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CHAPTER OUTLINES OF THE WORKING GROUP CONTRIBUTION TO THE IPCC SEVENTH ASSESSMENT REPORT (AR7)

Working Group I Contribution to the IPCC Seventh Assessment Report

Background information

(Submitted by the Co-Chairs of Working Group I on behalf of the Working Group I Bureau)

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Background information

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1. Introduction

This document is provided by the Co-Chairs of Working Group I (WGI) on behalf of the WGI Bureau to describe the broad structure and rationale of the Working Group I contribution to the IPCC Seventh Assessment Report (WGI AR7) as outlined in WG-I: 15th/ Doc. 2 and informed by WG-I: 15th/ Doc. 3.

Firstly, this document describes the actions taken by the WGI Bureau in preparation for the AR7 scoping meeting held in Kuala Lumpur, 9-13 December 2024 (Sections 2-5). This includes the development of the WGI contribution to the AR7 Vision Document, the undertaking of pre-scoping activities, and the selection of scoping participants. The section that follows (Section 6) describes the structure of the scoping meeting itself and the process by which the WGI AR7 draft outline was developed over the course of the scoping meeting. The next section of the document (Section 7) describes how the WGI outline is linked to the other AR7 products and the implications for coordination needed to ensure a comprehensive and integrative assessment cycle. The AR7 WGI annotated outline is presented in the final section (Section 8). Three annexes are included with this report that summarize:

- the analysis and outcomes of the pre-scoping activities (Annex 1)
- the WGI selection process for participants for the AR7 Scoping Meeting (Annex 2)
- the AR7 Scoping Meeting agenda (Annex 3)

2. Vision Document

The WGI Bureau contribution to the Vision Document for the Scoping Meeting of the AR7. See IPCC-LXII/INF. 7, Annex I.

The WGI contribution introduces the themes to be considered for the scoping of the AR7 WGI report, including recent focus areas of climate research, new and emerging topics, and issues of specific relevance for risk assessment, as identified by the WGI Bureau. It includes a discussion of why a WGI Report remains relevant for policy making and provides recommendations for the development of the outline and chapter structure of the report. The document also includes an analysis of key findings and gaps from the AR6 WGI Report and Synthesis Report (SYR), identifies a range of emerging topics since the AR6 as well as a list of society-relevant questions that the Report should answer.

3. Pre-Scoping Activities

WGI TSU, in cooperation with the Bureau, collected input on expectations, priorities, concerns and structural questions concerning the WGI AR7 from the scientific community and a range of external audiences, using different formats and sources. Outreach was targeted at international organisations and groups with a global constituency to ensure balanced representation. Many substantive inputs and helpful suggestions were received, reflecting the high level of commitment and engagement of the WGI scientific community in the IPCC process, and the continued relevance of climate science. An overview of those activities is given below. A summary of the analysis of all the responses is provided in Annex 1.

3.1 Pre-scoping Science Survey

The WGI TSU conducted a pre-scoping community consultation through an online-questionnaire shared with the AR6 WGI Authors and Review Editors (REs), the Synthesis Report (SYR) Core Writing Team (CWT), as well as with representatives of international science organizations.

The questionnaire was distributed to a total of ~ 470 people, counting some overlaps between, e.g., AR6 contributors and WCRP, CMIP and Future Earth leadership. The survey had a ~40% response rate, with 186 individual and one institutional response received. 70% of respondents were AR6 contributors, and almost 70% identified as male. 110 were from Global North countries, and 66 from the Global South. The survey results informed the preparatory work of the Bureau on key issues and scientific priorities for AR7, and on Report structure and organization of work.

3.2 Pre-scoping Webinars with non-selected Experts

IPCC focal points and experts who were nominated but not selected to participate in the IPCC AR7 Joint Scoping Meeting were invited to participate in one of three cross-Working Group pre-scoping webinars held on October 30th, 2024. These webinars lasted 1.5 hours and included general introductions to the IPCC Bureau and scoping process, followed by Working Group (WG) specific Breakout Groups (BOGs), a report back and an invitation to an online survey on inclusivity.

A total of ~600 participants, including ~70 WGI experts, attended the webinars, and each of the WGI BOGs gathered 23-27 experts. After a few ice-breaker questions, the BOG discussion focused on delivering policy-relevant insights for decision-makers, emerging or progressing scientific topics since AR6, and the main new message WGI might be expected to develop.

3.3 Pre-scoping Survey with Scoping Meeting Participants

To prepare discussions in Kuala Lumpur, a survey was sent to all experts selected to attend the WGI scoping meeting, including those also participating in the SYR conversations. Out of 68 experts invited, a total of 62 responded, many with detailed input on the questions posed (emerging vs. mature research areas, potential key messages, approaches to regional information, Report length, usability and workload, and on overall Report structure and organization in the light of delivering a policy-relevant report). This high level of engagement was extremely helpful for the Bureau to prepare the meeting and helped save time on the first day, where findings from the survey fed into the starting points for discussions. A synthesis of all pre-scoping activities had been shared with Scoping Meeting participants as part of the background information for the meeting.

3.4 Conversations with External Groups and Networks

Informal exchanges were held with international organizations outside the core climate space, including the United Nations Convention to Combat Desertification (UNCCD), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), United Nations (UN) Water and the International Energy Agency (IEA), as well as with representatives from international associations engaged on Insurance, Health, Environmental Issues, Food, Mountain regions and Oceans. In addition, two virtual roundtables were organized with international climate science reporters, and a dedicated survey for Youth was undertaken, focusing on their knowledge and feelings about climate change.

3.5 Onboarding webinars

Onboarding webinars were organized for selected experts to provide them with background on the IPCC, Working Group I, and the scope and purpose of the Scoping Meeting. These webinars focused on process, not content, to inform the selected experts, especially those new to the IPCC, about what to expect and how to best prepare, and to offer some space for questions.

4. Call for nominations for the Scoping Meeting

A call for nomination for experts to participate in the Scoping Meeting was issued to governments and observer organizations on the 3rd May 2024, with nominations submitted by the 7th June 2024.

Participants were sought with a broad understanding of climate change and related issues to collectively have expertise in the following areas:

- Observation, monitoring of climate variables, reanalyses (ocean, atmosphere, cryosphere, land, freshwater, coasts), process understanding (water cycle, short-lived climate forcers and air quality, other climate system processes);
- Climate modeling (global, Earth System Models, regional, coupled, ocean, atmosphere, cryosphere, land, hydrology, chemistry and biogeochemistry) and model evaluation;
- Statistical climatology (trends, extremes, attribution, downscaling and bias correction, observation constraints, AI, ...), recent global and regional trends;
- Near-term and long-term ensemble projections, storylines, emulators, uncertainties, carbon budget;
- Climate services and decision-support tools (experience working with stakeholders);
- High-impact climate outcomes and abrupt changes including tipping points, compounding and cascading events;
- Physical aspects of renewable resources (Energy, Water, ...).

In addition, the following areas of expertise cutting across Working Groups were identified as relevant:

- Integration of different forms of climate-related knowledge and data, including Indigenous Knowledge, local knowledge, and practice-based knowledge;
- Regional (including terrestrial, ocean, and coastal) and sectoral climate information;
- Carbon Dioxide Removal, Solar Radiation Modification and associated Earth System impacts/feedbacks;
- Scenarios and pathways, including physical climate, impacts and adaptation, mitigation, development, feasibility and socio-cultural considerations (equity, ethics, finance);
- Co-benefits, avoided impacts, risks and co-costs of mitigation and adaptation, including: interactions and trade-offs, technological and financial challenges, options and implementation and low regret options;
- Ethics and equity dimensions of climate change, sustainable development, gender, poverty eradication, livelihoods, health, and food security;
- Societal responses to spatial and temporal dimensions of risks and benefits of climate change, including sociological, financial, cultural and communication aspects.

5. Scoping Meeting Participant Selection

The WGI Bureau selected 61 experts from a pool of 1053 candidates who self-identified as having expertise related to the WGI report, out of a total of 2210. The selection considered the balance of expertise, geographical and gender representation, past IPCC experience, and the need to bring in new experts at the forefront of climate science development to the IPCC process. Seven additional WGI experts, identified by the IPCC Chair to attend the Synthesis Report sessions, were added to the WGI Bureau selection. The final selection of the total slate of 240 experts was coordinated among the WG I, II and III Co-Chairs and Bureaux, to ensure balance also across the WGs, and necessary cross-WG and interdisciplinary expertise.

The description of the selection process, related statistics, and the final list of participants is provided in Annex 2.

6. WGI Scoping Meeting

The scoping meeting was structured to promote a fully engaged and participatory discussion among all participants towards a consensus-based development of the Report outline in light of ongoing research developments, the treatment of cross-WG topics and coordination needs, and the lessons learned from previous WGI assessments. The full program is provided in Annex 3.

Day 1 focused on the possible narrative of the report. Thanks to the survey that had been conducted before the meeting, options for narratives and general organizations of the Report had been identified in advance and could be discussed with the group. This led to the agreement at the end of Day 1 to start with the following “working narrative”, as it matched a number of expectations (see Section 7.1):

- Current status and trends
- Futures
- Climate information for responses

This working narrative would define an overall organization of the Report into 3 main sections with several chapters, those chapters being discussed on Day 2 and later. Potential key structural concerns were captured to be rediscussed later during the process as needed, after more extensive deliberations on the content of the sections.

Day 2 focused on the content of the future WGI report. In plenary, experts discussed emerging, fast-growing topics, cross-Working Group topics, and other topics meriting specific attention. Here again, the survey conducted before the meeting enabled a concrete and very constructive discussion from the very start. The participants were then invited to attend breakout groups (BOGs) covering the three sections of the narrative with the objective to answer the following questions:

- What broad WGI topics should the section cover?
- What cross-WG topics is this section involving?
- What could be the potential chapter titles in this section?
- What are potential links to other sections?
- Are there specific questions that should be answered in this section?
- Suggestions to address the key structural concerns identified on Day 1

Day 2 was also dedicated to cross-Working Group interactions. As a start, nine main topics had been identified in advance by the Bureau, and cross-WG BOGs brought together participants from all three WGs to exchange on the following topics:

- Equity and justice
- Finance
- Health and well-being
- Losses and damages
- Overshoot
- Risk approaches and regionalization
- Scenarios
- Sectors and systems
- Solar radiation modification

Participants were requested to answer the following questions:

- Is xWG coordination needed for this topic because:
  xWG assessment / expertise is needed? or
  xWG coordination would facilitate integration into SYR?
- Is xWG coordination needed **at the scoping** for this topic?
- What are the important xWG elements of this topic?
- How should this topic/element be structured in the report(s)?

Participants were also invited to identify other topics that needed cross-WG coordination. A second session of cross-WG BOGs was held on Day 3 and included additional topics (biodiversity, tipping points and large-scale singular events; and societal development, including climate resilient development).

In the evening of Day 2, the WGI Bureau pulled together the outcomes of the BOGs in order to suggest a first “strawdog chapter structure” which was further discussed during Day 3 with the with the aim of coming up with options for the structure of the chapters.
In the evening of Day 3, the WGI Bureau proposed a final chapter structure, having considered all the discussions and comments collected during the day. They also suggested placement of the WGI and cross-Working Group topics identified by the participants in specific chapters.

The suggested chapter titles and their possible content was presented to the participants in the morning of Day 4. Experts then split into breakout groups with the mandate to:

- Refine the chapter titles
- Define the indicative bullet points for each chapter

Four BOGs were organized. Interlinked chapters were grouped in the same BOG to facilitate the discussions on the content of each and the identification of possible gaps/overlaps:

- Chapter 8
- Chapters 3, 7, 10
- Chapters 5, 6, 9
- Chapters 1, 2, 4

By the end of Day 4, a plenary took stock of the outcomes of each BOG and the group started approving its outline line by line. Each bullet/chapter title was discussed and refined in order to reach consensus in the group, and participants agreed on topics to include in the annotations, to give additional guidance and context to the future author team.

Day 5 was devoted to continue and finalize the line-by-line consensus approval. Each bullet was discussed in detail in WGI plenary, with a few separate huddles when needed. The agreed outline was then presented in the full plenary of all WGs.

7. WGI Report structure and Coordination

7.1 Vision for the AR7 WGI Report

The vision document (see Section 2 of this document) was drafted in preparation for the scoping meeting, based on discussions with the WGI Bureau, and informed by the results of the pre-scoping activities. The WGI vision document also took inspiration from the Chair's vision with the guiding principles of the cycle (policy relevance, inclusivity and inter-disciplinarity), and the objective to facilitate integration of WGI elements in the AR7 SYR.

The outline was built on a few principles that would:

- allow major policy-relevant questions to be addressed, and consider a "question-driven" approach and mindset;
- facilitate the localization of information for readers;
- reduce workload for authors and reviewers, through a clear structure avoiding overlaps as much as possible;
- highlight new areas of research and allow new key findings to emerge;
- favor interdisciplinary interactions with other WGs.

Three major clusters of question relevant to the WGI assessment emerged clearly throughout the experts' discussion and the pre-scoping activities:

- Understanding current trends in global and regional climate indices, and in particular the large anomalies recently observed, in the light of past trends from instrumental observations and paleoclimate proxies, the underpinning physical processes, and how well those are simulated by new climate model generations;
- Describing a new spectrum of plausible futures, taking knowledge and policy developments since AR6 into account (e.g., emission scenarios assessed in AR6 started in 2015, and an update starting in 2025 is necessary), and considering the importance of Earth system feedback and potential abrupt changes;
- Assessing how physical climate science can contribute to inform near-term responses through climate services and a comprehensive assessment of climate conditions under stabilization and overshoot scenarios.

In addition, as an outcome of the pre-scoping activities, it was clear that a few further considerations needed to be carefully addressed:

- the increasing need of regional climate information with high granularity;
- the recurrence of key topics that were brought up systematically, such as tipping points, exceeding 1.5°C, overshoot scenarios;
- the diversity of knowledge sources, their limitations, fitness for purpose and availability, and inequitable access to climate information.

7.2 The draft outline

Summary for Policymakers
Technical Summary
Chapter 1: Framing, methods and knowledge sources
Chapter 2: Large-scale changes in the climate system and their causes
Chapter 3: Changes in regional climate and extremes, and their causes
Chapter 4: Advances in process understanding of Earth system changes
Chapter 5: Scenarios and future global temperatures
Chapter 6: Global projections of Earth System responses across timescales
Chapter 7: Projections of regional climate and extremes
Chapter 8: Abrupt changes, tipping points and high impact events in the Earth system
Chapter 9: Earth system responses under pathways towards temperature stabilization, including overshoot pathways
Chapter 10: Climate information and services

Annexes
Cross Working Group Glossary
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The outline overall structure follows a narrative that develops first the current status of climate and trends and their explanation, then the possible futures, their uncertainty and dependence on assumptions about the main forcers, and finally the WGI contribution to responses, in the form of "climate information for responses". This narrative is similar to that of the AR6 WGI Summary for Policy Makers, which had four sections, addressing the information relevant for adaptation and for mitigation separately. It is also close to that of the AR6 Synthesis Report, and follows the prospective narrative discussed in the AR7 vision document for the AR7 Synthesis Report.

After an introduction chapter, Chapter 1, that outlines the overall framing and concepts of the report, and provides space to assess sources of information, the outline includes 9 Chapters grouped into 3 main sections:

Current status and trends: Chapters 2 to 4 develop the current status and trends in the Earth system, their attribution to human-induced climate change or to other causes (Chapters 2 and 3), as well as the advances in the process understanding (Chapter 4) that underpin changes. These chapters explain the developments observed in global Earth system indices and associated planetary-scale patterns (Chapter 2), and detail regional trends in means, extremes and other climatic impact drivers (extending to local scale where pertinent) in a region-by-region approach, for land and the Ocean (Chapter 3). These chapters assess not only observations, including from Indigenous Peoples' knowledge and local knowledge, but also the capacity of models to simulate trends and associated processes. This includes new generations of models (e.g., models resolving kilometric scales) and methods enhanced by machine learning and artificial intelligence.

Futures: Chapters 5 to 8 provide an assessment of the possible future conditions of the Earth system based on various emission and land use scenarios, and potential high-impact or abrupt changes that could occur. In Chapter 5, climate projections are examined in response to these scenarios focusing on global temperature, energy balance, and carbon budgets. Chapter 6 examines other global indices related to the Earth system components and planetary-scale changes. Chapter 7 focuses on regional and local changes for extremes, means and other climatic impact-drivers in each region, including for the Ocean (Chapter 7). Chapter 8 identifies and assesses potential abrupt changes, tipping points and high-impact events, their drivers, mechanisms and the associated uncertainties.

