, global and aggregate impacts
 - Costs related to risk-reduction practices for adaptation

6. *Towards a Sustainable and Resilient Future*
 - Integration of disaster risk reduction and adaptation into planning and actions at national, regional, and local levels
 - Synergies between short-term coping and long-term planning
 - Integration of disaster risk, climate change mitigation, and development strategies
 - Impacts of future climate change and implications for regional, local, and sectoral development, access to resources, equity, and sustainable development
 - Implications of climate-related risks on achievement of Millennium Development Goals

10:30 **Coffee Break**

11:00 **Breakout Groups (cont.)**

12:30 **Lunch**

14:00 **Plenary**

15:00 **Coffee Break**

15:30 **Breakout Groups**

17:00 **Adjourn**

Wednesday, 25 March 2009

09:00 Plenary

- Reports from breakout groups
- Challenges and opportunities for a Special Report (to include availability of relevant literature, a survey of comparable or related efforts, and identifying key participants)
- Structure and outline for the candidate Special Report

12:00 Lunch

13:00 New Breakout Groups to Address Structure and Outline

15:00 Coffee Break

15:30 Plenary: Reports from New Breakout Groups

16:15 Adjourn

16:30 Field Trip (optional)

Thursday, 26 March 2009

09:00 Breakout Groups

- White paper
- Early publications
- Potential Special Report outline
- Potential Special Report authors
- Potential Special Report timeline / planning

11:30 Concluding Plenary

13:00 Adjourn

14:00 Meeting of Small Integration Team

SUMMARY OF BREAKOUT GROUP DISCUSSIONS IN SCOPING MEETING

The goals of the scoping meeting were to:

- Identify what new information could be assessed in a Special Report on Extreme Events and Disasters: Managing the Risks; and to
- Outline such a Special Report.

To achieve these goals, fifteen presentations were given by experts in climate science, disaster risk reduction, and adaptation. In addition, the participants were divided into six breakout groups:

- Climate-related extreme events and future projections
- Observed impacts of extreme events and future outlooks
- Trends, distributions, and drivers of vulnerability to extreme events
- Current practice in reducing vulnerability and disaster risk
- Strategies for adaptation and for reducing risks related to future extreme events
- Towards a sustainable and resilient future.

During the meeting, it was decided to combine the breakout groups on “Trends, distributions, and drivers of vulnerability to extreme events” and “Current practice in reducing vulnerability and disaster risk” into “Managing the changing risks of climate-related disasters: knowledge and practice.”

The proposed outline of the Special Report resulted from the breakout group discussions.

Climate-Related Extreme Events and Future Projections

Three genera of weather/climate extremes were discussed:

- The occasional occurrence of a weather/climate event from the extreme tails of the frequency distribution. Many such extremes are associated with disasters (e.g., hot days with heatwaves; heavy rainfalls with floods; strong winds associated with cyclones).
- An event with a very strong socio-economic impact, particularly when critical thresholds are involved, whether or not the event comes from the tail of the distribution. An example is a one-in-ten year drought occurring in a region that is particularly vulnerable because of other factors.
- An “extreme” also can arise when a slow trend in a weather/climate variable (e.g., sea level) contributes to an unprecedented situation (of very high sea levels in this case). Such a situation, because of the slow onset, might not be considered an “extreme” although it could lead to very high human costs.

The identification of the physical processes that are associated with changes in specific extremes is essential in determining whether such changes are likely to be persistent; if the underlying factors are natural, then the observed trend may not persist into the future.

Whether or not an extreme event results in a disaster depends, in part, on the physical characteristics of the event. For example, in the case of drought, the duration, intensity, spatial area affected, timing, frequency, onset date, continuity (i.e., whether there are “breaks” within the drought) all affect the magnitude and extent of impacts. The longer term context is also important. Thus, if an acute period of drought follows a chronic decline in rainfall, the impact of the acute drought is likely to be more severe.

Many weather/climate extremes have impacts on physical systems such as soil moisture and streamflow, landslides or avalanches (after heavy rains or snow, for instance), dust storms, forest fire (after drought and heatwaves), and glacier mass balance. In turn, the changes in these “non-climate” parts of the physical environment can feedback onto the weather/climate system. Disasters have often resulted from non-climatic events that were caused by an extreme event. Therefore, monitoring and projections are needed of extremes as well as non-climatic events.

Many of the analyses of changes of extremes have focused on individual types of events. However, the simultaneous or near-simultaneous occurrence of two or more extremes (e.g., high sea level coinciding with tropical cyclone landfall) can exacerbate impacts. Such compound or multiple events could be considered in the Special Report to the extent that the literature regarding their analysis and monitoring is sufficiently well developed. Another example that could have significant impacts is when two extremes of the same variable but of opposite sense (e.g., drought and flood) occur in close succession in a small region or a single country.

The breakout group recommended that the Special Report assess changes in extreme events in the current decade and over the past few decades because of the general lack of data for extremes from before about the mid-20th century. The inclusion of the current decade (2011-2020) means that short-term projections of changes in extremes may be considered to the extent that they are understood and attributable to human influences.

A potentially important area for consideration is the detection of trends in extreme events and the attribution of these trends to human influence. Not all extremes have been observed to change in recent times. It will be important to point out the limitations in diagnosing and modeling changes in extremes.