Climate information for responses: Chapters 9 and 10 develop assessments of relevant topics to inform climate risk assessments, mitigation and adaptation. Chapter 9 assesses the Earth system response to various pathways towards temperature stabilization, including overshoot pathways. It highlights the constraints associated with stabilization and overshoot pathways examining how Earth system feedbacks and potential biophysical limits could impact large-scale carbon dioxide removal. It also discusses the Earth system responses to solar radiation modification and explores potential unintended regional consequences. Chapter 10 provides an assessment of how climate information is used in climate services, and for other purposes, such as for climate education and literacy. It defines climatic impact-drivers necessary for adaptation for sectors and systems, and tackles the disparity in data availability, capacity and access to climate information.

The outline references an interactive Atlas that will be developed as an update to the AR6 interactive Atlas, adding more visual elements such as indices and charts, to illustrate the changes assessed in the Report, and particularly in Chapters 3 and 7.

Several additional key aspects of the outline should be mentioned:

The outline allows an in-depth coverage of regional climate information: It features a region-by-region assessment presented in two symmetrical Chapters (Chapters 3 and 7) each with distinct remits: Chapter 3 focuses on assessing past and current trends, while Chapter 7 examines future trends. This structure offers an opportunity for extensive collaboration among a large group of authors from diverse regions, facilitated by strong coordination and communication between the two chapter teams, ultimately enhancing the depth of the regional knowledge provided. This is completed with a chapter dedicated to the use of climate information for responses across various regions and sectors (Chapter 10).

The outline has the potential to highlight several emerging topics: Each chapter bears the potential of providing new findings in emerging topics. Chapters 2 and 3 can highlight the development of recent climate anomalies (e.g., global and regional outstanding extremes) and their relation to human activities, particularly in the light of recent paleoclimate findings. Chapter 4 can highlight the integration of basic processes at the interface of Earth system components such as the couplings between water and carbon cycles, ocean and cryosphere, land and atmosphere. Chapters 5 through 7 can highlight how the Earth system responds to new, updated emission-based scenarios, based on results from e.g., dedicated CMIP7 experiments, and advances in reduced complexity climate models and the use of emulators. Chapter 8 can assess the substantial body of new literature on abrupt changes, tipping points and high impact events. Chapters 9 and 10 also assess very dynamic areas of research related to stabilization and overshoot pathways, and climate services respectively.

The outline gives space to highlight important aspects of equity in climate science: Several chapters are expected to include assessments of disparities in data coverage, access to data and regional climate information availability. This innovative diagnostic assessment is key to improving equity in climate science in the long term.

The outline emphasizes the expansion of knowledge sources: Several chapters explicitly specify Indigenous Peoples' knowledge and local knowledge as important resources to be assessed, alongside traditional literature. Assessments are also expected to increasingly draw on regional or national climate assessments, as well a as other relevant grey literature sources.

The outline addresses several key topics that will require cross-WG coordination (see details in 7.4): For many relevant cross-WG issues such as scenarios, health and well-being, losses and damages, the WGI outline identifies specific chapters where coordination will be required. Authors will need to work together to ensure consistent and coherent treatment of these topics across the working groups. For instance, regarding scenarios, Chapter 5 of WGI should coordinate with relevant WGIII chapters to provide a holistic assessment. A list of cross-WG themes addressed during the scoping meeting is detailed in Section 7.4. Additionally, a joint WGI-WGII Interactive Atlas, building on the AR6 WGI Interactive Atlas, has been discussed, but the two Atlases are presented separately in the outlines. This requires further discussion with the authors on both content and the technical implementation level to ensure coordination.

7.3 Relation to AR6

The AR6 WGI Report provided climate information from three different perspectives: a global perspective, with an assessment of current status, current and future changes, a process-based assessment section and a section assessing regional climate changes. While the overall structure of AR7 WGI is different, the logic of AR6 remains, with different balances across perspectives. Global and regional assessments of the Earth system components are now placed in parallel chapters (2 and 3 for past and current trends, and 6 and 7 for projections), giving them similar weight and enabling the use of common frameworks (e.g., for projections assessment, observational constraints). Specifics of underpinning processes are briefly presented within those chapters, but developed in depth in a separate chapter (Chapter 4), allowing integration across processes. AR7 Chapter 10 broadens the scope of AR6 Chapter 12 by expanding the assessment to include additional sources of knowledge and an assessment of disparities. The response of global temperature and energy balance to future emission and land use scenarios is now explored specifically across a wider range of physically distinct futures in a single chapter (Chapter 5). In response to the high increase in available literature, and their relevance for managing risk, two topics that were assessed in various places the AR6, are also presented in dedicated chapters, enabling more integrated assessment and easier access: Earth system responses under pathways towards stabilization, including overshoot pathways (Chapter 9), and abrupt changes, tipping points and high impact events in the Earth system (Chapter 8).

7.4 Cross-Working group themes

Several themes that cut across different WGs were discussed during the scoping meeting to ensure consistency and coherence in the WG outlines. For several topics, further coordination and discussion will be needed by authors and Bureau Members throughout the writing process. The cross-Working Group discussions were focused on the question how specific cross-cutting material should be treated, and whether dedicated joint formats were needed, which would affect the outline at a structural level.

During the AR7 Scoping Meeting, two sessions (Day 2 morning and Day 3 mid-day) were dedicated to cross-Working Group Breakout Groups (xWG BOGs). The Day 2 xWG BOG themes were identified in advance of the scoping meeting by the Bureau, drawing on several inputs and sources. The inputs considered were:

- The survey sent to government focal points before P-60 in view of collecting ideas for Special Report topics;
- Discussions with the panel during P-60 and P-61 (including submitted proposals for special Reports);
- Pre-scoping activities, including surveys, webinars and discussions with scientific organizations, AR6 authors, experts nominated to the scoping meeting, and international organizations;
- Internal IPCC Bureau discussions and brainstorming;
- AR6 knowledge gaps;

Nine xWG BOGs were organized on Day 2, focusing on the following themes: equity and justice; finance; health and well-being; (information for) losses and damages; overshoot; risk assessment approaches and regionalisation; scenarios; sectors and systems; and solar radiation modification. Additional xWG topics were identified during the scoping meeting resulting in three additional BOGs, focusing on the following themes: biodiversity; tipping points and large-scale singular events; and societal development, including climate resilient development (CRD). In addition, there was a WGII-led BOG that discussed the Technical Guidelines for Impacts Assessment and Adaptation (TGIA), that was attended by several WGI experts.

At the conclusion of each xWG BOG, BOG co-facilitators reported back to a cross-Working Group Plenary on the suggested outcomes. The proposed content was communicated to all WGI scoping participants, who considered whether and how to incorporate it into the proposed WGI outline.

The xWG BOGs were organised jointly by the three WGs. However, only those with outcomes relevant to the WGI outline are presented below, including a description of where these methods and themes are located in the proposed WGI outline. All themes listed below are relevant to all three WG's assessments, albeit to varying degrees. Specifically, topics discussed during the cross-WG BOGs on (information for) losses and damages, and risk assessment approaches and regionalisation, strongly focused on the interface between WGI and WGII. Themes are listed in alphabetical order.

Biodiversity and Ecosystems:
The WGI outline contains both implicit and explicit references to biological processes and ecosystems throughout all chapters. The Report will assess most processes and projected changes for Earth system components including their ecosystems, particularly in Chapters 6 and 8. Chapters 5 and 9 address different aspects of Earth system feedbacks primarily related to land-based ecosystems and related carbon sinks under different global warming levels and emissions pathways. Annotations in Chapter 3 highlight biodiversity hotspots as a potential typology to be included in the assessment. Both Chapters 3 and 7 include assessments of land use and land cover changes as well as vegetation in the context of regional climate change. The assessment of biogeochemical cycles in Chapter 4) incorporates biological components. Chapter 10 addresses responses of regional climate and extremes to adaptation and mitigation approaches, specifically through changes in land use and land cover, with a focus on ecosystems-based approaches such as urban greening and forest restoration.

Equity and Justice:
The rationale for this theme was:

- AR6 and previous IPCC reports addressed equity and justice to varying degrees.
- AR6 WGII and WGIII highlight equity and justice as entry points to their SPM, but equity implications are only assessed in a few chapters and were mainly missing in the outlines.
- A discussion on the best way to treat equity and justice dimensions in AR7 is needed to ensure these topics are appropriately reflected in the outlines.

The topic is introduced across several dimensions in Chapter 1, and addressed in Chapters 3, 7 and 10 with the perspective of disparities in coverage and unequal access to data, climate information and climate services. This aspect is also embedded in the Report structure, with space provided for specific, region-by-region assessments of regional climate changes, including extremes, means and other climatic impact drivers. This aspect can be coordinated with other equity and justice dimensions in the WGII and WGIII Reports.

Health and well-being:
The rationale for this theme was:

- Climate change is impacting human health and well-being.
- Many mitigation options can have benefits for health and well-being.
- Assessment of health was scattered across the AR6 report.

Chapter 10 explicitly addresses health and well-being, evaluating i climatic impact-drivers and their changes to support impact and risk assessment, losses and damages, as well as adaptation and mitigation strategies various systems and sectors across regions. Public health and well-being are vital components of that assessment. In addition, Chapter 4 assesses processes linked to short-lived climate forcers and air quality, both of which have considerable implications or human health.

(Information for) losses and damages:

- The rationale for this theme was:
- Determination, attribution, and projection of and response to regional losses and damages due to climate change is spanning the domain of all WGs.
- Those fields are progressing rapidly.
- AR7 could provide a significant coordinated policy-relevant advance assessment of the available information for losses and damages.

The recommendations from the BOG predominantly focused on content for WGI and WGII.
For WGI, Chapter 10 will be the main anchor for information relevant for losses and damages, drawing from assessments in other chapters. This chapter assesses information on climatic impact-drivers and their changes to support evaluations related to losses and damages, for systems and sectors across regions. This includes in particular how climate information is used for the attribution and projection of climate-change driven disasters and related losses and damages. Additionally, it highlights challenges such as gaps, disparities, and inequities in the available climate data and indicators.

Overshoot:
The rationale for this theme was:

- All three WGs addressed overshoot in AR6 but, constrained by what was available in the literature, each took a different approach, including differences in the level and duration of overshoot. More literature has emerged since AR6.

- Given the highly interdisciplinary nature of this topic (Earth System response, impacts, irreversibility, technologies, finance), xWG coordination is needed.

In the final WGI outline, much of the content suggested by the xWG BOG is reflected in Chapter 9**.** The Chapter 9 outline highlights several aspects addressed during this BOG such as reversibility vs irreversibility, the risk of temperatures failing to return after exceeding a certain threshold, and the overall response of the Earth system under net-zero or net-negative emission scenarios, including the long-term implications. This chapter also addresses the constraints to stabilization and overshoot pathways through Earth system feedbacks, potential hysteresis effects, and the bio-geophysical limits for large-scale implementation of specific carbon dioxide removal (CDR) approaches.

Risk assessment approaches & Regionalization:
The rationale for this theme was:

- AR6 Reports from both WGI and WGII achieved considerable progress in the alignment of granularities and causal chains of information for risk assessment.
- However, there is a large potential for further coordination across WGs.
- Presentation of risk information in a common structure across WGs, and/or in an interactive Atlas requires xWG coordination.

In the final WGI outline, information related to risk approaches and regionalization is mainly contained in Chapters 3, 7 and 10, and the Interactive Atlas, with Chapter 1 providing an introduction to both relevant concepts, such as climate impact drivers, and the definitions of regions. Chapter 10, Climate information and services, is dedicated to the link with WGII and III for systems and sectors across regions. It defines the interface between WGI and WGII in the chain from climate drivers to impact, in particular for physical impacts. It includes a definition of a set of climatic impact-drivers, building on AR6 WGI (Chapter 12), and co-designed with WGII, relevant for sectors and systems in WGII and WGIII, e.g., for risks related to water resources, renewable energy, agriculture, health or infrastructure. Finally, a common WGI-WGII Interactive Atlas was discussed. As it currently stands, the Atlas contributions are separated in the outlines of WGI and II, and coordination will be needed for optimal implementation.

Scenarios:
The rationale for this theme was:

- In AR6, all three WGs assessed scenario-based information, though in different ways.
- Since AR6, many challenges and opportunities have been identified with respect to the IPCC scenario-assessment.
- A xWG discussion on the approach to scenarios in AR7, including how to ensure consistency and coherence, accounting for current and a wide range of plausible future trends, would enable a holistic assessment.

For WGI, most of the information and assessment relevant in a cross-WG context, including projections of global temperature levels across different time scales, emerging constraints through global Earth system feedbacks, Earth system and climate sensitivity metrics, effects of non-CO2 forcers, or carbon budgets, is located in Chapter 5, Scenarios and future global temperatures. In addition, Chapter 1 provides an introduction to the characteristics and uses of scenarios, while Chapters 6 and 7 assess global and regional climate futures based on a variety of scenarios. Chapter 9 highlights the specific conditions and constraints associated with stabilization and overshoot scenarios. While some important interfaces across WG domains in the scenario-space are based on community initiatives such as Scenario-MIP (WGI-WGIII) and ISI-MIP (WGI-II), one of

the AR7's innovations could be a more comprehensive approach to scenarios. This will require coordination among authors to ensure an accessible and consistent assessment across all working groups.

Solar Radiation Modification:
The rationale for this theme was:

- AR6 identified a range of challenges and knowledge gaps concerning SRM.
- Since AR6, scientific literature, public interest and investment in SRM have grown substantially.
- Assessing the global and regional consequences of a large-scale SRM deployment would need to consider biophysical, economic, political, institutional, ethical and equity dimensions, warranting a xWG discussion and approach.

The xWG BOG recommended specific topics to be addressed in specific WGs. The Chapter 9 outline includes a dedicated bullet on the global and regional Earth system responses to different global and regional solar radiation modification (SRM) methods, including in the context of non-stabilization pathways.

Tipping points and large-scale singular events:
The XWG BOG on tipping points and large-scale events convened WGI and WGII experts, and focused on definitions and concepts to delineate the scope of the specific event types. It concluded without making explicit recommendations to WGs. WGI Chapter 8 on *Abrupt changes, tipping points and high-impact events in the Earth system* will require coordination with WGII, as events may include either threshold behavior in ecosystems that are at the interface between WGI and WGII (e.g., tropical coral reefs), or may lead to cascading impacts that extend beyond the climate domain, including those represented in a bullet on case studies and storylines.

Technical guidelines for Impacts assessment and Adaptation:
Chapter 10 includes assessments of the usage of climate information and climate services, as well as the key sectoral climatic impact-drivers, which can be an essential input to the Technical Guidelines for Impacts and Adaptation.

8. Annotated Outline of the AR7 WGI Chapters

Summary for Policymakers
Pages[1]: 20

Technical Summary
Pages: 80

Chapter 1:
Framing, methods and knowledge sources
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Framing, narrative and context of the AR7
- Key findings and gaps in AR6 WGI

[1] Page count indications refer to plain text count, excluding figures and tables. These were added after the scoping meeting but agreed by Experts who have seen and agreed on the proposed annotated outline.

- Knowledge sources
- Assessment of knowledge sources
- Methodologies to integrate lines of evidence
- Emerging topics and tools

Pages: 80

Chapter 1 annotations

The purpose of Chapter 1 is to frame the Report. It should provide the context in which it is written, and introduce and assess common methodologies and sources of knowledge that are used throughout the Report. Chapter 1 should be coordinated with Chapter 1 of other WG Reports to ensure consistency in terminologies, in particular for cross-WG topics, but also for future timescales and regional definitions.

The first bullet should be used to frame the report, introducing the narrative and the framework ("current and past trends", "futures" and "information for responses"), and how a question-driven approach will be used to deliver essential findings to policy-makers. The bullet points outline the main questions guiding the Report and highlight important topics. It should introduce the necessary considerations for the reader to navigate the Report, including timescales, concepts and definitions used in other chapters. It outlines dimensions of integration across Working Groups, the TFI, and with the Special Report on Climate Change and Cities. Additionally, Chapter 1 should be used to contextualize the Report in relation to sustainable development and broader global trends, as well as relevant international frameworks, including the UN Agenda 2030 and its Sustainable Development Goals, the UNFCCC, and the Paris Agreement. It should highlight the position of the report, in terms of information relative to other reports, such as regional or national climate assessments.

The second bullet should briefly outline the overall key findings of AR6 WGI and Special Reports, and the main gaps in knowledge that require attention. It should highlight those for which significant advances have been made since AR6 and signpost where in the Report the detailed assessment can be found.

The third bullet should introduce key knowledge sources and types that are used throughout the Report, and how these were prepared by the scientific community (e.g., different observational data products, proxy series, coordinated modeling efforts such as CMIP). The sources typically include, but are not limited to, remote sensing and in-situ observations, paleoclimate proxies, historical information, models of varying complexity including emulators, reanalyses, Indigenous Peoples' knowledge and local knowledge, grey literature, non-English literature. This should also include information on scenario construction, noting that a more detailed description is to be provided and assessed in Chapter 5.

The fourth bullet should undertake an initial high-level assessment of knowledge sources, outline how these sources are combined to make an assessment, and introduce various common metrics used for assessing knowledge sources. The bullet should assess the fitness for purpose of those knowledge sources used across the Report. Model evaluation aspects need to be coordinated with the rest of the Report, in particular Chapters 2, 3, 4 and 5. Chapter 1 should stay at a relatively general level for model evaluation, with more specific and detailed model evaluation provided in other chapters, as needed.

The fifth bullet should introduce common methodologies used throughout the Report to integrate the multiple sources of knowledge to make an assessment. This includes dealing with model ensembles and observations together, proxy and other lines of evidence. It should outline how the confidence and likelihood assessment is arrived at using IPCC calibrated language.

The sixth bullet should introduce and highlight emerging topics and tools since AR6 that are used in the Report, such as (but not limited to) new analytical techniques, instruments, platforms for observations (including space-borne observations), new statistical techniques (e.g. attribution tools for future risk assessment), and new theoretical developments. It should also discuss various model types, including those that utilize Artificial Intelligence and especially Machine Learning, emulators, high-resolution convection-permitting, eddy resolving models, Earth system models capable of running emission-driven scenarios, as well as the concept of digital twins. The regional inequity in access to tools and information is an aspect that can also be included here, in close collaboration with Chapters 3, 7 and 10.

Chapter 2:
Large-scale changes in the climate system and their causes
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Natural and anthropogenic radiative forcing
- Indicators of climate change and related methodologies
- Observed changes across the Earth system and their long-term context
- Changes in modes of variability
- Assessment of model-simulated changes
- Attribution of changes

Pages: 80

Chapter 2 Annotations

The purpose of this chapter is to assess the observed and modeled global large-scale changes in climate to date, selected Earth system global indicators, and the attribution of observed changes to specific drivers, including human activities. The focus is on global, hemispheric, continental, and ocean basin scales. The chapter requires close collaboration with its regional counterpart, Chapter 3, to enable a coherent overall assessment, and to avoid gaps and overlaps.

The first bullet invites the assessment of changes in the main anthropogenic climate change drivers, emissions and concentrations of greenhouse gas (GHG) and short-lived climate forcers (SLCF), including dust and other natural aerosols and their precursors, along with anthropogenic pollutants and stratospheric ozone depleting substances. It should also assess radiative forcing changes induced by land use and land cover change. In addition, it should consider changes in natural radiative forcers - principally solar and volcanic forcings.

The second bullet should be used to examine various large-scale climate change indicators, and the methodologies used in their assessments across different contexts, including their use to provide updates to key numbers on a regular basis.

The third bullet should address observed trends across the Earth system components: atmosphere, ocean (including sea level changes), cryosphere, land, and biosphere, assessing their 'unusualness' in both long-term and paleo contexts. The focus is on large patterns observed at global,

hemispheric, continental, and ocean basin scales, and should include the assessment of the observation system capacity. In addition, this section may include a discussion of two key questions: Firstly, how can we robustly detect when 1.5°C mean human induced global temperature rise would be crossed (in coordination with Chapter 5). And secondly, is warming accelerating, and if so, what drives this acceleration.

The fourth bullet should be used to provide an overview of the changes in key modes of variability, also in the context of paleoclimate variability. It will require coordination with other chapters, in particular Chapter 6 to identify and assess a common set of modes of variability across the Report.

The fifth bullet should be used to specifically evaluate model-simulated past trends across the atmosphere, ocean, cryosphere, land, and biosphere, as well as changes in modes of variability, contrasting these with observed elements from the third and fourth bullets. This assessment should highlight both consistencies and discrepancies with observations, including a consideration of the pattern effect, and should incorporate a paleoclimate perspective.

The sixth bullet should focus on the attribution and causes of observed large-scale trends across the Earth system components and changes in modes of variability, particularly distinguishing between natural variability and anthropogenically-forced changes, with a paleoclimate perspective included. It covers attribution across climate components and variables, including changes in circulation.

Chapter 3:
Changes in regional climate and extremes, and their causes
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Regions and spatial scales of analysis, including land and oceanic regions and typological areas
- Disparities in regional information availability, accessibility and gaps, and integration of multiple information sources, including Indigenous Peoples' knowledge and local knowledge, and paleo archives
- Advances and limitations in the assessment of regional climate change and extremes including models and observations
- Emerging regional and local process understanding, including regional interconnections and long-range transport
- Rapid and slow emerging changes in regional and local climate, including changes in seasonality and extremes
- Attribution of regional changes, including extremes and compound events
- Indicators of regional climate change and related methodologies

Pages: 100

Chapter 3 Annotations

The purpose of Chapter 3 is to assess past and current trends and changes in regional climate across regions and their attribution to human influence or other drivers. Regional climate changes include changes in regional extremes such as heatwaves, extreme precipitation, droughts, and other climate extremes and compound events, including those addressed in chapter 11 of the IPCC AR6 WGI, as well as changes in means and in other climatic impact-drivers (see Chapter 10 below, and cf. Chapter 12 of the IPCC AR6 WGI). It includes a region-by-region analysis, and should be

structured to facilitate navigation and easy access to key quantitative information for policy makers. Supporting figures for this assessment can be included in the interactive Atlas. Chapter 3 should coordinate with Chapters 1, 2, 4 and 10 to avoid gaps and overlaps and Chapter 7 for the consistency of content and alignment of definitions and regional framework.

The first bullet should be used to describe the regional framework for the analysis, in coordination with Chapter 1, characterizing various regions, including oceanic and typological regions. The description should be consistent and closely aligned with the regional split of WGII. It could include region typologies, such as mountains, small Islands, polar regions, monsoon regions, forested areas, deserts, urban areas, and biodiversity hotspots. The region split should be sufficiently granular (at least as granular as in AR6 WGI) to allow a detailed assessment.

The second bullet should be used to provide an assessment of the sources and disparities in the availability of regional information, building on a more general introduction in Chapter 1. It should focus on the accessibility and gaps of a wide range of climatic impact-drivers relevant to regional policy-making, while also exploring methods for integrating multiple information sources to conduct assessments tailored to each region. The sources of information can have a wide spectrum and include national or regional reports, and Indigenous Peoples' knowledge and local knowledge, including products provided by local governmental and non-governmental institutions, and national reports in languages other than English.

The third bullet should highlight the advances and limitations in the tools for assessing regional climate change, including extremes. It covers progress made in downscaling methods and bias adjustment techniques, as well as the evaluation of regional and global models that describe regional changes and associated key processes such as land-atmosphere-ocean interactions. This assessment would be coordinated with Chapter 4, which focuses on evaluating how models represent Earth system processes, while Chapter 3 has a specific focus on individual regions.

The fourth bullet is intended to highlight emerging regional and local process understanding, including desertification and aridification processes, shrinking cryosphere, regional sea level rise, regional hydrology and carbon cycle, ocean-land interactions (e.g. shoreline position change), as examples. It also addresses teleconnections and long-range moisture and dust transport. The assessment is done in close coordination with Chapter 4, where processes are described in more depth at component level, while Chapter 3 highlights specific features region-by-region.

The fifth bullet invites a focus on both slow and rapid changes in climate regimes, seasonality, extremes, compound and cascading events, seasonality changes, coastal effects (e.g. groundwater salinization, flooding, shoreline change) and sea level changes, inland lake changes, etc. There should also be a focus on unprecedented extremes, record-shattering extremes, short-duration (sub-daily) extremes and weather hazards, such as flooding and wildfires.

The sixth bullet should introduce the attribution of regional changes, by region, to human activities and natural variability, including extremes and compound events, potentially including case studies. It should also describe and assess attribution methodologies used in the regional context.

The seventh bullet should be used to describe various indicators of regional climate change and related methodologies used at national or regional levels, along with an assessment of changes in these indicators (including essential climate variables and derived variables).

Chapter 4:
Advances in process understanding of Earth system changes
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Biogeochemical cycle processes and budgets, including changes in sinks and sources of greenhouse gases
- Short-lived climate forcers, air quality and climate interactions
- Earth system energy budget and fluxes, heat storage and redistribution
- Water cycle processes and budgets
- Cryosphere and ocean processes
- Atmospheric processes, including circulation and clouds
- Land-surface processes, including biosphere
- Earth system feedbacks on multiple time scales
- Model process evaluation, including paleoclimate constraints

Pages: 120

Chapter 4 Annotations

This chapter is devoted to recalling AR6 main results and assessing advances since AR6 on the principal processes governing the Earth System, which help explain observed past changes and inform future projections. It should include processes in the Earth system components and their interactions and nexuses, as well as climate feedbacks. This chapter should support all other chapters, and in particular Chapters 2 and 3. It will require strong inter-chapter coordination.

The first bullet should be used to assess advances in understanding, since AR6, of the biogeochemical cycles' processes and budgets, including carbon-climate feedbacks. It should also assess processes driving changes in GHG sinks and sources (including efficiency of sinks), and the consistency of land-use net emissions (modeled) with national GHG inventories (reported), coordinating with the assessment of the total and remaining carbon budget in Chapter 5. It should include biogeochemical process in the ocean, atmosphere, cryosphere, and land surface, including from a paleoclimate perspective. There should be a focus on policy relevant aspects such as ocean acidification and deoxygenation, land/ocean carbon fluxes, methane and nitrous oxide natural emissions, atmospheric chemistry, and the interaction between the biosphere and the atmosphere. The bullet should also include process model evaluation.

The second bullet should be used to introduce a focus on advances on understanding processes involving short-lived climate forcers, including ozone, hydrogen, methane and natural and anthropogenic aerosols (incl. biomass burning, dust), air quality in relation to health, chemistry-climate interactions, including with the water cycle (clouds, snow), and a dedicated evaluation of advances in modeling those processes.

The third bullet should introduce and assess the advances in the changes of the Earth's energy budget, the Earth heat inventory and the processes involved in the Earth's energy imbalance, including the albedo change effects. It should include a paleoclimate perspective, carbon-heat nexus and a model evaluation perspective.

The fourth bullet should be used to include advances in process understanding of the changes in the water cycle, including all its components (groundwater, soil moisture, precipitation, water

vapor...) and storage aspects, through the lens of uncertainties at global and regional levels including for monsoon regions. It should also cover land-atmosphere interactions, drought mechanisms and drought-floods interactions, as well as interaction with the energy budget and the carbon cycle. As for other processes, the ability of models to simulate the water cycle and its changes should be assessed.

The fifth bullet is dedicated to advances in understanding of processes driving cryosphere and ocean changes, including the sea level budget closure (possibly joint with the energy budget) and sea level rise acceleration. It should assess processes critical to changes in the extent, mass, and state of the cryosphere, glaciers and permafrost, including in high mountain areas, air-sea and ocean-cryosphere interaction processes, salinity changes, deoxygenation, evaporation, and circulation changes, including the Atlantic Meridional Ocean and Southern Ocean Circulation changes. As in other bullets, this bullet also includes a dedicated model process evaluation, while incorporating a paleoclimate perspective.

The sixth bullet should be used to include the advances in understanding of key processes driving changes in the atmosphere, including changes in circulation, weather patterns, monsoons, clouds and their interaction with atmospheric composition, and a model evaluation specific to these aspects. Considerations could also include cloud-aerosol feedbacks, precipitation changes and the role of dust, sea-salt and other natural SLCFs.

The seventh bullet should be used to include the recent advances in understanding of land-surface processes, land-climate interactions and land-atmosphere feedback, processes in areas of fast and widespread land-use change. It should include considerations of the biosphere (linking to WGII), including in particular the specific conditions in high-mountain areas. The bullet should also include an evaluation of models' ability to represent these land surface processes.

The eighth bullet should consider the various feedbacks and interactions between the Earth system components on multiple timescales, including paleoclimate perspectives. It should also include model process evaluation, and interaction between cycles identified in earlier bullets. The bullet should be focused on feedbacks and on all components, while Chapter 5 should assess related metrics, and climate sensitivity process aspects. Coordination between Chapter 4 and 5 will be required to ensure consistency and a clear handover.

The ninth bullet provides a catch all to ensure that the chapter considers the evaluation of any other identified critical aspects of models' large-scale processes not mentioned above, on multiple timescales, including the paleoclimate scale from proxies, and all other types of observations.

Chapter 5:
Scenarios and future global temperatures
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Description of scenarios (emissions, removals, and concentrations of GHGs and short-lived climate forcers; land cover and land use change)
- Use and evaluation of models and tools for the assessment of scenarios
- Global Earth system and climate sensitivity metrics and properties, relationship between carbon cycle, energy balance and global temperature
- Effects of non-CO_2 forcers on temperature across scales

- Global temperature projections on different time scales
- Crossing times for different global warming levels
- Total and remaining carbon budgets

Pages: 100

Chapter 5 Annotations

Chapter 5 focuses on characterizing the global temperature response to a broad range of physically distinct future emissions and land use scenarios, assessing links to the global energy balance and the carbon cycle, as well as biophysical limits to these scenarios. It evaluates and integrates multiple lines of evidence to inform potential global warming futures and remaining carbon budgets, also covering key metrics of climate sensitivity and other indicators (e.g. ECS, TCR, TRCE and various GWP metrics). It should be developed in close cooperation with WGIII, and coordinate with WGII and WGI chapters 4, 6 and 9.

The first bullet is dedicated to describing the scenarios used in the Report in terms of physical variables that drive climate models (emissions, removals, and concentrations of GHGs and short-lived climate forcers, including aerosols from natural and anthropogenic sources; land cover and land use change), covering a range of physically distinct storylines for possible futures, exploring for example short- and long-term forcing trade-offs, overshoots, land-based mitigation and regional forcing considerations. The description of scenarios should be coordinated with WGII and III as appropriate.

The second bullet would elaborate on the use and evaluation of models and tools for the assessment of global scenario response uncertainty. It should outline the opportunities and limitations of reduced complexity climate models, in global and regional Earth System Model emulators and other tools, as well as methods for their calibration using historical observations and assessed system understanding. Earth System Model experiments and their characteristics are also discussed. Model limitations should be considered across complexity levels, noting potentially missing processes (e.g., the effect of climate extremes on ecosystems), and methods for synthesizing observations and modeled responses (such as emergent constraints) should be detailed. The assessment would be done in coordination with Chapters 2 and 4 accordingly.

The third bullet should address the relationship between the carbon cycle, the global energy balance and global temperature. It also invites to assess best available evidence for Global Earth system response metrics and properties, such as the transient climate response to cumulative CO_2 emissions (TCRE), the transient climate response (TCR) and equilibrium climate sensitivity (ECS), coordinating also with Chapters 2 and 4. Methods for assessing zero emission commitments and climate reversibility under net negative emissions under a range of trajectories should also be considered, including the dynamical responses of managed and natural carbon sinks and relevance for net-zero targets.

The fourth bullet would detail the assessment of the effects of non-CO_2 forcers on future global temperature across different timescales, including from a) aerosols and other short-lived climate forcers, of both natural (including dust) and anthropogenic origin, b) from land cover and land use changes through impacts on albedo, evapotranspiration, roughness length, atmospheric chemistry and other modifications affecting atmospheric and climate processes, and c) from other non-CO_2 forcers. It should also address advances in different ways to calculate global warming potentials, assessing roles of short-lived climate forcers and land use change in global stabilisation.

The fifth bullet presents global temperature projections across various time scales, including the near-term, mid-term, long-term and beyond within the scenario-space, with timescales being coordinated across chapters 5 to 8 to enable a consistent assessment and synthesis. This bullet would provide syntheses of future global projection outputs, using calibrated emulators and process-based models where available, considering future forcing uncertainty and using a range of emissions scenarios from decadal to millennial timescales. Time evolution of global temperatures, radiative balance, atmospheric composition and sea level should be considered. In addition, assumptions underlying emissions scenarios (e.g. carbon dioxide removals, afforestation, agriculture, changes in population and infrastructure) would be assessed in the context of Earth system feedbacks and climate extremes/impacts on ecosystems, agriculture and society.

The sixth bullet should define the concept of global warming level and assess the crossing times for different global warming levels in scenarios available from the scientific literature. A more detailed assessment of overshoot scenarios, including their associated Earth System feedbacks and constraints, is provided in Chapter 9. Coordination may also be needed with Chapter 2 on the definition of crossing times.

The seventh bullet is intended to provide estimates of the total carbon budget, as well as the remaining carbon budget for achieving specific climate targets and discusses related uncertainties. Methodologies for deriving carbon budgets for temperature levels which have been reached or exceeded would also be assessed. This topic should be developed in close coordination with Chapter 4.