It will be important to differentiate between near- and long-term projections. Changes in extremes over the next few years to a decade are unlikely to be qualitatively different from changes observed in recent decades. However, towards the second half of the 21st century, it is anticipated that at least some extremes will exhibit much larger changes and that these will be a challenge to risk management, especially in vulnerable regions. For some classes of extremes, the information on projected changes from climate models may be limited. For some variables (e.g., frequency of cold extremes) where there is good reason for expecting considerable spatial coherence in the sign (and perhaps even the magnitude) of any trend, global projections from coarse resolution climate models might provide quantitative information for risk management. However, for many extremes (e.g., heavy rainfall events) coarse resolution model projections may only be able to provide qualitative information. It may still be necessary to examine the regional projections of extremes, rather than simply assume that global projections provide

sufficient information. The uncertainties associated with projections should be expressed clearly and accurately.

Suggested Boxes:

- Progress on downscaling for extremes
- What can be learned from experience with seasonal-to-interannual climate predictions?

Possible Case Studies:

- Heatwaves – reasonably well understood and predicted
- Droughts – cannot predict with confidence, providing other chapters opportunity to discuss actions appropriate for reducing risk from a poorly predicted variable
- Floods – poorly simulated and projected (but concerns that there will likely be changes in these extremes).

Observed Impacts of Extreme Events and Future Outlooks

Weather and climate-related extreme events have had major impacts on natural and human systems, most of which have been negative. There is a wide range of extreme events, from the weather-related that typically last for a short period over a geographically defined region, to the climate-related that persist over an extended period and cover a very large region (e.g., drought). The impacts can cover a similarly diverse range. For instance they may be spatially constrained or expansive, and have immediate or longer term consequences. In addition, impacts can be either direct (e.g., the destruction of buildings resulting from a hurricane) or indirect (e.g., forced migration of people as a consequence of the hurricane destruction, although in this case the ultimate cause of the migratory response may be obscure). The translation of an extreme event through to impacts is complex and involves a series of processes changes and/or changes of state (e.g., heavy rainfall, through runoff and river flood, to property damage). Regardless of event type, the magnitude of impact (IM) can be summarized as a result of a combination of the exposure and vulnerability of the location, and the characteristics of the particular hazard event, or more formally as: $IM = f(\text{exposure, vulnerability, hazard})$.

Observed trends in extreme events and vulnerability suggest that many natural and human systems are vulnerable, with differences across regions and sectors. Some systems are particularly vulnerable to climate/weather extremes, others both to extremes and average climate change. In general, low-income countries have higher vulnerability to extreme events and disasters. Exposures of human/environment systems have massively increased over the past decades caused by concentration of people and values (built-up areas, residential homes, industrial plants, and other assets) in urban areas, often situated in regions prone to weather extremes (e.g., coastal regions), resulting in increasing annual losses from weather-related disasters. At the same time, many observed weather extremes cannot be related to climate change.

This chapter should take into account not only new publications, but also consider relevant older studies of observed impacts of extreme events in the context of climate variability, whether the impacts were attributed to climate change (heatwaves) or still a matter of discussion. A problem

will likely arise from the difficult choice of references for inclusion that take into account interactions with non-climate drivers, which often result in large differences in observed impacts due to variations (in space and time) of exposure, sensitivity, and vulnerability.

For future projections, climate model outputs are usable for some events (heatwaves, frost, heavy rainfall), but still need to be refined for others (storm intensity and frequency, droughts generally restricted to the duration of dry spells). Using these outputs to project future impacts is difficult when the events are outside the range of experience. Further, the extent of future impacts will be partially determined by the combination of non-climatic drivers and expected adaptation strategies, as well as the evolution of systems and sectors that will evolve with gradual climate change. The complexities mean there are limited projections of the impacts of future extreme events.

It is not possible to project compound disasters such as the recent experience in northern Brazil where a complex chain of events lead to catastrophic mudslides with hundreds of victims. The cascade started with a drought associated with a La Nina event, which was followed by forest fires, which were followed by extreme rainfall events that led to flooding; these events interacted to cause the mudslides.

Suggested case studies include:

- Severe drought in northern China and other Asian countries, with consequences for water resources, ecosystems, health, transportation, and agriculture
- Severe freezing-rain and an ice storm in January 2008 in China that affected power generation, transportation, and insurance
- Arctic sea-ice retreat and associated extremes
- Caspian Sea level changes
- Permafrost thawing and geo-cryological hazards.

Trends, Distributions, and Drivers of Vulnerability to Extreme Events

Disasters result from the interaction of exposure to extreme events and the vulnerability of the affected natural and/or human systems. Vulnerability is the susceptibility to harm, which can be defined in terms of a population or a location. Vulnerability to climate change is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity to that exposure, and its ability to avoid, prepare for, and effectively respond. When describing the vulnerability of a region, its characteristics – such as baseline climate, abundance of natural resources (e.g., access to freshwater), elevation, infrastructure, institutions, and other factors – can alter vulnerability. Socioeconomic factors also play a critical role. All these factors can interact to mediate risk and/or lead to differences in the ability of communities to adapt or respond to extreme events.

Considerable progress has been made in recent years in identifying regions, sectors, and populations with higher vulnerability to extreme events, and in determining the reasons for that increased vulnerability, ranging from population characteristics to institutional arrangements. New information also is available on existing coping capacities (including disaster risk reduction

programs and activities) and their effectiveness to address current climate variability. Trends in vulnerability and coping capacities can be used in conjunction with projected changes in extreme events to suggest how extreme events could create short-, medium-, and long-term shocks to communities; these can then be used to suggest adaptation strategies to avoid, prepare for, and effectively respond to changing patterns of extreme events.

Managing the Changing Risks of Climate-Related Disasters: Knowledge and Practice

The risk of more complex, frequent, intense, or unpredictable extreme weather events, coupled with both gradual and non-linear changes to ecosystems and natural resources, suggests the need to focus on the ways these risks can be managed more effectively – by assessing the risks, reducing them, managing their impacts, and looking at options to pool and transfer some of the risks.

The disaster risk community provides many tools, methods, and policies that can be used to address the risks of climate-related extremes. Methods and experiences in working with vulnerable people and their needs through community-based initiatives are emerging as a cornerstone for disaster risk reduction. At the same time, the climate change community offers a growing body of research and experience on adaptation as a social process, with an emphasis on strategies and measures to reduce vulnerability and enhance the capacity to adapt to shocks and stressors. Given these overlapping areas of expertise and empirical experience, there is a great opportunity for synergies in addressing risks in the short, medium, and long term.

It was recommended that the chapters on knowledge and practice be divided into (i) managing the risks at the local level (local government, community, household, individual); (ii) managing the risks at the national level; and (iii) managing the risks at the regional and international level.

Coping vs. Adapting

Strategies for coping and adapting are often the same or similar but occur on different time scales. Coping takes place in situations of immediate stress, where life-saving solutions are needed. Medium- or longer term consequences are rarely considered. As a consequence, these strategies can deplete the capital base upon which the adaptation process relies. Relying on coping strategies as a way to adapt can therefore lead to maladaptation, whereby vulnerability is increased.

The difference between coping and adapting is fundamental when trying to understand the sustainability and effectiveness of a chosen response to change in the context of risk. In some cases, adaptation requires a transformational change away from practices/customs that are no longer viable; examples include migration (displacement, forced migration) as a result of or in anticipation of system collapse (e.g., sea-level rise on small islands) and abandoning livelihood practices (e.g., moving out of pastoralism/agriculture).

Most examples of anticipatory or reactive response to extreme events are examples of coping. Coping strategies are often the repertoire of options that a household is aware of in response to stresses that have evolved over long periods (traditional coping strategies), but these are not always strategies that can be used on a regular basis because of their destructive nature. When hazards are more frequent or have greater impacts, coping strategies may no longer be viable for the new context.

Adapting, on the other hand, involves a process of adjustment that moves towards resilience, even when the dynamics of risk is changing. Adapting involves a more forward-thinking process that acknowledges that actions taken to reduce risk today can have adverse implications for future risk.

Managing the Risks at the Local Level

It is often the suite of local coping mechanisms and activities that enable households and communities to withstand and ‘live with’ climate-related extremes. Whether an extreme event becomes a disaster depends on the local vulnerability, including all relevant stressors, and responses to the event. The influence of these stresses further depend on a host of interacting factors and circumstances, including gender and local-livelihood options that, in turn, are often further shaped by local-level institutions and policies at other levels (local government plans and policies).

Various coping strategies are often employed to reduce risks to extremes and are usually related to withdrawals on asset bases and resources, and involve diversification of activities. Those communities that usually can diversify their livelihood activities (e.g., engaging in casual employment) and can draw on various social networks often cope better with both extreme events and the insidious, daily challenges presented by slow-onset disasters. Various approaches and methods that enable detailed understandings of the interactions among various local players (e.g., government, civic society, communities at one level) and other micro-scale interactions (e.g., inter- and intra-household interactions), moreover, are also important when trying to reduce the risks to climate-related disasters. Approaches that treat communities as homogenous, for example, can be prone to failure. Similarly, those approaches and interventions that do not focus on the local context (e.g., poverty) may also enhance vulnerability and risks to climate-related disasters. Inadequate and poor planning in local contexts – heightened by poor infrastructure and services, for example – can lead to unplanned settlement expansion into marginal areas that may heighten the vulnerability of communities to climate-related extremes.

Effectively communicating information that may reduce risks to climate-related disasters is well known (e.g., early warning systems). The ability to respond to and effectively incorporate information related to climate risks and the processes required to establish sustainable and effective early warning systems are, however, also fundamental to enhancing local coping capacity. In some contexts, a more decentralized, sustainable early warning system that is well integrated into existing, local development (e.g., farmer commodity groups, women’s groups) and that includes a strong focus on user needs, local knowledge, and practice can result in more

effective communication and uptake of information required to reduce climate-related disasters (e.g., boundary organizations).

A range of methods and tools has been used to identify and reduce risks to climate-related disasters, including vulnerability indicators, indices, and aggregated ‘hot spot’ identification. Assessments of such tools have been undertaken in Latin America (La Red, DISENVENTAR).

Novel micro-insurance programs are demonstrating their potential to pool economic losses and smooth incomes of the poor facing climate-related extremes. For example, in Malawi, smallholder farmers can purchase index-based drought insurance made affordable by donor organizations. Scaling up micro-insurance programs can provide safety nets throughout the developing world. By pricing risks, and taking account of climate change, these systems can provide incentives for adaptation.

Managing the Risks at the National Level

A key element of managing risks at the national level is emergency response, including the organization of governmental emergency services, such as public health and safety, along with volunteer organizations. It includes the national responsibility for early warning, including both the information and communication systems needed to get the message to the right actors. National planning also includes responsibilities for risk reduction, ranging from risk-aware policies on land use and sector development, to standards such as building codes. Changing risks may call for adjustments in standards and/or their application.

Risk transfer is emerging as a tool for national governments to reduce their climate-related catastrophe exposure. As a recent example, the Mexican government was the first to issue a catastrophe bond to transfer its risks to the global capital markets and thus reduce its risk of large fiscal deficits following disasters. This assures its ability to repair damaged infrastructure and assist the poor. Ethiopia has followed this example (assisted by the UN Food and Agriculture Organisation), demonstrating a large potential for novel risk transfer tools that can greatly supplement international post-disaster assistance. As another example, the Caribbean island states recently formed the world’s first multi-country catastrophe insurance pool to provide governments with immediate liquidity in the aftermath of hurricanes or earthquakes. There is a largely untapped potential for pooling uncorrelated risks of country governments ill prepared to respond to disasters.