Chapter 6:
Global projections of Earth System responses across timescales
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Projected changes across the Earth system, its components and their ecosystems
- Forcing-dependent responses arising from GHGs, short-lived climate forcers, and land use and land cover change
- Projected changes in biogeochemical cycles, including vulnerability of carbon sinks and pools
- Projected changes in modes of variability
- Near-term information from multiple sources
- Uncertainties arising from forcings, models, internal variability, and process understanding

Pages: 100

Chapter 6 annotations

This chapter explores the projected changes across the Earth system, its components and their ecosystems for the near term and long term, at global and large scale, including effects on global modes of variability (at scales similar to those of Chapter 2), driven by greenhouse gases (GHGs), short-lived climate forcers, and land-use changes over various time scales. It uses the scenarios and global warming levels described in Chapter 5. It also aims to address uncertainties in model simulations arising from different sources. It does not address regional changes which are assessed in Chapter 7, or changes in global surface temperature that are the focus of Chapter 5, and aligns with Chapter 2 which assesses past global changes.

The first bullet should evaluate the projected changes in the atmosphere, including temperature, precipitation, clouds, atmospheric circulation, and atmospheric composition. It should also examine changes on land, such as temperature, soil moisture, vegetation, inland water, groundwater levels, and albedo. Consideration of the Ocean would include variable such as temperature, salinity, heat uptake, circulation, acidification and deoxygenation, and sea level changes including global mean sea level and different patterns. The cryosphere assessment would include ice sheets, glaciers, permafrost, snow cover, sea ice and freshwater ice. Where appropriate, the assessment reflects ecosystem changes related to these physical changes.

The second bullet introduces the assessment of forcing-dependent responses of the Earth system components and the commitment of the Earth system and its ecosystems. Forcing includes CO_2 and other long-lived greenhouse gases, aerosols and short-lived climate forcers, land use and land cover changes.

The third bullet should be used to evaluate the changes in the biogeochemical cycles and atmospheric chemistry, as well as the vulnerability and resilience of carbon sinks and pools due to human-driven climate change, such as due to the impacts of increasing droughts, forest disturbances and permafrost change. It would also discuss projected ecosystem changes in response to physical changes covered in the first bullet, including the robustness and the uncertainties of carbon sink projections in Earth System Model experiments.

The fourth bullet should be used to provide an overview of the projected changes in large-scale modes of variability, including teleconnections, in the coupled climate system, aligning with chapter 2 on a consistent set of modes of variability to assess.

The fifth bullet should focus on near-term time scale, with information coming from different types of simulations. This includes decadal and initialized predictions as well as uninitialized global projections.

The sixth bullet should encompass other uncertainties not explicitly mentioned in preceding bullets, including uncertainties arising from various forcings, including greenhouse gases, short-lived climate forcers, and land use and land cover change, models, internal variability and process understanding.

Chapter 7:
Projections of regional climate and extremes
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Regions and spatial and temporal scales of analysis, including land and oceanic regions and typological areas
- Projected regional and local changes in means, variability and seasonality including regional circulation
- Projected regional and local changes in extremes and compound events
- Natural and anthropogenic drivers of regional changes and their feedbacks
- Influence of regional interconnection processes and long-range transport on projected changes
- Assessment of cascading uncertainties

- Limitations of existing approaches and methodologies for regional climate assessment, including disparities of information availability and accessibility

Pages: 100

Chapter 7 annotations

Chapter 7 assesses the projected changes in regional climate and aligns with Chapter 3 which assesses past changes. It employs the same continental and typological regions, as well as climatic impact-drivers used in Chapter 3. The temporal scales should be the same as Chapters 5 and 6. It includes a region-by-region analysis, and should be structured to ensure easy navigation and quick access to essential data for policy makers. Figures supporting the assessment can be included in the Interactive Atlas.

The first bullet should introduce the regional, spatial, and temporal scales of the chapter's analysis, covering both land and oceanic regions as well as various typological areas, in alignment with Chapter 3. The temporal scales include near-term, long-term and very long-term commitments across different scenarios and global warming levels. Additionally, this bullet discusses the availability of new emulator and AI techniques, as well as kilometer-scale projections, that facilitate assessments from regional to local scales, including urban scales.

The second bullet should be used to assess projected regional and local changes in means, variability and seasonality across the Earth system components. This assessment encompasses changes in the atmosphere such as temperature, precipitation, clouds, circulation and composition and water cycle/resources. It addresses changes on land (e.g., temperature, soil moisture, vegetation and land use, inland water, groundwater, albedo, and shoreline position), in the ocean and regional seas (e.g., temperature, heat uptake, circulation, and acidification), in regional sea level and the cryosphere (e.g., ice sheets, glaciers, permafrost, snow, and sea ice).

The third bullet should be used to focus on regional and local changes in extremes and compound events, including changes in frequencies, magnitudes, and durations, and the possibility of record-shattering and severe cascading events. Extremes also cover the ocean regions (e.g. marine heatwaves, biogeochemical extremes, extreme sea levels), sub-daily extremes and urban area extremes, the latter in coordination with the upcoming Special Report on Climate Change and Cities.

The fourth bullet reflects the role of natural and anthropogenic drivers of regional changes, and relevant feedbacks. It addresses aerosols (natural, including volcanoes, wildfires or dust, and anthropogenic), land-atmosphere interactions and feedbacks, including the effects of land use and land cover change as climate forcers, the role of the cryosphere, stratospheric and tropospheric ozone changes, long-lived and short-lived climate forcers, and the impact of human interventions such as irrigation and dam operations.

The fifth bullet is dedicated to discussing how regional interconnection processes and long-range transport (natural aerosols, pollutants, nutrients, ...) influence projected regional climate change. This assessment should include transport of moisture and dust between regions, ocean-land interactions, teleconnections and modes of climate variability.

The sixth bullet should be used to assess cascading uncertainties, including the skill of models in representing regional phenomena, downscaling, and data scarcity and uncertainty in observations

for constraining projections, when applied to specific regions. This calls for careful coordination with Chapters 3 and 10.

The seventh bullet should further assess limitations of existing approaches and methodologies for regional climate assessment, including those related to model availability and quality, access to tools and data, and challenges in distilling regional climate information. It also addresses disparities of information availability and accessibility as an aspect of equity and justice. This assessment will be conducted on a region-by-region basis and will require careful coordination with Chapters 3 and 10.

Chapter 8:
Abrupt changes, tipping points and high impact events in the Earth system
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Framing: definitions, characterization, time and spatial scales, reversibility
- Abrupt changes, tipping points and high impact events and their drivers within the Earth system components and their ecosystems
- Evidence from and limitations of observations, models, paleoclimate and Indigenous Peoples' knowledge
- Regional to global climatic consequences relevant for impacts and risks, their magnitude, spatial extent, timing, reversibility, teleconnections, cascading and compounding effects
- Critical thresholds, including global warming levels, and early warning indicators
- Case studies and storylines

Pages: 80

Chapter 8: Annotations

The objective of this chapter is to assess Earth system events or mechanisms that could lead to large-scale consequences with high potential impacts, taking the form of abrupt changes, changes due to crossing tipping points or other high-impact events, which may have low or unknown likelihood. Instead of providing a predefined list of these events, the chapter begins by defining key concepts and frameworks. It then assesses the events' likelihood and processes involved, drawing from a wide range of information sources and building on chapters 5 and 6 for the likely range of changes. It also presents relevant case studies, and links to WGII, e.g. for ecosystem events that respond to climatic events.

The first bullet should outline the point of departure from previous assessment cycles, define key concepts and frameworks, and set the thematic structure of this chapter. Building on the AR6 Glossary, and in close coordinating with AR7 Glossary development, it should define key concepts like high impact events, tipping points, abruptness, and irreversibility, along with their associated spatial and temporal scales, provide examples, and differentiate them from other types of regional extremes assessed in Chapters 3 and 7.

The second bullet is dedicated to identifying the types of events covered throughout the Earth system components (land and ocean, including coasts, cryosphere and atmosphere), and its ecosystems and the major potential tipping elements, such as large forest systems, monsoon systems, coral reefs, ice sheets (non-exhaustive list). It would consider drivers of these events,

including external drivers (e.g. greenhouse gas forcing), mechanisms such as strong warming or extreme events, and interactions between events (e.g. one event triggering another). It should also explore the processes, feedbacks and dynamics that could lead to abrupt changes, distinguishing between natural variability and human-driven climate change.

The third bullet should be used to examine diverse evidence sources, their limitations, and the implications for understanding these types of events. It would include evidence from past and current events (observations, paleoclimate reconstructions), and from Indigenous Peoples' knowledge. This bullet would also evaluate different types of models, including conceptual and Earth system models, their capacity to simulate abrupt changes and feedbacks, and their challenges in simulating or coupling specific processes and interactions, like dynamic vegetation including fire or ice sheet feedback, impacting simulation accuracy.

The fourth bullet should explore the climatic consequences induced by abrupt changes, crossing of tipping points or high-impact events. It should take a risk perspective, looking at how the profile of climate hazards would change, considering cascading effects, regional perturbations and interconnections. It should also discuss changes in system states, their magnitude, timing and reversibility.

The fifth bullet introduces the assessment of thresholds for a range of event types, along with early warning indicators, fingerprints and signatures that provide insights into likelihood, potential impacts, and strategies for risk management and policy action. It should include the evaluation of probability of occurrence, timing, and scale of consequences for thresholds and risks, ensuring that likelihood is explicitly considered. By examining the consequences of exceeding thresholds, it can inform an assessment of mitigation and adaptation potentials by WGII and WGIII.

The sixth bullet invites case studies and storylines to illustrate risks and consequences for selected events types in case of occurrence. "What-if" scenarios should be explored to assess future potential impacts, even when likelihoods are uncertain, focusing on cascading consequences. Input from WGII perspectives is encouraged to ensure a comprehensive understanding of the impacts involved, and of breaching thresholds relevant for impacts (e.g., ecosystems).

Chapter 9:
Earth system responses under pathways towards temperature stabilization, including overshoot pathways
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Global and regional Earth system responses to global net-zero emissions, and long-term implications
- Pathway dependency of responses including irreversible aspects
- Bio-geophysical limits on carbon dioxide removal (CDR) methods
- Global and regional Earth system responses to different CDR methods and global net negative emissions
- Global and regional Earth system responses to different global and regional solar radiation modification (SRM) methods, including in the context of non-stabilization pathways

Pages: 80

Chapter 9 annotations

Chapter 9 assesses the Earth system response to various pathways towards temperature stabilization, including overshoot pathways. Its objective is to provide policy-relevant information on global and regional Earth system responses to global net-zero and net-negative emissions, including the long-term implications and path dependencies. It addresses constraints to stabilization and overshoot pathways through Earth system feedbacks and potential biophysical limits for large scale carbon dioxide removal, and assesses responses to solar radiation modification at global and regional level. Due to its cross-cutting character, Chapter 9 is expected to be developed in close cooperation with WGII and WGIII, and would build on and coordinate with WGI Chapters 4, 5 and 6 in particular.

The first bullet should address how the Earth system (land, ocean, atmosphere and cryosphere) responds to global net-zero emissions, including the water cycle, biogeochemical cycles and the biosphere. It should examine both changes in average conditions and in extremes. It should also assess the Earth system response to sustained net-negative emissions, for both fast and slow components, and for the carbon cycle.

The second bullet discusses how climate change at specific global warming levels depends on pathways taken. It should include considerations of hysteresis effects, and the reversible and irreversible aspects of overshoot pathways, including delayed responses of the Earth system across all domains, coordinating with chapter 6, and relationships to feedbacks and tipping points (covered in more detail in chapter 8).

The third bullet would address bio-geophysical limits for large-scale implementation of specific carbon dioxide removal (CDR) methods on ocean and land, such as afforestation and bioenergy with carbon capture and storage (BECCS). This would include potential limits on removal capacity from the effect of climate change on ecosystems through disturbances and the response of carbon sinks. The assessment would be developed in coordination with Chapter 4 and 5.

The fourth bullet is intended to discuss global and regional Earth system responses to the full range of different CDR methods, including marine and land-based CDR, in the context of global net-negative emissions, stabilizing and non-stabilizing pathways in coordination with WGIII. Global effects would include ecosystem dynamical responses to reducing CO_2 concentrations and ocean circulation hysteresis effects.

The fifth bullet should be used to assess the global and regional responses of the Earth system to various global or regional solar radiation modification (SRM) methods, based on multiple lines of evidence, including paleoclimate information, in the context of both stabilizating and non-stabilizing pathways. It addresses unintended consequences, including changes in extreme events, and potential risks of termination and teleconnection effects, as well as the failure to achieve net-zero emissions. Additionally, it may consider potential interactions between mitigation, CDR, and SRM.

Chapter 10:
Climate information and services
Executive Summary
Plain Language Summary
Frequently Asked Questions

- Usage of climate information from multiple lines of evidence and knowledge sources, including Indigenous Peoples' knowledge and local knowledge, for public awareness, impact and risk assessment, losses and damages, adaptation and mitigation
- Advances in climate services across timescales, including early warning systems
- Methodologies to develop climate information to support impact and risk assessment, losses and damages, adaptation and mitigation
- Information on climatic impact-drivers and their changes to support impact and risk assessment, losses and damages, adaptation and mitigation, for systems and sectors across regions
- Responses of regional climate and extremes to adaptation and mitigation strategies, including ecosystem-based approaches
- Gaps and disparities in available climate data, information and indicators for climate services, and their implications across spatial and temporal scales, across regions
- Climate information and services to reduce gaps and disparities in climate education and literacy, capacity, training and strengthen the science-policy interface
- Case studies and storylines for systems and sectors across regions

Pages: 80

Chapter 10 annotations

Chapter 10 should focus on the application of climate science for impact and risk assessment, losses and damages, adaptation and mitigation, including a discussion of disparities in available information, access and capacity. It is a handshake chapter with WGII and III, covering climate information and services across sectors and regions, particularly for the near term. Chapter 10 builds on the assessment in Chapters 3 and 7 and requires strong coordination to ensure consistency and avoid overlaps.

The first bullet considers the use of various types of climate information, and the sources of this knowledge (including Indigenous Peoples' knowledge, local knowledge, and evidence from paleoclimates). It discusses how uncertainties are evaluated and treated, and how information from various sources can be combined to increase confidence. This content will likely be referenced by the Technical Guidelines Assessing Climate Change Impacts and Adaptation (TGIA), and requires coordination with WGII, as well as with Chapters 1, 3 and 7.

The second bullet refers to the assessment of progress in climate services over various timescales and across regions. This includes early warning systems for extreme events, seasonal to decadal prediction, and the use of climate observations and projections to reduce disaster risk. Additionally, it should cover emerging areas such as climate services relevant to humanitarian needs in conflict situations, as well as those related to social safety nets and protection.

The third bullet refers to the assessment of the various methodologies for developing, integrating and tailoring climate information and services for impact and risk assessment, losses and damages, adaptation and mitigation. Examples of such methodologies include downscaling, bias correction, methods integrating simulation ensembles and observations, methods tailored to extremes, probabilistic approaches and machine learning methods. Critical inputs required for implementation, in particular observational data, should be addressed. It would again link to the TGIA and should be coordinated with WGII.

The fourth bullet should introduce and define the climatic impact-drivers for various systems and sectors across regions, to support impact assessment, risk evaluation and reduction, losses and damages, adaptation and mitigation (drawing from AR6 WGI Chapter 12). This includes, for instance, information to support energy transition, renewable energy development, water resource management, agriculture and food security, public health and well-being, ecosystem health, and disaster risk reduction. The assessment should build on Chapters 3 and 7, and should coordinate with WGII and WGIII for links to sectors and systems in particular.

The fifth bullet should include information on the regional climate response to adaptation and mitigation measures, e.g., through changes in land use and land cover. It would primarily address ecosystems-based approaches, such as urban greening, and forest restoration, and should also include indirect effects such as land-use change due to mining operations related to materials (e.g. rare earth) required for the energy transition.

The sixth bullet should be used to assess gaps, disparities, and inequities in available climate data and indicators, and access to climate services, as well as their impacts on the effectiveness of climate services, in coordination with Chapter 1. It describes how decision-making approaches can cope with such gaps.

The seventh bullet should introduce the assessment of the climate information and services used for capacity building, e.g. for climate education and literacy, training and strengthening the science-policy interface to reduce gaps and disparities across regions as identified in the previous bullet.

The eighth bullet should be used to present a collection of case studies and storylines using climate information across different sectors and systems in various regions. The selection of these cases is at the discretion of the authors, considering regional and sectoral balance, and data scarce regions in particular, to illustrate the assessment in bullet 6 above.

Annexes

Cross Working Group Glossary

Technical Annexes

Number and content of technical Annexes will be determined by the author team and Bureau during writing. They may contain elements that are relevant across Working Groups, and therefore be developed jointly with other WGs' or TFI authors.