The creation of national safety nets or wider social protection programming is increasingly being viewed as a way to help avoid increases in poverty following a disaster (e.g., reduce need for distress selling or exploiting fragile ecosystem assets). Until recently, direct asset transfers tended to be reserved for post-disaster assistance, but evidence from Mexico, Brazil, Ethiopia, India, and others indicates considerable value in using safety nets and asset transfers to reduce risks. Conditional and unconditional cash transfers, restocking, employment guarantee schemes, social safety nets, etc., demonstrate the ability to create a baseline of assets on which other forms of risk management and transfer can be built, and can target different poverty and social groupings not able to engage with insurance markets.

Stimulated by the Hyogo Framework for Action, there has been rapid extension of the multi-stakeholder ‘national platforms for disaster risk reduction’. There is generally limited interaction between national platforms and national institutional structures that address climate change, which tend to be less well developed and closely associated with Ministries of the Environment or National Meteorological Services. Some countries retain a structure for managing disaster risks that is led by a single agency within a government ministry.

An increasing number of countries have adopted legislation on disaster management in recent years to provide for the formation of ‘national platforms’. Countries such as South Africa and Indonesia have passed legislation that promotes a disaster risk reduction approach, but such legislation has tended to follow significant disaster events. With changes in climate change-related extreme events, legislation may need to be strengthened to mandate new institutional structures and financing mechanisms.

Countries have tended to either make financial resources available to regional or local government agencies on demand following a disaster to cover immediate relief costs, or local governments have pre-assigned annual budgets. The Philippines has altered its policy so the pre-assigned budget for response can now be used for preparedness. Financing for disaster risk reduction tends to be available via bilateral and multi-lateral donor channels or in some cases through programming of international NGOs. There are few cases of significant national budget provision for disaster risk reduction.

Practitioners, governments, and development organizations, among others, need tools for prioritizing and assessing investments in disaster risk reduction. Cost-benefit is a widely used tool for this purpose, but with limited applicability to disaster risk management.

Managing the Risks at the Regional and International Level

Global property losses (insured and uninsured) in disasters associated with extreme weather events have been rising at a rapid rate for the past several decades. At the same time, loss of life from such events has declined. In the light of anticipated changes, assessing current practice (including methods and tools) in the management of disaster risks has become more important. Management practice is known to vary widely on a global scale and efforts at improvement have been underway for some time (decades) supported and facilitated by the international community. Salient among these efforts are the International Decade for Natural Disaster Reduction (1990-1999), and the subsequent establishment of the International Strategy for Disaster Reduction (ISDR) and the adoption of the Hyogo Declaration/Framework.

The successes that have been achieved at the global level in strengthening the management of disaster risks have nevertheless been insufficient to slow the rising trend in losses. To the extent that changes in extreme events associated with climate change will pose additional challenges for risk management, it is pertinent to ask what further opportunities for improvement exist if disaster losses are to be prevented from continuing to increase.

Cooperation at the global level on disaster risk reduction and climate change adaptation could address the development of stronger global strategies, the improvement in planning and policies (especially at the national level) and in practice, and the availability of tool and methods (especially at the local level). Another element is global humanitarian assistance, including how humanitarian agencies cope with the trends in risk, including innovative international financing mechanisms that allow more flexible responses.

The international community can provide essential support for risk financing instruments as a way of supporting disaster risk management in developing countries. Recent proposals on the part of AOSIS and MCII have provided concrete options for risk sharing and transfer to be included as part of a climate adaptation fund. These proposals build on current practices at international financial institutions and donor organizations.

Towards a Sustainable and Resilient Future

Climate extremes have long-term consequences for development in relation to material (i.e., impacts on resources, infrastructure, and investments) and non-material (i.e., health and psychological consequences, cultural significance, etc.) factors. There is a large body of literature that documents the uneven impacts of extreme events, which are influenced by differential exposures and vulnerabilities. The implications of uneven outcomes for sustainable development emphasizes the ways that disasters can set back economic development, but they also present potential windows of opportunity for initiating change. Successful disaster management and adaptation strategies must be considered as a necessary component for the achievement of the Millennium Development Goals.

Under some conditions, chronic or repeated disasters may lock individuals, households, communities, regions, or states into poverty, and diminish the effectiveness of ongoing poverty alleviation strategies. Short-term population displacement may have long-term consequences for economic and social development, particularly when food, health, and water security are affected by extreme climate events, which could trigger local, regional, or inter-state conflicts and migration. Increases in the frequency and intensity of extreme events combined with economic disruptions and population displacement also could stress governance regimes.

Actions to promote resilience to climate extremes and management of disaster risk may constrain or enhance efforts to achieve longer term societal goals (e.g., human development, peace, prosperity, etc.). However, coping and adaptation to achieve resilience and sustainability have yet to be mainstreamed. Adaptation to future scenarios that take into account extreme events with significant consequences for societies requires the mobilization of a range of intellectual, institutional, political, and financial resources over several decades. Successful mainstreaming can only be achieved by expanding the engagement of the private sector and civil society stakeholders in the adaptation process.

Some adaptations may contribute to higher greenhouse gas emissions (e.g., using desalination technology to increase freshwater availability) that should be taken into consideration in order for adaptation to be sustainable. Other sustainable adaptations such as designs and engineering

interventions (“climate proofing”) for development need to take into account future changes in the profiles of extreme events and interactions with development pathways.