WGI Interactive Atlas

WGI Interactive Atlas Annotations
The WGI Interactive Atlas should build upon the IPCC AR6 Interactive Atlas, https://interactive-atlas.ipcc.ch/, incorporating AR7 updates to the suite of existing projections, as well as new Climatic Impact Drivers, indices, and any other additional elements that may emerge from the AR7 WGI Report Chapters, and to the graphical setup. It should serve as a reference tool to synchronize across various chapters requiring regional and global references. Additionally, it will serve as an instrument for communicating graphical information and summarizing concepts and content.
It will also serve as a basis for and link to the WGII digital Atlas, and coordination with WGII is expected on technical implementation level foremost.

List of Acronyms

List of Contributors

List of Reviewers

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9. Timeline

A call for the nominations of experts to serve as Coordinating Lead Authors, Lead Authors and Review Editors will be issued in March 2025, immediately following the 62nd Session of the IPCC. Approval and acceptance of the Working Group I contribution to the IPCC Seventh Assessment Report (WGI AR7) is proposed to be planned for May 2028. In order to achieve this, the timetable for the WGI AR7 is as follows:

2025	
7 March-17 April	Call for Author nominations
30 June-2nd July	Decision on selection of Authors
27-31 October **or** 1-5 December *depending on location*	Joint First Lead Author Meeting
2026	
27 April - 1 May	Second Lead Author Meeting
10 August - 2 October	Expert Review of the First Order Draft
2-6 November	Third Lead Author Meeting
2027	
3 May - 25 June	Expert and Government Review of the Second Order Draft
26-30 July	Fourth Lead Author Meeting
20 December - 25 February	Final Government Distribution of the Final Draft and Final Government Review of the Summary for Policy Makers
2028	
1-5 May	Approval of the Summary for Policymakers and acceptance of the underlying Report

10. Annexes

Annex 1: Summary and analysis of the pre-scoping activities

To support the Co-Chairs and Bureau in preparing for the scoping meeting, WGI TSU used different formats and sources to collect input on expectations, priorities, concerns and structural questions concerning the WGI AR7. This Annex provides a brief overview about those activities and some of the key findings.

Pre-scoping science survey

The WGI TSU solicited input from the global WGI scientific community on key issues and priorities for AR7, and on Report structure and organization of work. The questions were developed based on initial discussions within the WGI Bureau in preparation for the AR7 scoping meeting, and responses collected via an online survey between late September and early October. The form was distributed to AR6 WGI authors, and scientific organisations and networks with international reach, as well as the AR6 Synthesis Report Core Writing Team to include cross-WG perspectives. While some personal information was collected to get an overview of the respondents' background, the survey results themselves were not linked to individuals or analysed differentiated by specific characteristics.

The survey was sent to ~ 420 individual experts, ~ 370 were AR6 WGI authors, REs and SYR CWT and ~ 115 representatives of WCRP leadership, CMIP and Future Earth (with some overlap between the groups), and to ~ 45 additional international science organisations.

The survey had a ~40% response rate, with 186 individual and one institutional response received over the course of 3 weeks. 70% of respondents were AR6 authors, and almost 70% identified as male. 110 were from Global North countries, and 66 from the Global South, with EU countries, UK and US dominating, but a diverse Global South representation.
Many substantive inputs and helpful suggestions were received, reflecting the high level of commitment and engagement of the WGI scientific community in the IPCC process.

On overall narrative and focus, all questions proposed by the WGI Bureau were judged as being very relevant, with those related to extreme events, recent observations, and tipping points receiving the highest support.
In open responses, the question how WGI can "communicate urgency and make people act" was prominent in many responses. In line with this, a large number of participants advocated for a focus on information relevant for policy issues, mitigation, adaptation, losses and damages, and the interfaces with WGII and III respectively.

There was also support for a stricter focus on physical science, and concerns whether science is mature enough for some of the questions posed, and calls to resist the urge to respond to all kinds of requests, and take both the relevance of the question and the readiness of science to address them into account.

Many highlighted the robust assessment of uncertainties and the evaluation of performance/ quality of different data, tools, and methods as a valuable WGI service to policy makers/ users. Another key priority that emerged from the answers was to systematically evaluate "how right we have been", e.g., concerning past projections, and assess whether we understand what is happening now in the climate system (e.g., high Ocean temperatures, unprecedented extremes...).

Most prominent content areas

- *Extreme events, compound and cascading risk and „tipping points“*
- *The water cycle and its interlinkages with other human interventions, water requirements for human needs/the transition, and Earth System Feedbacks*
- *(More) systematically assess the role of the Ocean, “Oceans’ perspective” of the climate system)*
- *Land-climate feedbacks and the role of sinks/biomass-based mitigation/NbS*
- *SLCF, and their link to mitigation, health, and relevant Earth System Feedbacks*

Key results on structure and process

- *Emphasis on shorter, more focused report, no encyclopedia /more of the same*
- *Integration with WGII/III has high priority, esp. Informing risk and regional climate information/Atlas*
- *Calls not to change everything and keep much of AR6 structure, but updating rather than rewriting: all structures have pro‘s and con‘s*
- *Plan ahead and devote resources to coordination, solicit input from community (e.g., synthesis papers, special issues) to help with volume of literature, provide tools to support authors*

Key issues highlighted in the space provided for “anything else you wish to communicate regarding the structure of the WGI contribution to the IPCC's 7th Assessment Report” included:
Emphasis on Regional and Local Context: Several responses highlight the need for greater emphasis on regional aspects of climate change, to enhance impact and accessibility, and link to WGII / Atlas

Keep to AR6 structure for efficiency: while views are mixed on AR6 structure (critique mainly on overlaps and lack of clarity in scope of chapters), several propose to build AR7 on AR6 to avoid lengthy discussions and efforts to establish a new structure:

- *Keeping the structure would enable short updates plus longer chapters for new areas*
- *Focus on what is new and addressing key gaps instead of re-ordering*

Focus on Key Societal Questions: Some advocate for key societal questions and policy needs as structuring principle, while others argue such an approach that would be more appropriate for WGII/III, and not applicable to systems and process chapters

Process and Structure

- *Similar levels of support for the various structures offered (by timeframe, by processes and systems, from global to regional, or by question)*
- *some support for a “near-term” section, including a focus on decadal predictions (WMO)*
- *Bringing together multiple lines of evidence is generally appreciated, as are in-person meetings*
- *Strong call for shorter reports*
- *Process and global chapters are more likely to be able to draw on third party assessments, and could be shorter; making space for regional and emerging/key topic assessments*

Content

- *include methodologies that allow regular updates by researchers (such as Forster et al. for indicators)*
- *drive dialogue around key variables (SLR, ocean warming, precipitation, floods etc.)*
- *comprehensive assessment of cost of inaction vs transition costs (xWG);*

- *links with Oceans and Biosphere;*
- *more inclusive yet strict/transparent vetting processes*

Prescoping Webinars with non-attending nominees

IPCC focal points and experts who were nominated for, but will not participate in, the December scoping meeting were invited to attend one of three pre-scoping webinars that the IPCC Bureau hosted on October 30th, 2024. A total of ~600 participants attended the webinars, including ~70 participants affiliated to WGI. Each webinar lasted 1.5 hours with the following format

Cross-Working Group Introduction
- *Welcome – IPCC Vice-Chair*
- *Overview of IPCC – Recorded Video Remarks by IPCC Chair Jim Skea*
- *Overview of Scoping Meeting Process – Working Group Co-Chairs*
- *Slido Poll – "Key Cross-Working Group Themes for AR7"*

Working Group-Specific Breakout Groups
- *Specialized Slido Polls – Working Group Co-Chairs*
- *Working Group-Specific Discussion and Q&A Session*

Cross-Working Group Conclusion
- *Highlights from Breakout Groups – Working Group Co-Chairs*
- *Opportunities to Continue to Engage with AR7 – Vice-Chair*
- *Invitation to an online survey on increasing inclusivity*

The three WGI-BOGs had comparatively lower attendance (23-27 external experts per session) than the other WGs, allowing slightly more time for interaction. The composition of the groups was broadly representative of the international WGI community, with a majority of male experts from Europe, North America, Australia, China and India. There was also a total of 10 participants from South- and Central America, but only two African experts joined the WGI BOG. Approximately two thirds of participants self-identified as senior scientists.

Questions asked during the WGI BOGs
- *What level of temperature rise would you still consider to be safe?*
- *To what extent has WGI been able to deliver policy-relevant information for decision-makers?*
- *Which scientific topic has been emerging and/or progressing most quickly since the publication of the last IPCC reports?*
- *In one sentence/three key words, what would be the main new message that could be delivered by WGI at the end of this cycle?*

In response to the "Icebreaker" questions "What level of temperature rise would you still consider to be safe?", a large **majority gave estimates between 0 and 1.5C**, with some pointing out that current levels of warming were already unsafe, or that "safe" levels depend on location. There were also ~10% of responses that considered up to 2C to be safe, and two votes each for 2.5 and 3 degrees.

Over 70% supported a shorter WGI contribution to AR7, while keeping it comprehensive, policy relevant and policy neutral. The group rated the WGI's past provision of policy-relevant information to decision-makers as generally positive, with less than 10% of votes below medium level.

The **most dynamic research areas since AR6** identified by the group fell mainly into the following categories: **Tipping Points**, especially AMOC; **extreme and compound events and their attribution**; **improved climate models**, including high-resolution (km scale), convection-permitting and AI-enabled modelling; and **advances supported by AI and machine learning** more generally, especially for regional climate information. Polar, cryosphere and marine research were also highlighted, as well as CDR and Solar Radiation Modification. Both the categories and the individual topics highlighted correspond well with responses from other surveys.

Key messages that might be delivered by WGI covered the broad categories of **urgency of action**, given the unfolding effects of climate change and a rapidly closing window of opportunity; **communicating reduced uncertainty**, including better constrained future scenarios and the ability to detect impacts of emissions reductions in the near term**; a focus on regional changes and risk**, and specific impacts, e.g., the water cycle or extreme events **rather than GMT changes**; the urgency to understand and respond to **increasing extreme events and potential climate tipping points**, including the roles of overshoot, early warning signals and complex feedbacks; and providing **robust information for decision making**, especially for mitigation and adaptation strategies, and elaborate on their consequences for climate (e.g., aerosol reduction).

The keywords provided fall into the categories of **Urgency and Action** (Act now! Time for action, Act now fast, efficiently; Danger, agency, action; don't ignore science, actionable information), **Uncertainty** (Don't ignore uncertainty, Earth System Unknowns, Clarity of historical trends, Reducing uncertainty), **Regional information** (Knowledge for local action, Action now regional, emerging regional changes), **Feedbacks, thresholds and Tipping Points** (Climate-carbon feedback, Tipping points, Irreversibility, Overshoot, unprecedented extremes, Crossing 1.5, risks), **Solutions** (Impact-based information, adaptation and mitigation, net-zero pathways, new scenarios, end fossil fuels, carbon budget, reducing emissions, actionable physical basis, adaptation starts now), **Justice and cooperation** (Ambition, equity, finance; responsibility; global action, international collaboration); **Science and Monitoring** (Real-time tracking, observations, relevance of climate services, early warning systems, climate sensitivity); and **Sustainability** (Livability, sustainability, resilience, sustainable solutions, One Earth).

Prescoping survey with scoping meeting participants

WGI TSU sent a brief survey to all confirmed scoping meeting participants with a WGI affiliation, a total of 68, not counting WGI Bureau members. Five questions were developed based on the feedback received hitherto and discussions within the Bureau. The objective was to get a first impression of experts' thinking on emerging vs. mature research areas, potential key messages, regional information, Report length, usability and workload, and on overall Report structure and organization in the light of delivering a policy-relevant report. A total of 62 responses were received, with many valuable insights and helpful suggestions.

On emerging and highly dynamic research areas that would warrant a more in-depth assessment in AR7, a wide range of suggestions was received, ordered below into clusters. The most prominent issue areas in terms of number of experts highlighting them were methodological advances in modeling and observations, including the role of AI/ML as enabling tools, regional information and relevant processes, tipping points, compound and unprecedented extreme events, overshoot scenarios, and Earth System and carbon cycle feedbacks.

On areas of research considered to be more mature, with a comprehensive assessment in the AR6 report, where new findings are likely to be more incremental in nature, responses were less clear and sometimes contradictory, indicating that the question may not have been as clear as

intended. Several respondents noted that many of the previous key messages were supported by very mature research, and pointed towards the concept of providing updates rather than broad re-assessments of the full body of new literature. It was also noted that it would be helpful to have a mechanism to formally link areas where there are now standardized annual assessments, such as the global carbon budget, or indicators of climate change, to the IPCC assessment. Some of the areas that featured most prominently in the list of mature topics were global mean indicators, incl. climate sensitivity, TCRE, the Earth energy and the global carbon budget, large scale (past) changes in the climate systems, records and projections of global climate change and most GHG concentration on century timescales, and human influence on the climate.

On options to address regional information, the concept of keeping the Report mostly focused on global and move most of the regional information into the Atlas received some support but also strong opposition. Specifically on the Atlas, respondents stressed the need to only include material that is assessed in the report, and that the Atlas should not have textual component.
The suggestion to integration regional information with global information within all chapters received the strongest support and almost no rejections. One suggestion was to systematically follow the same format for regional information, e.g., summary tables, that could be developed and included for each major topic addressed, or use visuals to outline regional consequences (as done in SROCC). Participants also supported having specific chapters / sections on regional information, while the option of organization by typological region or a focus on data-scarce regions lacking prior in-depth assessment was broadly supported yet also had a larger group being unsure.

On an overall organization of the Report that would enable a shorter, policy-relevant AR7, two-thirds of the group strongly supported the approach to “ensure that the outline provides for a short and focused assessment giving most space to areas that are emerging or rapidly progressing”, and 90% saw at least some benefit. Using a very concise writing style, e.g., with headline statements followed by a summary of key developments and references also received broad support, with ~51% stating full support and a total of 81% seeing at least some benefit. The group was more divided on approaches based on number of chapters.
Several proposals outlined how to build on AR6, providing updates where needed and reserving more space for topics that had not been assessed or where science is moving fast. Starting early on the Technical Summary and make it the glue that sticks chapters together and train authors from the start to write in assessment, not review style was also suggested. Some respondent cautioned against too much focus on new and emerging issues, highlighting the need for AR7 to be a comprehensive, standalone Report and re-stating the key basic findings. Limiting the time and energy to ensure consistency and address overlaps emerged as a common concern.

On the Report structure in terms of chapter organization and narrative, experts provided a wide range of views and many helpful and constructive (yet often mutually exclusive) suggestions. There was some convergence on:

- *the general importance of providing enough space for regional information, yet emphasizing the challenge to avoid redundancy with global/process information*
- *a stronger focus on changes in modes of variability and circulation which are important for regional projections and local manifestation of climate change*
- *giving more space to (directly) policy-relevant and highly dynamic research areas, building on some sort of “updating AR6” approach summarizing most relevant new findings for more mature and basic research areas, incl. global indicators, processes and projections*
- *preserving at least some of the AR6 structure to enable continuity and an “update” approach, guide the reader and benefit from coordination and delineation work done in AR6*
- *support for the AR6 SYR structure “Current Status and Trends, Long-Term Climate and*

Development Futures, Near-Term Responses in a Changing Climate", with some form of special focus on regional information

Conversations with external groups and networks

In addition to ongoing engagement with the wider climate science community, WGI TSU organized exchanges with international organisations outside the core climate space, including UNCCD, IPBES, UN Water and the IEA, as well as with representatives from international associations engaged on Insurance, Health, Environmental Issues, Food, Mountain regions and Oceans.

Conversations took place in different formats, mostly at working level (senior scientists, program managers, Secretariat staff), at the sidelines of community events, the UNFCCC Bonn Climate Conference (SB61), and dedicated online and in person meetings, and sometimes also involved WGI Bureau members and leadership-level representatives on the side of the partners. In addition, two virtual roundtables were held with reporters from international media outlets that cover IPCC and climate science, and a dedicated survey for Youth was undertaken. Conscious that reaching out to all interested audiences is not feasible, the TSU intentionally targeted international organization to ensure a global perspective, and made additional efforts to ensure increased diversity among interviewees.

Consultations with international organisations, networks and civil society

Questions posed during consultations varied according to audience, but generally covered the following three issue areas:

- *What are your expectations, questions and key concerns that should be addressed by the WGI AR7?*
- *Do you find the WGI interactive Atlas useful, and do you have suggestions for improvement?*
- *Do you have any recommendations for publications and/or further partners and networks WGI should take into account?*

As to be expected, not all partners were familiar with the WGI "domain" or IPCC's work mode and governance structure. While valuable feedback was received on the perception of IPCC's role and priorities and concerns across communities, the usability of the input received in terms of informing the scoping meeting was sometimes limited.