The complexity of socio-ecological systems means that many of the constraints placed on future development may be unexpected, cross scales, or have delayed impacts. The notion of tipping points or thresholds is useful in describing key moments when development trends are set in motion and cannot be reversed. Examples include decisions to build sea-walls or apply managed retreat in adapting to sea-level rise with implications decades in the future for land-use and associated property values. Evolutionary maladaptation recognizes that the appropriateness of adaptive options can change over time as the context changes – not only climate change but also changing demographic and economic contexts. Social judgments on acceptable levels of risk and loss, and the development costs of adaptation, may also change over time.

Mechanisms for transferring and funding climate-related disaster risk reduction and adapting to climate extremes are evolving. Established mechanisms, including market insurance in developed countries and development assistance, are adapting to increased disaster damage costs. New instruments are emerging, particularly in least developing countries, to transfer and finance the risk of loss from climate extremes. Long-term options to support the widespread implementation of sustainable and effective instruments should be assessed.

This chapter also should consider the long-term consequences of present-day responses to extremes, including those that successfully take resilience and sustainability into account (e.g., building better health-care networks, relocating vulnerable populations, diversifying livelihoods towards less climate-sensitive sectors, improved climate information and early warning systems).

**SCOPING PAPER SUBMITTED
TO THE 30TH SESSION OF THE IPCC**
Managing the Risks of Extreme Events and Disasters
to Advance Climate Change Adaptation

Submitted by:

Vicente Barros, Christopher Field, Co-chairs of WG2

Jean-Pascal van Ypersele, Vice-chair IPCC

1. INTRODUCTION

At the 29th Session of the IPCC held in Geneva, Switzerland (September 2008), Norway introduced a proposal, prepared with the International Strategy for Disaster Reduction (ISDR), for a Special Report on *Managing the Risks of Extreme Events to Advance Climate Change Adaptation*. The Panel agreed in principle to convene a scoping meeting in 2009 to provide expert advice to the Panel on whether to develop a Special Report on this topic. At the 38th Session of the IPCC Bureau (November 2008, Geneva), a revised proposal was presented, and the Bureau agreed to convene a scoping meeting in the second half of March 2009. It was agreed that if the outcome of the scoping meeting was a recommendation for a Special Report, the meeting should also deliver a scoping paper, including a timetable and proposed outline for such a Special Report, for decision by the Panel at its 30th Session to be held April 21st - 23rd 2009 in Antalya, Turkey. This scoping paper is the result of the positive decision of the scoping meeting in favor of a Special Report.

2. SCOPING MEETING ON EXTREME EVENTS AND DISASTERS: MANAGING THE RISKS

From March 23rd – 26th, 2009, the IPCC scoping meeting on Extreme Events and Disasters: Managing the Risks was held in Oslo, Norway. A Science Steering Group (membership list provided in Annex 1) and the Co-chairs and Technical Support Unit (TSU) for IPCC Working Group II organized the meeting. The Norwegian Pollution Control Authority and ISDR provided significant support.

Seventy countries and fifteen observer organizations such as the International Red Cross nominated about 375 experts as meeting participants, including 115 nominated experts from developing countries and countries with economies in transition. The IPCC Trust Fund financed participation for 40 experts.

Approximately 140 experts were invited, of whom 117 from 51 countries participated, to represent the three communities whose expertise would be needed to scope a possible Special Report: climate scientists, experts on the impacts of climate change and adaptation policies to address extreme events and extreme impacts, and experts on disaster risk reduction. Fifteen major presentations were given and discussions were held covering all aspects of a possible Special Report. After extensive discussion of different possible approaches, the participating

experts reached agreement on the basic structure presented in this document. This structure was elaborated by six breakout groups and an integration team (membership list provided in Annex 2), and was discussed at length by all experts present.

3. RATIONALE FOR PROPOSING A SPECIAL REPORT ON *MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION*

The mandate of the scoping meeting was to guide and support decision-making by the IPCC on a possible Special Report on *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*.

Background: The IPCC Fourth Assessment Report (AR4) concluded that climate change has begun to affect the frequency, intensity, and length of many extreme events, such as floods, droughts, storms, and extreme temperatures, thus increasing the need for additional timely and effective adaptation. At the same time, gradual and non-linear change to ecosystems and natural resources and increasing vulnerability further increase the consequences of extreme weather events. The AR4 recognized that reducing vulnerability to current climatic variability can effectively reduce vulnerability to increased hazard risk associated with climate change. However, the AR4 reviewed policies and measures that were specifically identified as adaptation and not the full range of activities undertaken to reduce the risks of extreme events and disasters.

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) acknowledged the relevance of disaster risk reduction to advance adaptation in the December 2007 Bali Action Plan, which calls for enhanced action on risk management and risk reduction strategies, including risk transfer mechanisms such as insurance, and disaster reduction strategies to lessen the impact of disasters on developing countries.

Disaster risk reduction efforts are guided by *The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters*, to which 168 Governments agreed in Hyogo, Kobe, Japan, in 2005. The Framework aims for “the substantial reduction of disaster losses, in lives and in the social, economic, and environmental assets of communities and countries.” As part of its text, Governments agreed to integrate climate change adaptation and disaster risk reduction through:

- (i) The identification of climate-related disaster risks;
- (ii) The design of specific risk reduction measures; and
- (iii) The improved and routine use of climate risk information by planners, engineers, and other decision makers.

Rationale: The participants concluded that a Special Report is needed for the following reasons:

- The Special Report would contribute to the goals of the UNFCCC and to the work of the Nairobi Work Programme on Impacts, Vulnerability, and Adaptation to Climate Change. The Nairobi Work Programme is structured around nine areas of work, including “Climate Related Risks and Extreme Events.” The objective of this area is to promote understanding of the vulnerability to and impacts of climate change, current and future

climate variability and extreme events, and the implications for sustainable development.

At the UNFCCC Subsidiary Bodies meeting in Bonn in 2008, in the context of the Nairobi Work Programme, Parties requested further information on the inclusion of disaster risk reduction strategies into national policies and programs. The Special Report would complement and inform the work done within the Nairobi Work Programme on collecting and analyzing information on adaptation actions and advances towards integrating disaster risk reduction strategies and climate change adaptation into national policies and programs.

- Disaster risk reduction strategies and practice are primary approaches for reducing vulnerability and increasing resilience to extreme weather events. However, there has not been a comprehensive assessment of the guides, frameworks, and tools used by various institutions, organizations, and communities to build the capacity for reducing vulnerability and risk; to develop early warning systems; to strengthen community capacity and social resilience, particularly among the most vulnerable; to improve construction practices; and to establish preparedness to respond to inevitable climate impacts.

AR4 reviewed programs and activities on adaptation to climate change and not the wide range of efforts undertaken worldwide by Governments and communities to promote and implement disaster risk reduction, sustainable development, and environmental risk management. An in-depth assessment that identified successful practices, with information on appropriate contexts, cost, and social consequences, and potential constraints, would provide concrete guidance to Governments in planning and implementing adaptation activities. A systematic review would also enable Governments to identify those existing practices that should be strengthened because they provide important synergies. Governments, through the Nairobi Work Programme, have indicated that the increasing risks of extreme climate events are an immediate and urgent problem. A Special Report, completed before the Fifth Assessment Report (AR5), would help guide UNFCCC Parties in their development of disaster risk reduction and adaptation strategies, policies, and measures, thus reducing the extent to which extreme events result in disasters.

- To further assist the IPCC in its decision-making, Norway reviewed the humanitarian consequences of climate change and compiled a detailed bibliography of relevant literature, showing there is substantial literature that covers peer-reviewed literature, academic books, and reports, and literature that is produced by agencies and NGOs.

The proposed Special Report is consistent with the IPCC framework and criteria for establishing priorities for IPCC reports, in particular the aim to “strive to serve the policy community with relevant information in a pro-active fashion.” It also meets the other priority guidelines: sufficient scientific literature exists; the primary audience is the UNFCCC and the target is the development of the post-2012 agreement and adaptation plans; the scientific community is available; and the topic is specific in scope.

A Special Report could be finalized in the second half of 2011, thus providing the necessary information to Governments sooner than the AR5; the WGI contribution is planned for completion in 2013 and the WGII and WGIII contributions are planned for completion in mid-2014.

4. PROPOSED CONTENT AND STRUCTURE OF A SPECIAL REPORT

The expert participants recommended that the Special Report, if approved, should focus on climate change and its role in altering the frequency, severity, and impact of extreme events or disasters, and on the costs of both impacts and the actions taken to prepare for, respond to, and recover from extreme events and disasters. The emphasis should be on understanding the factors that make people and infrastructure vulnerable to extreme events, on recent and future changes in the relationship between climate change and extremes, and on managing the risks of disasters, over a wide range of spatial and temporal scales (Figure 1). The assessment should consider a broad suite of adaptations, ranging from early warning to insurance to altered infrastructure and social safety nets. It should also explore the limits to adaptation, the conditions that can transition adaptation into maladaptation, and the human and financial consequences of those limits. Finally, the assessment should build durable links and foundations for partnerships between the stakeholder communities focused on climate change and those focused on disaster risk reduction.

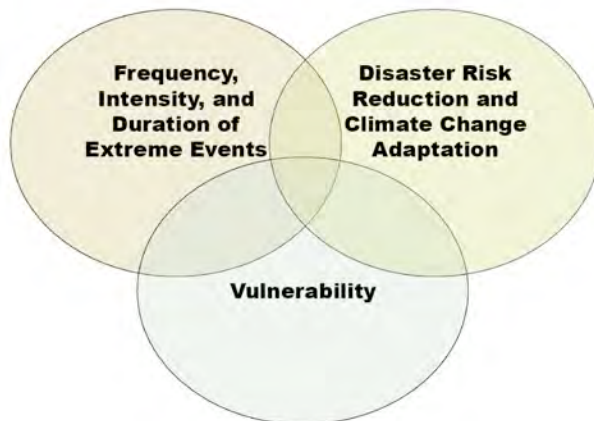


Figure 1: Conceptual model of the topics to be assessed in the special report and of the links among them. The focus will be on the part of the domain where all three spheres overlap.

The expert participants recommended that the special report focus on three kinds of extremes or disasters with the potential to be altered by climate change (Figure 2). The first includes extreme events for which climate change has amplified variability or may do so in the future. This category includes, among others, aspects of floods, droughts, windstorms, and extreme temperatures. A second category includes events in which trends outside the domain of climate increase exposure or vulnerability to climate-related extremes. Examples include coastal development increasing exposure to storm surges on top of sea-level rise or increasing urbanization amplifying exposure to heat waves in a warming climate. The third is new kinds of potentially hazardous events and conditions that may occur as a result of climate change. This category includes events like glacial lake outbursts and wildfire in forests that had historically been too wet to burn. Disasters of more complex origin such as landslides, wild land fires, and insect infestations should also be considered, where there is the possibility of a consequential link with climate change.