International organisations would generally welcome IPCC engagement on their respective issues (e.g., water, desertification, biodiversity) and expressed interest towards joint products such as policy briefs or fact sheets. It was recognized that this would be both helpful for integrating climate change into their primary issue areas, and raising awareness for important nexus areas. Higher level asks tended to focus more on mitigation and adaptation/impacts (local and regional), especially requests directed at WGIII to account for interlinkages with land, biodiversity, water, and energy in their mitigation pathways and policy assessment. Feedback received on engaging with Indigenous Peoples and integrating Indigenous Knowledge emphasized the role of intermediaries, establishing trusted long-lasting relationships, and mutually beneficial forms of engagement. Many highlighted the important role of physical climate science basis to better understand what is coming, especially with a view to unprecedented extreme events or crossing tipping points, to evaluate responses (e.g., in terms of renewable energy capacity, water / resource needs, resilience), and to inform risk analysis with robust future projections.

WGI-specific issues and priorities emerging from many conversations included:

- *The request for regionally specific, "realistic" future projections with high level of granularity*
- *Improving the WGI region definition and coarse model resolution that currently limit usability*

- *Concerns that prominent treatment of Solar Radiation Modification in the IPCC Report would establish SRM as a viable solution, despite high uncertainty and potential risks*
- *More focus on the near-term, both in terms of projections and evaluating recent past and current developments, to support decision-making, communication, and planning*
- *How climate change impacts will limit the potential of natural sinks to take up carbon, and feedbacks from such impacts (e.g., increased wildfires) on the carbon cycle and feasibility of future pathways, notably high "negative emissions" (nature-based CDR)*

Summary of Conversations with Climate Journalists

The conversation with global media representatives that cover climate science, IPCC and the science-policy interface proved to be very insightful and valuable. The rich input provided has been documented in a separate summary and can help to guide future communication and design questions beyond scoping.

Key messages that emerged from the roundtables most relevant for scoping included the following:

- *Basic climate science is still very much needed. Do not underestimate the anchor IPCC provides, and how critical it is to have an authoritative body. Repetition is not a bad thing. Don't step away just because the message has not changed for 40 years*
- *Focus on the near term, both the recent past and the coming decade! What do we know, what is coming? What can we attribute, what exactly is "human induced", how will regional differences play out?*
- *Evaluate and show where IPCC has been right. Highlight the advances of science over 30 years, re-confirm or refute the idea that everything is "faster than we thought, worse than we feared".*
- *Emphasize the authoritative voice of IPCC as institution, including on tipping points – what's coming? what do we know? And if tipping points happen, what will be the impacts?*

Below is a more detailed summary of key takeaways based on journalists' comments:
Climate change basics: There is still an acute need to communicate to as wide a public as possible the well-established conclusions of climate science, and the IPCC speaks with unrivaled authority on these topics. That said, there is a diminishing appetite for massive reports such as the IPCC's ARs – among editors fixated on what's new, and among a public shifting their attention from problem to solution, from bad news about the state of world to hopeful news about what we can do about it.

Feedbacks, tipping points and overshoot: There is growing public awareness of the threats posed by feedbacks (e.g., wildfires) and tipping points in the climate system (e.g., WAIS & GIS, Amazon savannafication), and the world is turning to the IPCC for authoritative assessments of how imminent those threats are. Ditto the realization that overshooting the Paris Agreement's temperatures goals will have consequences beyond a simply delay in reaching net zero.

New metrics & timelines: More effective communication on climate change science will require metrics beyond global mean temperature change and more focus on the present and near-term. What appear to most people as small increases over decades in global average surface temperature fail to convey the true scale of risk, and projections to 2100 or even mid-century feel distant and remote. The far more tangible impact of climate change on water cycles was seen as a potentially potent vector of communication, as was development of attribution for its capacity to make strong and quantified links between climate and extreme weather in near real-time.

IPCC track record: The IPCC could boost its own credibility and provide an even stronger scientific underpinning to its conclusion by evaluating its projections over 35 years against the observations it has catalogued. Do they line up? Even if such an exercise confirms the oft-heard observation of scientists that climate impacts are "faster than we thought" or "worse than we feared", the inherent conservatism embodied in the acronym ESLD ("erring on the side of least drama") at least means that no one can accuse the IPCC of exaggerating. It was suggested that a report or "scorecard" reviewing more than three decades of conclusions would be seen as highly newsworthy by the media.

The 'science-media interface': The IPCC should boost contact between its lead scientists and select journalists from key news media with a record of responsible and fair-minded reporting. This can happen through "early engagement" weeks and months ahead of the release of SRs and ARs; proactive visits by IPCC scientists to major newsrooms to speak with editors, reporters and data journalists; more timely access to IPCC authors after plenary approval but before a report's release. Encouraging IPCC authors to tell anecdotes and speak about their personal engagement with the science would help "humanize" the stories that journalists write, making them more compelling and memorable.

Low-hanging fruit: Over the course of these conversations, it became apparent that the IPCC has produced a wealth of resources of potentially high utility to the news media that even specialized climate and science journalists do not use are or not even aware of. Cataloguing, organizing, formatting and presenting these resources could be a cost-effective way to improve media coverage of the IPCC and climate science. Anticipating how news media can easy and quickly integrate IPCC products into their content management systems would also be a big help.

IPCC-media relations: Journalists with many years of experience were uniformly critical of the handling of media access around the release of IPCC reports, and suggested that relative minor changes could result in improved coverage and less stressful relations.

Youth Survey

Via an online survey, the WGI TSU asked gathered input from young people all over the world about their knowledge and feelings about climate change, as well as their familiarity with the IPCC.

The results portray youth as interested in climate issues but also as anxious about the way things might go down. Indeed, if 80% of the participants knew that the IPCC was the United Nations body for collecting and evaluating the science related to climate change, 79% of them would agree with the statement *"Thinking about climate change impacts me emotional/ makes me anxious".* They request dialog, answers and tools to light this obscure and uncertain future to come. Details are provided in this report, showing results of the survey as well as some recommendations, with a view to reaching out to youth.

One issue that stood out from the survey was the need to improve communication about the IPCC's role, work and available materials, since many asked for information that is actually currently available. To reach Youth as an audience, recommendations include investing more on social-media, on audio-visual media and on teaching materials, since these are main sources of information for young people. More intuitive visuals, notably on the IPCC website, and developing easy-to-understand documents were other priorities mentioned. Given capacity constraints within the IPCC Working Group TSU and Secretariat, cooperation with third parties to develop and promote such products could be a promising venue to explore. Lastly, translation was highlighted as a key factor enabling engagement, with Youth and beyond.

Annex 2: WGI process of selection of participants for the AR7 Scoping Meeting

Overview of the process

Introduction
The following participant selection process built on the selection processes of the AR6. The approach was intended to facilitate the selection of a robust and balanced participant list, ensure a consensus-based selection process, be efficient, and include clear traceability in decisions.

During a first stage (mid-June to end of July 2024), each WGI Bureau Member was asked to consider the nominations and provide a 'ranking' focusing on expertise also considering all criteria as stated in Appendix A of Principles Governing IPCC Work:

"In selecting scoping meeting participants, consideration should be given to the following criteria: scientific, technical and socio-economic expertise, including the range of views; geographical representation; a mixture of experts with and without previous experience in IPCC; gender balance; experts with a background from relevant stakeholder and user groups, including governments."

The selection process was completed almost exclusively through the use of Excel spreadsheets via email. Targeted calls/meetings of the WGI Bureau were also held.

During a second stage (August to mid-September 2024), the six WG Co-Chairs and the Chair met to refine the lists and identify gaps, facilitate consensus on any overlaps as well as on the cross-cutting participants proposed and included in the final selection to be circulated to the WGI, WGII and WGIII Bureau's.

The IPCC had allocated 120 Trust Fund trips for the AR7 Scoping Meeting which implied 240 participants altogether assuming equal numbers of experts from developed and developing countries. Each WG initially selected 60 experts (excluding Bureau members). 55 of the remaining slots were attributed to the Chair and would include all the Bureau members (34) and approx. 20 experts (with a particular emphasis on cross-cutting perspectives) to be selected to help progress SYR discussion. The last 5 slots were given to WGII, on top of their 60, in order to select additional experts to support the scoping of the Adaptation Guidelines document.

Each WG took the lead for the selection of experts for their respective scoping.

Full List of nominations across WGs
2210 applications were received from six regions.

WGI Full List of nominations
The three WG TSUs, under the guidance of the Co-Chairs, divided the nominations by Working Group based on the areas of expertise that were selected by the nominees.
1053 candidates selected at least one area of expertise out of the seven related to WGI and composed the WGI Full List.
Among these 1053 candidates:

- 126 countries over 6 regions were represented;
- 30% of the applicants were women;
- 60% of the applications came from developing countries or countries with economies in transition;
- The majority of the candidates came from the Academia/Research sector and 56% did not have any IPCC experience.

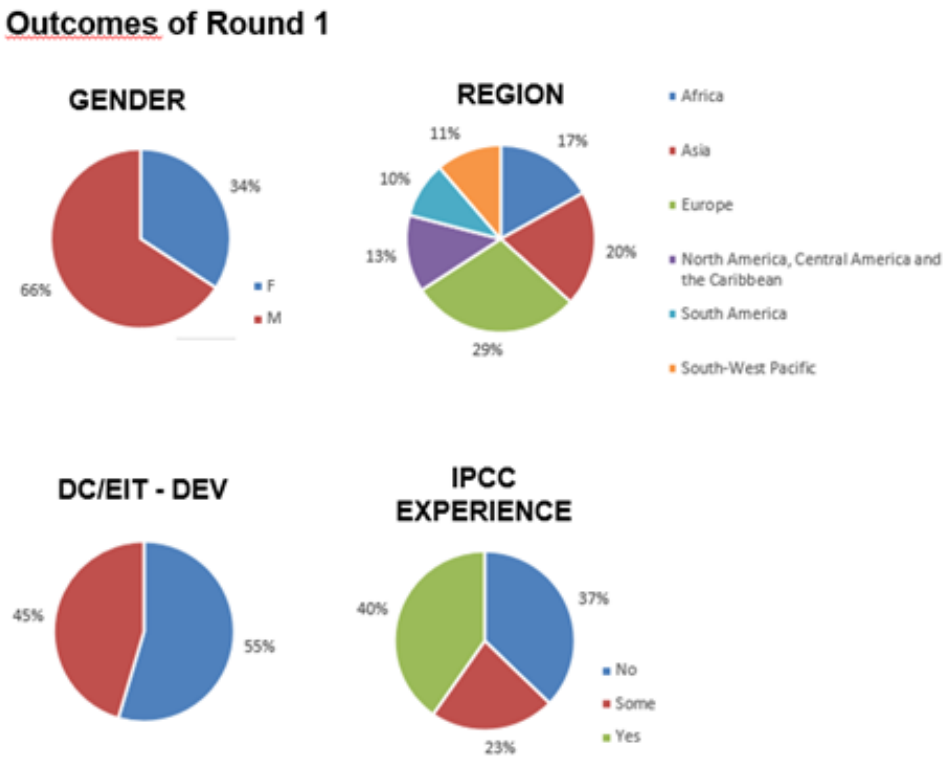
WGI detailed selection process

Stage 1 – Selection process for the 60 WGI participants (13 June-mid August)

Round 1 – From the WGI Full List to the WGI Preliminary List (mid-June-early July)
All WGI Bureau members received the WGI Full List of nominations (+ corresponding stats as a FYI) as an Excel spreadsheet that included all the experts who had selected WGI + cross cutting expertise. As some candidates had ticked expertise in more than one WG, the "weighting" of expertise per WG was indicated for each candidate of the list. Candidates who did not indicate expertise relating to any WG, but only cross-cutting areas were also be part of the WGI Full List.

Each Bureau member was requested to identify 10 high priority and 20 second priority experts considering their expertise but also all the criteria as stated in Appendix A of Principles Governing IPCC Work (see above). To facilitate and share the work during the first round, each Bureau member was assigned two or three WGI expertise so they could focus on the experts who had selected these expertises. All the expertises were covered by at least 3 Bureau members. For each selection, explanatory comments were requested.

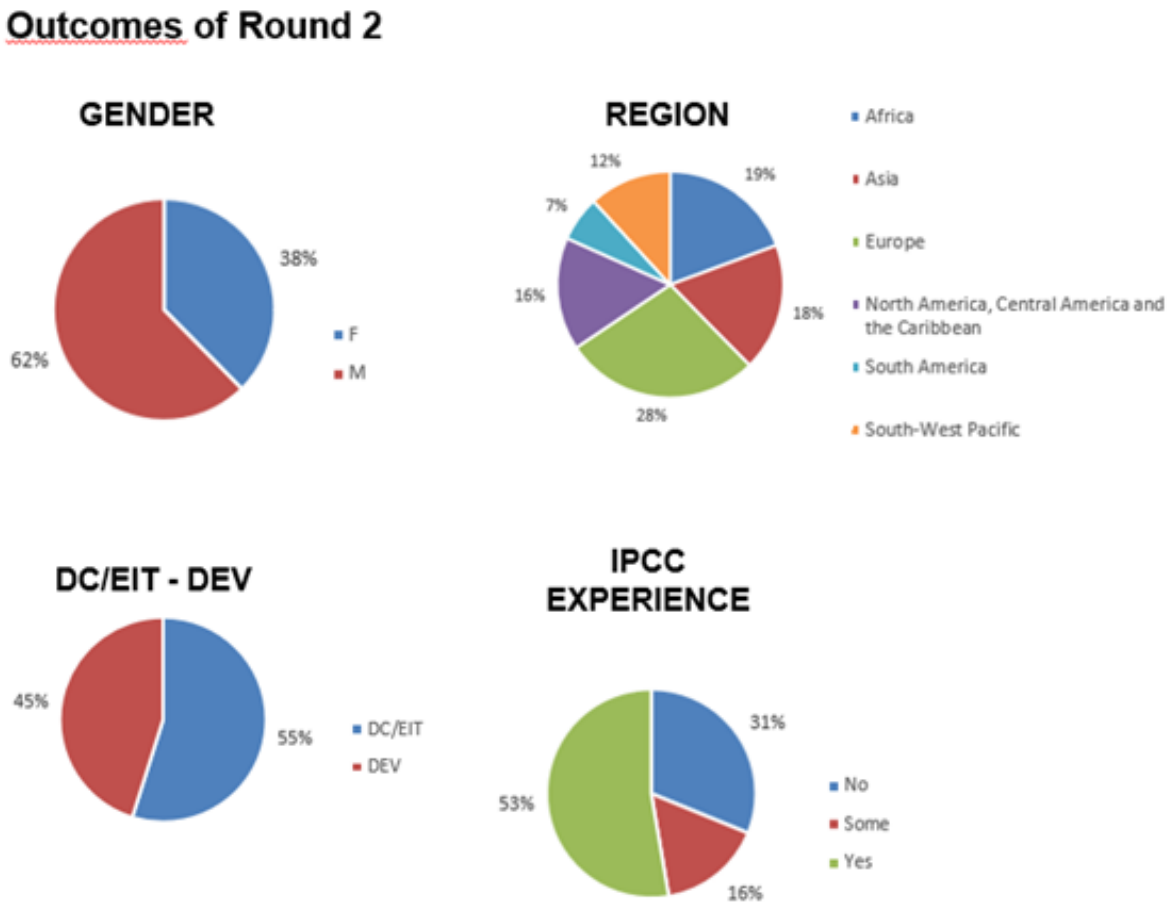
Early July, the TSU compiled the results of the first round of selections: all the candidates who had received at least one vote were highlighted as part of the Preliminary List (196 names). Basic stats were also prepared.



Round 2 – From the WGI Preliminary List to the WGI Revised Preliminary List (early to mid-July)
The objective of the second round was to shorten the list of experts and come out with a Revised Preliminary List that the WGI Co-Chairs would consider and refine mid-July; to ensure that all the WGI expertise were covered and to refine gender, region, sub-region and North-South balance.

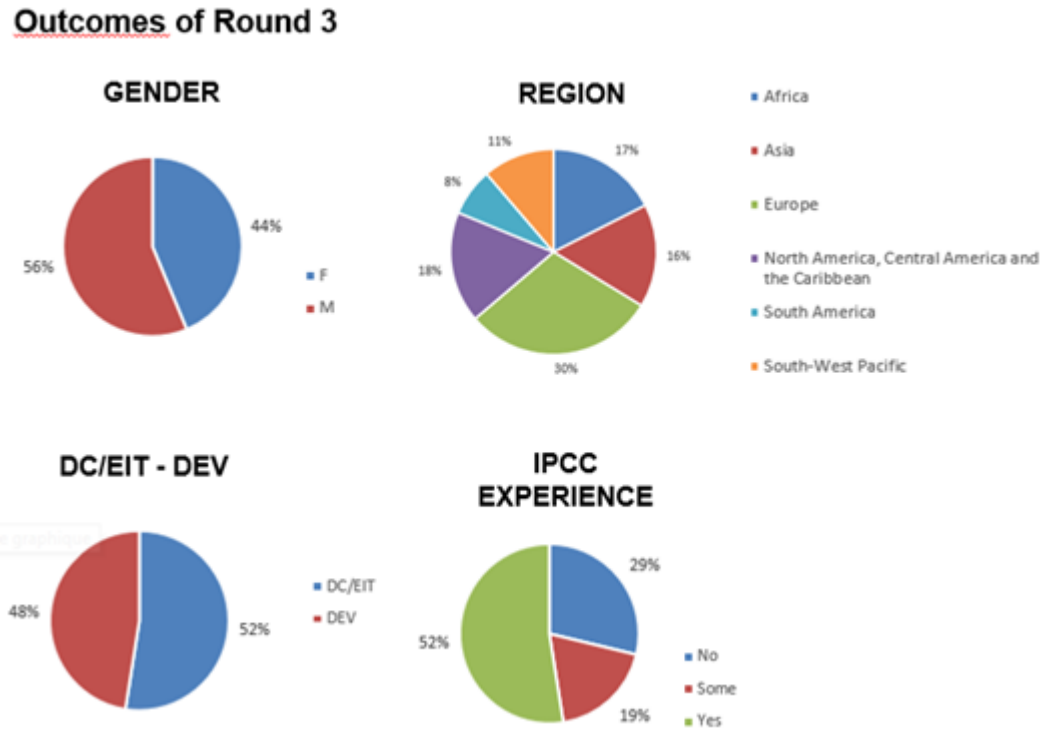
WGI Bureau Members were requested to select 15 priority names from the Preliminary List making sure that the selected names covered all the WGI expertise and that their selection was balanced in terms of gender, region, sub-region and north/South. The Full list remained available to pick from, especially to fill gaps of any were identified. WGI Bureau members were also requested to select two priority cross-cutting experts.

Upon reception of the selections, the TSU compiled them and set up a Revised Preliminary List including all the experts who had received at least one vote during round 2. Basic stats were also prepared.



Round 3 – From WGI Revised Preliminary List to WGI Core List

This round was dedicated to the refinement of the WGI Revised Preliminary List by the Co-Chairs who were in charge of identifying any gaps, overlaps, balance issues and replacements. They also considered the cross-cutting expertise. The objective was be to come out with a WGI Core List of 80 names.



The WGI Core List, the corresponding stats and the detailed explanatory elements were circulated among the WGI Bureau for review and comments. The main issues that were identified were the following:

- Expertise overlaps in SRM;
- Expertise gaps in paleo, regional emulators, emission scenarios, hail, convective storms;
- Sub region imbalances
- Under representation of women

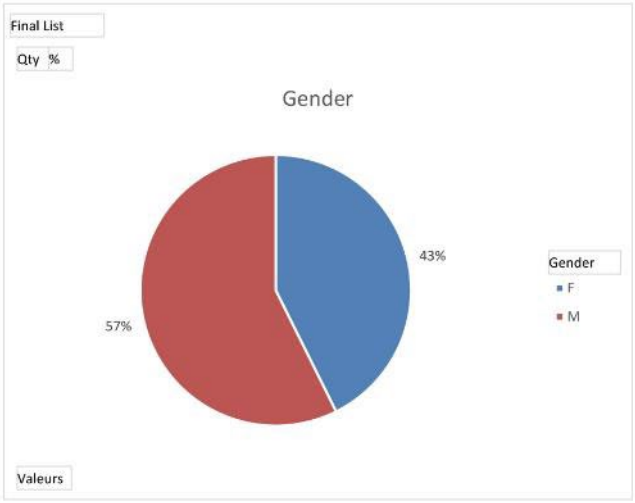
Round 4 – From WGI Core List to WGI Pre-Final List

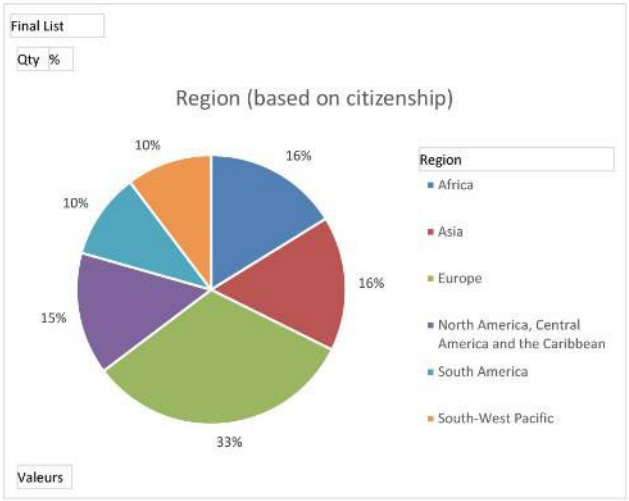
WGI Bureau members exchanged by email and met during P61 to solve the remaining issues and agree on a WGI Pre Final List of 60 names (+20 backup names) which was shared with the other Working Groups early August.

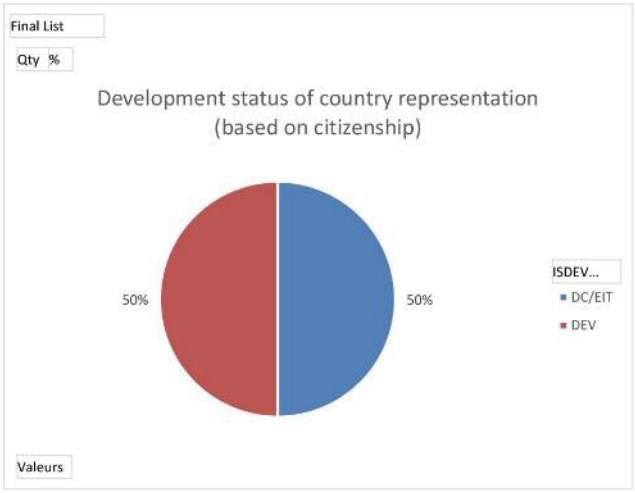
Stage 2 – Cross WG fine tuning and balance (early-August – mid-September)

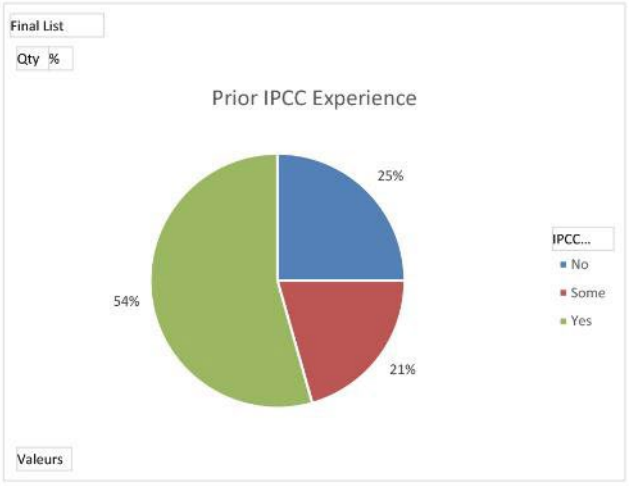
Between early-August and mid-September, WG Co Chairs and the Chair met to discuss gaps, overlaps, balance and potential replacements. They also agreed on cross cutting selections with the objective to come out with a Final List that was shared with all WG Bureau Members for information and feedback on 23rd August. Final adjustments were made early September and the invitations were sent out mid-September.

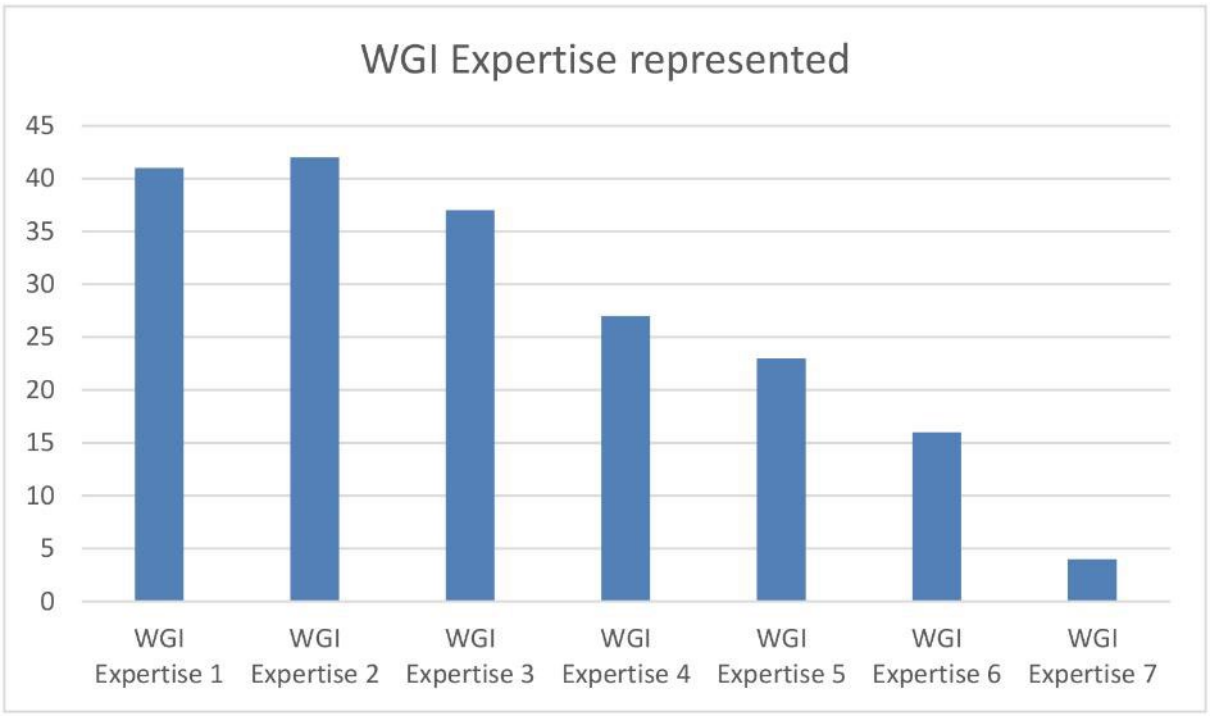
WGI Final List of selected Experts (68)











WGI Expertise 1:
Observation, monitoring of climate variables, reanalyses (ocean, atmosphere, cryosphere, land, freshwater, coasts), process understanding (water cycle, short-lived climate forcers and air quality, other climate system processes);
WGI Expertise 2:
Climate modeling (global, Earth System Models, regional, coupled, ocean, atmosphere, cryosphere, land, hydrology, chemistry and biogeochemistry) and model evaluation;
WGI Expertise 3:
Statistical climatology (trends, extremes, attribution, downscaling and bias correction, observation constraints, AI, ...), recent global and regional trends;
WGI Expertise 4:
Near-term and long-term ensemble projections, storylines, emulators, uncertainties, carbon budget;
WGI Expertise 5:
Climate services and decision-support tools (experience working with stakeholders);
WGI Expertise 6:
High-impact climate outcomes and abrupt changes including tipping points, compounding and cascading events;
WGI Expertise 7:
Physical aspects of renewable resources (Energy, Water, ...).

IPCC AR7 WORKING GROUP I REPORT

Scoping Meeting

9-13 December 2024 - Kuala Lumpur, Malaysia

Selected Experts and IPCC Bureau Members

Last Name	First Name	Gender	Citizenship	Country	Affiliation	Source of nomination(s)
ABRAM	Nerilie	F	Australia	Australia	Australian National University	Australia
AKHTAR	Farhan	M	United States of America	United States of America	U.S. Department of State	United States of America
ALDRIAN	Edvin	M	Indonesia	Indonesia	IPCC Bureau Member	
ARIAS GOMEZ	Paola Andrea	F	Colombia	Colombia	Universidad de Antioquia	Colombia
ARRIGHI	Julie	F	United States of America	United States of America	International Federation of Red Cross and Red Crescent Societies	International Federation of Red Cross and Red Crescent Societies (IFRC)
AYUGI	Brian Odhiambo	M	Kenya	Republic of Korea	SEOUL NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY	Kenya
BARIMALALA	Rondrotiana	F	Madagascar	Norway	Norwegian Research Center	Madagascar, World Climate Research Programme (WCRP)
BARREIRO	Marcelo	M	Uruguay	Uruguay	Instituto de Fisica, Facultad de Ciencias, Universidad de la Republica	Uruguay
BETHEL	Brandon	M	Bahamas	Bahamas	University of The Bahamas	Bahamas
BRACONNOT	Pascale	F	France	France	Laboratoire desciences du climat et de l'environnement-Institut Pierre Simon Laplace	France, World Climate Research Programme (WCRP)
CAMILLONI	Ines	F	Argentina	Argentina	IPCC Bureau Member	
CANADELL	Josep (Pep)	M	Australia	Australia	Commonwealth Scientiifc and Industrial Research Organization (CSIRO)	Australia
CEREZO MOTA	Ruth	F	Mexico	Mexico	Universidad Nacional Autónoma de México	Guatemala
CHHABRA	Abha	F	India	INDIA	INDIAN SPACE RESEARCH ORGANISATION	India
CROITORU	Adina-Eliza	F	Romania	ROMANIA	BABES-BOLYAI UNIVERSITY	Romania
CRUZ	Faye Abigail	F	Philippines	Philippines	Manila Observatory	Philippines
DERKSEN	Chris	M	Canada	Canada	Climate Research Division, Environment and Climate Change Canada	Canada
DIEDHIOU	Arona	M	Senegal	Cote d'Ivoire	IRD-UNIVERSTY FELIX HOUPHOUET BOIGNY	Senegal, Côte d'Ivoire
DIONGUE-NIANG	Aïda	F	Senegal	Senegal	IPCC Bureau Member	

Last Name	First Name	Gender	Citizenship	Country	Affiliation	Source of nomination(s)
DRIOUECH	Fatima	F	Morocco	Morocco	University Mohammed VI Polytechnique (UM6P)	Morocco, IPCC Bureau
DURAN QUESADA	Ana Maria	F	Costa Rica	Costa Rica	UNIVERSIDAD DE COSTA RICA (SCHOOL OF PHYSICS AND RESEARCH CENTER FOR ENVIRONMENTAL POLLUTION)	Costa Rica, Inter-American Institute for Global Change Research (IAI)
EDWARDS	Tamsin	F	United Kingdom (of Great Britain and Northern Ireland)	United Kingdom (of Great Britain and Northern Ireland)	King's College London	United Kingdom (of Great Britain and Northern Ireland)
ENGDAW	Mastawesha Misganaw	M	Ethiopia	Kenya	Postdoctoral Fellow	Kenya, CGIAR System Organization
FORSTER	Piers	M	United Kingdom (of Great Britain and Northern Ireland)	United Kingdom (of Great Britain and Northern Ireland)	University of Leeds	United Kingdom (of Great Britain and Northern Ireland)
FRIEDLINGSTEIN	Pierre	M	United Kingdom (of Great Britain and Northern Ireland)	United Kingdom (of Great Britain and Northern Ireland)	University of Exeter, Faculty of Environment, Science and Economy	United Kingdom (of Great Britain and Northern Ireland)
FRÖLICHER	Thomas	M	Switzerland	Switzerland	Climate and Environmental Physics, University of Bern	Switzerland
GRASSI	Giacomo	M	Italy	Italy	European Commission, Joint Research Centre	European Union (EU) - DG Research & Innovation
GUTIÉRREZ	José Manuel	M	Spain	Spain	Spanish Research Council (CSIC)	Spain
HALENKA	Tomas	M	Czech Republic	Czech Republic	Charles University, Dept. of Atmospheric Physics	Czech Republic
HARPER	Sherilee	F	Canada	Canada	IPCC Bureau Member	
HEGERL	Gabriele	F	United Kingdom (of Great Britain and Northern Ireland)	United Kingdom (of Great Britain and Northern Ireland)	School of GeoSciences, the University of Edinburgh	United Kingdom (of Great Britain and Northern Ireland), World Climate Research Programme (WCRP)
HIRABAYASHI	Yukiko	F	Japan	Japan	Shibaura Institute of Technology	Japan
HOPE	Pandora	F	Australia	Australia	Bureau of Meteorology	Australia
HUARD	David	M	Canada	Canada	Ouranos	Canada
JACQUES COPER	Martín	M	Chile	Chile	Universidad de Concepción	Chile, IPCC Bureau
KATTSOV	Vladimir	M	Russian Federation	Russian Federation	Voeikov Main Geophysical Observatory	Russian Federation
KOUADIO	Kouakou	M	Cote d'Ivoire	Cote d'Ivoire	Université Felix Houphouet-Boigny	Cote d'Ivoire
KUMI	Naomi	F	Ghana	Ghana	UNIVERSITY OF ENERGY AND NATURAL RESOURCES	Ghana
LAMBERT	Fabrice	M	Switzerland	Chile	Pontificia Universidad Catolica de Chile	Chile, IPCC Bureau
LAPOLA	David	M	Brazil	Brazil	Universidade Estadual de Campinas - UNICAMP	Brazil
LEE	June-Yi	F	Republic of Korea	Republic of Korea	Research Center for Climate Sciences, Pusan National University and Institute for Basic Science Center for Climate Physics	World Climate Research Programme (WCRP)
LU	Yixiong	M	China	China	Earth System Modeling and Prediction Centre, China Meteorological Administration	IPCC Bureau