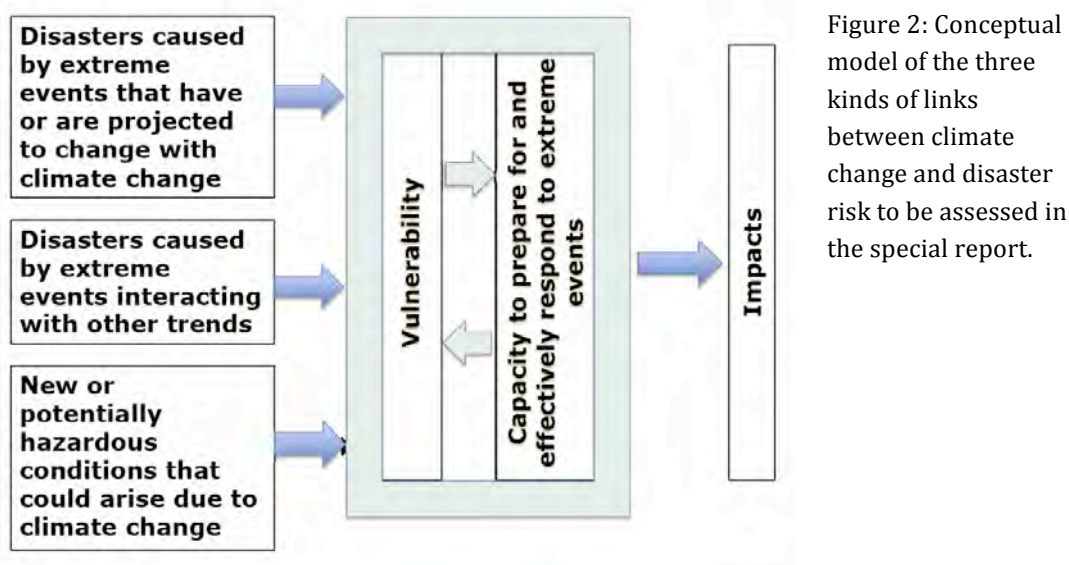


Figure 2: Conceptual model of the three kinds of links between climate change and disaster risk to be assessed in the special report.

The following outline was agreed by the expert participants to ensure the most informative treatment of the issues. If approved, the special report will begin with material that frames the issues, followed by an assessment of vulnerability, discussing the reasons that communities, businesses, and ecosystems are vulnerable. The next section, consisting of two chapters, will assess the role of past and future climate change in altering extremes and the impact of these on the physical environment, human systems, and ecosystems. A series of three chapters will then assess available knowledge on impacts and adaptation, focusing on the time period extending from a few years in the past to several years into the future, with separate chapters considering the very different literature, stakeholder relationships, and potential policy tools relevant to the local, national, and international scales. Longer term components of adaptation to weather and climate extremes and disasters will be assessed in the context of moving toward sustainability.

Case studies, examples focused on particular kinds of extremes, parts of the world, and modes of adaption, will appear in the report in three ways. Examples useful for illustrating specific points will be integrated into the chapters for which they are most relevant, in some cases as boxes. Two other case studies, one representing an extreme with a clear connection to climate change and one without, will form a thread that runs through all of the chapters. This thread of common case studies will provide a set of reference frameworks for exploring findings about managing the risks of extremes at many different levels, when the risks are known relatively well and relatively poorly. A third set of case studies will be collected in a separate chapter, at the end of the volume. These will be case studies that integrate themes across several chapters or are so unique that they need to be considered separately.

Each chapter will pose and address a limited number of carefully selected “Frequently Asked Questions” concerning key stakeholder concerns. The questions and the answers to them will constitute a component of the Special Report that can encourage solid engagement and clear communication with a wide range of stakeholders.

The proposed outline, with chapter titles and first-order chapter topics, follows:

1. *Climate change: new dimensions in disaster risk, exposure, vulnerability, and resilience*
 - Risk reduction, risk management, risk transfer
 - Coping vs. adapting
 - Extreme events vs. extreme impacts
2. *Determinants of risks: exposure and vulnerability*
 - Dimensions of vulnerability
 - Vulnerability profiles
 - Coping and adaptive capacities
 - Assessment of and trends in vulnerability
 - Risk identification, risk accumulation, and the nature of disasters
3. *Changes in climate extremes and their impacts on the natural physical environment*
 - Weather and climate events related to disasters
 - Climate extremes and impacts: the changing landscape
 - Climate extremes and impacts: the causes behind the changes
 - Climate extremes and impacts: projected long-term changes
 - Climate extremes and impacts: confidence in the projections
4. *Changes in impacts of climate extremes: human systems and ecosystems*
 - Role of climate extremes in natural and socioeconomic systems
 - Nature of impacts and relation to hazards
 - Observed trends in system exposure and vulnerability
 - System- and sector-based aspects of vulnerability, exposures, and impacts
 - Regional aspects of vulnerability, exposures, and impacts
 - Costs of climate extremes and disasters
5. *Managing the risks from climate extremes at the local level*
 - Community coping, including migration
 - Community-based disaster risk management
 - Gender, age, wealth, and entitlements
 - Social transfers, including microfinance, cash transfers, benefit schemes, and cash for work
 - Risk transfers, including microinsurance
 - Data as input for risk management, including challenges
 - Costs of managing the risks from climate extremes
6. *Managing the risks from climate extremes at the national level*
 - Practice, including methods and tools
 - Approaches for managing the risks
 - Planning and policies
 - Strategies, including institutions, legislation, and finance
 - Perspective on the links between national and local scales
 - Costs of managing the risks from climate extremes

7. *Managing the risks: international level and integration across scales*

- International policy frameworks
- International humanitarian institutions and practice
- Other relevant international issues (health, food security, finance, security)
- International law
- Financing and (dis)incentives for risk reduction, costs and benefits of various approaches, and implications for financing flows
- Technology cooperation
- Risk transfer
- Perspective on links between local, national, and global scales
- Costs of managing the risks from climate extremes

8. *Toward a sustainable and resilient future*

- Disaster risk reduction as adaptation: relationship to development planning
 - Synergies between short-term coping and long-term adaptation for sustainable development
 - Interactions among disaster risk management, adaptation to climate change extremes, and mitigation of greenhouse gas emissions
 - Implications for access to resources, equity, and sustainable development
 - Implications for achieving relevant international goals
- Options for proactive, long-term resilience to future climate extremes

9. *Case studies*

This chapter will include up to 25 case studies selected to illustrate how extreme events and vulnerability interact to result in disasters, lessons learned on effective and ineffective approaches to preparing for, responding to, and reconstructing after extreme events. Possible case studies could address vulnerable regions (e.g., Bangladesh, Southern Africa), vulnerable kinds of settlements (e.g., large cities), particular kinds of extremes (e.g., intense rain, persistent heat waves), experience with particular risk management strategies (e.g., early warning systems), or integrated evaluations of particular events (e.g., European heat wave of 2003, Australian wildfires of 2009). The individual case studies will be written by contributing authors who will be identified in association with the case study each wrote. The chapter will be under the leadership of at least two coordinating lead authors.

5. PROPOSED MANAGEMENT WITHIN THE IPCC

The topic of the proposed Special Report draws on the expertise and perspective of all three working groups. Input from WGI is necessary to provide a state-of-the-science update on climate change and extreme events. Input from WGII is necessary for assessing vulnerability and impacts to extreme events and disasters, as well as assessing options for adaptation. Input from WGIII is necessary for evaluating the issues in a context that includes mitigation, especially in the chapter on moving toward sustainability. Operationally, it is proposed that WGII would have the lead, but with a structure and philosophy that ensures full engagement and sharing of responsibility among all three working groups. Careful attention will be paid to avoid potential

overlap between the final Lead Author meetings of a Special Report and the first Lead Author meetings for WGI.

6. TIME SCHEDULE AND PROVISIONAL BUDGET ESTIMATE

If the 30th Session of the IPCC in April 2009 decides to proceed with the preparation of a Special Report, a call for nominations of Lead Authors would be issued no later than June 2009. Approval and acceptance of the Special Report would be planned for the second half of 2011. In order to achieve this timetable, one Lead Author meeting would be held in 2009, two Lead Author meetings in 2010, and one Lead Author meeting in the first half of 2011. The planning would be designed to properly synchronize with the preparation of the AR5.

Budget 2009: assuming 1 Lead Author Meeting with 45 journeys of DC and EIT Lead Authors at 4.500 CHF per journey, plus 15% for other meeting costs, 232.875 CHF will be needed from the IPCC Trust fund.

Budget 2010: assuming 2 Lead Author Meetings with 45 journeys each of DC and EIT Lead Authors at 4.500 CHF per journey, plus 5 Review Editors for each meeting, plus 15% for other meeting costs, 517.500 CHF will be needed from the IPCC Trust fund.

Budget 2011: assuming 1 Lead Author Meeting with 45 journeys of DC and EIT Lead Authors at 4.500 CHF per journey, plus 5 Review Editors, plus 5 DC and EIT CLAs to the approval meeting, plus 15% for other meeting costs, 284.625 CHF will be needed from the IPCC Trust fund. In addition, assuming 4 days for the IPCC Plenary to approve the Summary for Policymakers, costs are projected to be approximately 820.000 CHF plus 27.000 for a preparatory meeting with 6 DC and EIT CLAs and their participation in the Session. The total budget for 2011 will then amount to approximately 1.131.625 CHF.

Costs for translation and purchasing of the Special Report, shipping costs, and outreach are to be included later.

7. LEAD AUTHOR SELECTION PROCESS

Nominations can be called for in a letter to governments, no later than June 2009. Based on the nominations, the IPCC Bureau will select the Coordinating Lead Authors, Lead Authors, and Review Editors.

Annex 1: Science Steering Group

Vicente Barros, Argentina (SSG Chair and WG2 Co-Chair)
Christopher Field, USA (WG2 Co-Chair)
Abdalah Mokssit, Morocco (WG1 Bureau)
Ajmad Abdulla, Maldives (WG2 Bureau)
Antonina Ivanova Boncheva, Mexico (WG3 Bureau)
Øyvind Christophersen, Norway (Norwegian Pollution Control Authority)
Jean Jouzel, France (WG1 Bureau)
Nirivololona Raholijao, Madagascar (WG2 Bureau)
Neville Smith, Australia (WG2 Bureau)
Francis Zwiers, Canada (WG1 Bureau)

Annex 2: Integration Team

Vicente Barros, Argentina
Reid Basher, New Zealand
Ian Burton, Canada
Øyvind Christophersen, Norway
Jeremy Collymore, Barbados
David Dokken, IPCC Working Group II TSU
David Easterling, USA
Kristie Ebi, IPCC Working Group II TSU
Christopher Field, USA
Zhahui Lin, China
Alimullah Miyan, Bangladesh
Pauline Midgley, IPCC Working Group I TSU
Neville Nicholls, Australia
Lisa Schipper, Sweden
Coleen Vogel, South Africa
Francis Zwiers, Canada

LIST OF PARTICIPANTS

Invited Speakers

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Meteorological Research Institute, Japan
Meteorological Agency
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Jose Marengo
INPE / Centro de Ciencias do Sistema Terrestre
Brazil

Andrew Maskrey
UN International Strategy for Disaster Reduction
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Gordon McBean
The University of Western Ontario, Institute for
Catastrophic Loss Reduction
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Franklin McDonald
University of the West Indies, Institute for
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Roger McLean
University of New South Wales
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Thomas C. Mitchell
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Jose Moreno
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