Last Name	First Name	Gender	Citizenship	Country	Affiliation	Source of nomination(s)
MAHER	Nicola	F	Australia	Australia	Australian National University	Australia
MANZOU	Rebecca	F	ZIMBABWE	ZIMBABWE	ZIMBABWE METEOROLOGICAL SERVICES	Zimbabwe
MÅRD	Johanna	F	Sweden	Sweden	Uppsala University	Arctic Monitoring and Assessment Programme (AMAP) Secretariat
MARENGO ORSINI	Jose Antonio	M	Peru	Brazil	CEMADEN MCTI	Brazil
MISHRA	Vimal	M	India	India	Center for Sustainable Development and Earth Sciences, Indian Institute of Technology (IIT) Gandhinagar	India, CGIAR System Organization
MOEHNER	Annett	F	Germany	Germany	UNFCCC	United Nations Framework Convention on Climate Change (UNFCCC)
MUGUME	Seith Ncwanga	M	Uganda	Uganda	Makerere University, Department of Civil and Environmental Engineering, College of Engineering, Design, Art and Technology	Uganda, International Council of Science (ICSU)
NATALI	Susan	F	United States of America	United States of America	Woodwell Climate Research Center	United States of America, Climate Action Network International (CAN - 1)
NENES	Athanasios	M	United States of America	Switzerland	Ecole Polytechnique Federale de Lausanne, Switzerland	Switzerland
NURHATI	Intan	F	Indonesia	Indonesia	Research Center for Deep Sea. National Research and Innovation Agency (BRIN).	Indonesia
ODOULAMI	Romaric Christel	M	Benin	Benin	University of Cape Town, African Climate and Development Initiative	Benin
OSHIMA	Naga	M	Japan	Japan	Meteorological Research Institute, Japan Meteorological Agency	Japan
OTTO	Friederike	F	United Kingdom (of Great Britain and Northern Ireland)	United Kingdom (of Great Britain and Northern Ireland)	Imperial College London	Imperial College London
PINTO	Izidine	M	Mozambique	Netherlands	Royal Netherlands Meteorological Institute / University of Cape Town	Mozambique, World Climate Research Programme (WCRP)
PIRANI	Anna	F	Italy	Italy	Euro-Mediterranean Centre on Climate Change (CMCC Foundation)	Italy
RANASINGHE	Roshanka	M	Sri Lanka	Netherlands	IHE Delft Institute Water Education/Deltares	Netherlands
RARAI	Allan	M	Vanuatu	Fiji	University of the South Pacific	Vanuatu
RIBES	Aurélien	M	France	France	CNRM, Météo-France, CNRS	France
RIVERA	Juan Antonio	M	Argentina	Argentina	National Scientific and Technical Research Council of Argentina (CONICET)	Argentina
RUPAKHETI	Maheshwar	M	Nepal	Nepal	IPCC Bureau Member	
SANDERSON	Benjamin	M	United Kingdom (of Great Britain and Northern Ireland)	Norway	CICERO senter for klimaforskning	Norway
SÉFÉRIAN	Roland	M	France	France	CNRM (Université de Toulouse, Météo-France, CNRS)	France, World Climate Research Programme (WCRP)
SENEVIRATNE	Sonia	F	Switzerland	Switzerland	IPCC Bureau Member	

Last Name	First Name	Gender	Citizenship	Country	Affiliation	Source of nomination(s)
SHAW	Tiffany	F	Canada	United States of America	The University of Chicago	United States of America
SHRESTHA	Archana	F	Nepal	Nepal	Department of Hydrology and Meteorology	Nepal
SÖRENSSON	Anna Amelia	F	Argentina	Argentina	Centro de Investigación del Mar y la Atmósfera	Argentina
THORNE	Peter	M	Ireland	Ireland	Maynooth University	Global Climate Observing System (GCOS)
VAUTARD	Robert	M	France	France	IPCC Bureau Member	
VISIONI	Daniele	M	Italy	United States of America	Cornell University - Department of Earth and Atmospheric Sciences	World Climate Research Programme (WCRP)
VON SCHUCKMANN	Karina	F	Germany	France	Mercator Ocean international, France	France
ZHANG	Da	M	China	China	Tsinghua University	IPCC Bureau
ZHANG	Xiaoye	M	China	China	IPCC Bureau Member	
ZHILI	Wang	M	China	China	Chinese Academy of Meteorological Sciences	China, IPCC Bureau
ZHOU	Tianjun	M	China	China	Institute of Atmospheric Physics, Chinese Academy of Sciences	China

Annex 3: Agenda of the scoping meeting

AR7 SCOPING MEETING – Kuala Lumpur, Malaysia, 9-13 December 2024

WORKING GROUP I (WGI) AGENDA

- Sessions highlighted in orange are Plenary Sessions intended for all participants
- Sessions highlighted in green are breakout group sessions dedicated to all participants
- Sessions highlighted in blue are sessions dedicated to WGI participants. These sessions can be either plenaries or breakout groups (BOGs)

Day 1	Monday 9 December
09.00-09.30	Cross WG Plenary 1: Opening Remarks *Abdalah Mokssit, IPCC Secretary* Welcoming Remarks, Abdalah Mokssit, IPCC Secretary Introductory Remarks, Sir Jim Skea, Chair of IPCC Officiating Remarks, Dato' Dr. Ching Thoo Kim, Secretary General, Ministry of Natural Resources and Environmental Sustainability, Malaysia
09.30-10.30	Cross WG Plenary 1: Seventh Assessment Report Vision *Diana Ürge-Vorsatz & Ladislaus Chang'a, IPCC Vice-Chairs* Chair's Vision / Synthesis Report, Sir Jim Skea, IPCC Chair IPCC Code of Conduct, Sir Jim Skea, IPCC Chair Cross-Working Group Introduction, WG Co-Chairs
10.30-11.00	Coffee break
11.00-12.45	Cross WG Plenary 1: Working Group Introductions and Cross-Cutting Themes *Diana Ürge-Vorsatz & Ladislaus Chang'a, IPCC Vice-Chairs* Working Group I, Robert Vautard & Xiaoye Zhang, WGI Co-Chairs Working Group II, Bart van den Hurk & Winston Chow, WGII Co-Chairs Working Group III, Kate Calvin & Joy Jacqueline Pereira, WGIII Co-Chairs Cross-Cutting Themes, WG Co-Chairs Q&A Meeting Logistics, David Dokken, WGIII TSU
12.45-13.00	Group Photo
13.00-14.30	Lunch
14.30-16.30	WGI Plenary 1 Introduction *Robert Vautard and Xiaoye Zhang – WGI Co-Chairs* Ambitions for AR7 and WGI *Sherilee Harper and Maheshwar Rupakheti, WGI Vice Chairs* WGI Report Narrative *Aïda Diongue Niang and Sonia Seneviratne, WGI Vice Chairs*
16.30-17.00	Coffee break

17.00-18.30	**WGI Plenary 1 continued** WGI Report Narrative *Aïda Diongue Niang and Sonia Seneviratne, WGI Vice Chairs* Cross-Working Group topics *Ines Camilloni and Edvin Aldrian, WGI Vice Chairs*
18.30	**Welcome Reception**
19.30-21.00	**WGI Bureau Meeting 1** *Robert Vautard and Xiaoye Zhang, WGI Co-Chairs* Stocktake of Day 1 and decisions for Day 2
Day 2	Tuesday 10 December
09.00-10.30	**Cross WG Breakout Groups – Round 1** Cross WG BOG1.1: Equity and justice *Fatima Denton, WGII Vice-Chair and Eduardo Calvo, WGIII Vice-Chair* Cross WG BOG1.2: Finance *Carlos Mendez, WGII Vice-Chair and Gervais Itsoua Madzous, WGIII Vice-Chair* Cross WG BOG1.3: Health and well-being *Sherilee Harper, WGI Vice-Chair and Ramon Pichs Madruga, IPCC Vice-Chair* Cross WG BOG1.4: Losses and damages *Aïda Diongue Niang, WGI Vice-Chair and Adele Thomas, WGII Vice-Chair* Cross WG BOG1.5: Overshoot *Sonia Seneviratne, WGI Vice-Chair and Oliver Geden, WGIII Vice-Chair* Cross WG BOG1.6: Risk approaches and regionalization *Edvin Aldrian, WGI Vice-Chair and Zinta Zommers, WGII Vice-Chair* Cross WG BOG1.7: Scenarios *Mahehswar Rupakheti, WGI Vice-Chair, Raman Sukumar, WGII Vice-Chair, Jan Fuglestvedt, WGIII Vice-Chair* Cross WG BOG1.8: Sectors and systems *Laura Gallardo, WGII Vice-Chair and Siir Kilkis, WGIII Vice-Chair* Cross WG BOG1.9: Solar Radiation Modification *Ines Camilloni, WGI Vice-Chair and Malak AlNory, WGIII Vice-Chair*
10.30-11.00	**Coffee break**
11.00-12.00	**Cross WG Breakout Groups – Round 1 continued**
12.00-13.00	**Cross WG Plenary 2: Stocktake** *Diana Ürge-Vorsatz & Ramón Pichs-Madruga, IPCC Vice-Chairs* Report back from cross-WG breakout groups
13.00-14.30	**Lunch**

14.30-15.15	**WGI Plenary 2: From the science to the reader** *Sonia Seneviratne & Edvin Aldrian, WGI Vice-Chairs* Emerging, fast-growing topics Other topics meriting attention Survey results Discussion Presentation of the BOGs
15.15-16.30	**WGI Break Out Groups (BOGs) – Round 1** What broad WGI topics should the section cover? What x-WG topics is this section involving? What potential chapter titles? Links to other sections? Are there specific questions that should be answered in this section? How would you suggest to address the key structural concerns identified on day 1 (treatment of regional information, processes, and extremes) BOG1.1 - Stocktake Edvin Aldrian & Aïda Diongue Niang BOG1.2 - Futures Sonia Seneviratne & Maheswar Rupakheti BOG1.3 - Climate info for responses Sherilee Harper & Ines Camilloni
16.30-17.00	**Coffee break**
17.00-17.45	**WGI Break Out Groups – Round 1 continued**
17.45-18.30	**WGI Plenary 3: Stocktake Round 1 BOGs** *Ines Camilloni & Maheshwar Rupakheti, WGI Vice-Chairs* 5' report back from each BOG 15' Discussion
18.30-20.00	**High tea**
19.30-21.00	**WGI Bureau Meeting 2** *Robert Vautard & Xiaoye Zhang* Decision on the overall structuring of the Report
Day 3	Wednesday 11 December
9.00-10.30	**WGI Plenary 5** *Sherilee Harper & Aïda Diongue Niang, WGI Vice-Chairs* WGI Bureau outcomes Discussion in small groups of 8-9 people Objective: adjustments, agreement to the suggested strawdog Report back Discussion
10.30-11.00	**Coffee break**

11.00-12.00	**WGI Plenary 5 continued** Discussion continued
12.00-13.00	**Cross WG Breakout Groups – Round 2** xWG BOG2 Goals Identify where in AR7 the content should appear. Develop indicative chapter titles, bullets, etc. needed to reflect the structure and content determined in xWG BOG 1. Cross WG BOG2.1: Biodiversity *Edvin Aldrian, WGI Vice-Chair & Zinta Zommer, WGII Vice Chair* Cross WG BOG2.2: Finance *Carlos Mendez, WGII Vice-Chair and Gervais Itsoua Madzous, WGIII Vice-Chair* Cross WG BOG2.3: Health / Sectors & Systems *Sherilee Harper, WGI Vice-Chair, Siir Kilkis, WGIII Vice-Chair and Laura Gallardo, WGII Vice-Chair* Cross WG BOG2.4: Losses and damages *Aïda Diongue Niang, WGI Vice-Chair and Adele Thomas, WGII Vice-Chair* Cross WG BOG2.5: Overshoot *Sonia Seneviratne, WGI Vice-Chair and Oliver Geden, WGIII Vice-Chair* Cross WG BOG2.6: Societal Development/CRD *Fatima Denton, WGII Vice-Chair* Cross WG BOG2.7: Scenarios *Mahehswar Rupakheti, WGI Vice-Chair, Raman Sukumar, WGII Vice-Chair, Jan Fuglestvedt, WGIII Vice-Chair* Cross WG BOG2.8: Tipping points *Marc Howden, WGII Vice-Chair* Cross WG BOG2.9: Solar Radiation Modification *Ines Camilloni, WGI Vice-Chair and Malak AlNory, WGIII Vice-Chair*
13.00-14.30	**Lunch**
13.45-14.30	**WGI Bureau Meeting** Consideration of the Plenary 5 comments and preparation of a revised strawdog
14.30-15.30	**Cross WG Breakout Groups – Round 2 continued**
15.30-16.30	**Cross WG Plenary 3** *Ramon Pichs Madruga & Ladislaus Chang'a, IPCC Vice-Chairs* Report back from Cross Working Group Breakout Groups Round 2
16.30-17.00	**Coffee break**
17.00-18.30	**WGI Plenary 6** *Ines Camilloni & Maheshwar Rupakheti, WGI Vice-Chairs*

	Report back from Synthesis Report discussions Report back from Cross Working Group topics Presentation of the revised strawdog Discussion
18.30-20.00	**High Tea**
19.30-21.00	**WGI Bureau Meeting 3** *Robert Vautard & Xiaoye Zhang, WGI Co-Chairs* Decision on final chapter structure Distribution of the identified WGI & XWG content in the different chapters
Day 4	**Thursday 12 December**
9.00-9.15	**WGI Plenary 7** *Robert Vautard & Xiaoye Zhang, WGI Co-Chairs* Outcomes of Bureau Meeting 3 Presentation of BOG Round 2 objectives
9.15-10.30	**WGI Break Out Groups – Round 2** Refine Chapter titles Define bullet points BOG 2.1: Chapter 8 *Robert Vautard & Edvin Aldrian* BOG 2.2: Chapters 3, 7, 10 *Maheswar Rupakheti & Sherilee Harper* BOG 2.3: Chapters 5, 6, 9 *Sonia Seneviratne & Xiaoye Zhang* BOG 2.4: Chapters 1, 2, 4 *Aida Diongue Niang & Ines Camilloni*
10.30-11.00	**Coffee break**
11.00-12.00	**WGI Break Out Groups – Round 2 continued**
12.00-13.00	**WGI Plenary 7 continued** Stocktake
13.00-14.30	**Lunch**
14.30-16.00	**WGI Break Out Groups – Round 2 continued**
16.00-16.30	**Coffee break**
16.30-18.00	**WGI Plenary 8 continued** Approval of the outline line by line
18.00-18.30	**Cross Working Group Plenary 4** *Diana Ürge-Vorsatz & Ladislaus Chang'a, IPCC Vice-Chairs*

	Working Group status
18.30-19.30	**High Tea**
19.30-22.00	**WGI Plenary 8 continued** Approval of the outline line by line
Day 5	Friday 13 December
9.00-10.30	**WGI Plenary 8 continued** *Robert Vautard & Xiaoye Zhang, WGI Co-Chairs* Approval of the outline line by line
10.30-11.00	**Coffee break**
11.00-13.00	**WGI Plenary 8 continued** *Robert Vautard & Xiaoye Zhang, WGI Co-Chairs* Approval of the outline line by line
13.00-14.30	**Lunch**
14.30-16.30	**WGI Plenary 8 continued** *Robert Vautard & Xiaoye Zhang, WGI Co-Chairs* Approval of the outline line by line
16.30-17.00	**Coffee break**
17.00-19.00	**WGI Plenary 8 continued** *Robert Vautard & Xiaoye Zhang, WGI Co-Chairs* Approval of the outline line by line
19.00-19.30	**Cross Working Group Plenary 5** *Diana Ürge-Vorsatz & Ramon Pichs Madruga, IPCC Vice-Chairs* Sharing of agreed outlines Sharing of Synthesis Report outcomes
19.30	**End of the meeting**