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PROGRESS REPORTS

Working Group I contribution to the Sixth Assessment Report

(Prepared by the Co-Chairs of Working Group I)

(Submitted by the Secretary of the IPCC)

PROGRESS REPORTS

Working Group I contribution to the Sixth Assessment Report

This report describes the activities undertaken by the Working Group I (WGI) since the last update presented during the 52nd Session of the IPCC (IPCC-52) in February 2020. WGI Co-Chairs acknowledge the impressive dedication and commitment of WGI Coordinating Lead Authors, Lead Authors, Review Editors, Chapter Scientists, and the constant support from WGI bureau and WGI Technical Support Unit (TSU) over the past year. The adjustment to the timeline implemented in June 2020 was critical in the pandemic context. It has implied a longer period of work on the IPCC Sixth Assessment Report (AR6) WGI report for authors who also had further challenges in their family and professional contexts, in particular for those with teaching duties. The success of the Second Order Draft (SOD) review has been impressive and supports a rigorous, objective and exhaustive assessment. Many scientific manuscripts that are related to cutting edge research activities have been accepted for publication on time to be considered in the WGI assessment, thanks to the adjustment of the cut-off date for literature to be assessed until January 31, 2021. The whole WGI team has been able to shift to purely online work and is currently in the final run to deliver the Summary for Policy Makers and the underlying report for the Final Government Review starting on May 3. Summary for Policymakers (SPM) authors have adjusted their professional and family schedules to be available for the WGI session scheduled in the last week of July 2021.

1. Government and Expert Review of the Second Order Draft (SOD) of the WGI Report

The SOD drafts were released for the Government and Expert Review on 2 March 2020. Over 1500 invitations to review were sent out to invited Experts (WGII-III authors, Special Report (SR) authors, experts requested by the author teams) in order to maximise participation in the review and a comprehensive coverage of expertise. The start of the SOD review was also communicated widely via social media. Due to the COVID-19 pandemic and related measures implemented around the world, the WGI Bureau, in consultation with Coordinating Lead Authors (CLAs), decided to extend by 6 weeks the deadline for the submission of comments for the SOD. This was agreed at the 75th meeting of the IPCC Executive Committee (ExCom) on 30th March 2020, and the review portal remained accessible until Friday 5 June 2020, 23.59 (GMT+2).

1237 experts coming from 82 countries and 42 governments provided a total of 51387 comments (as a comparison, 31422 comments coming from 800 reviewers from 46 countries and 26 governments were received for the Fifth Assessment Report (AR5) WGI SOD). We note that the AR6 WGI SOD has received roughly 60% more review comments, from around 60% more reviewers, than the AR5 WGI SOD, despite the pandemic difficult context

2. Fourth Lead Author Meeting

Taking into consideration the international health situation, the results of various surveys released in March 2020 and the highly focused and intense nature of the final Lead Author Meeting not easily replaced by a virtual meeting, the WGI Bureau and TSU decided in mid-April 2020 to postpone the in-person Fourth Lead Author (LAM4) meeting scheduled for the first week of June in Santiago, Chile to early 2021 and to meet the urgent objectives of the meeting “virtually” over a 3-month period (01 June - 30 September), a period that was called 'pre-LAM activities'. Four weeks of virtual meetings were organized:

- 1-5 June
- 20-31 July
- 22-25 September

The aim was to respect the clearly expressed preference to hold a postponed in-person meeting, so not replacing LAM4 with the pre-LAM activities, and to spread the workload related to the report over a longer period to help support those who were dealing with additional responsibilities during this crisis. The design of the pre-LAM activities was so as to focus authors' work on chapter revisions, building on the SOD review, and to foster coordination across chapters, and also with WGII and WGIII on cross-cutting topics. Activities related to implications and other work on to the preparation of the Technical Summary and Summary for Policymakers are scheduled for October onwards.

The approach implemented was intended to be flexible, allowing for progress without over-burdening the coming months, instead complementing the work being done by chapter teams, and taking into account for the possibility of universities reopening in September and authors other duties. Ensuring inclusivity and participation was a priority as much as achieving the pre-LAM objectives. The building blocks of the meeting included:

- Plenaries, to plan and take stock
- Break out groups (BOGs) to address key coordination challenges for the report identified when drafting the SPM/TS (June meetings) and key cross-chapter issues identified in the SOD review comments (July meetings).
- Guidance and training sessions
- CLA-Bureau coordination meetings (CLAMs)
- Chapter meetings
- Virtual coffee breaks

The following organizing principles were adopted for all sessions:

- All live meetings would be a maximum of two hours and would focus on critical discussions and decisions.
- Supporting materials would be circulated in advance where possible (including presentations, documents and pre-recorded presentations as appropriate).
- All meetings would be recorded and made available allowing participants who could not attend the live sessions to look at the recordings. Meeting notes would be taken by the TSU during all the sessions and shared with participants.
- BOGs would be scheduled after identification of participants and selection of the best timing to maximise overall participation.
- Draft meeting notes would be made available during 24 hours allowing participants to comment before they were finalized.
- No one would be expected to attend a meeting between 00:00 and 06:00 local time.
- Chapter meetings would be self-organised by chapters when needed/preferred. The schedule would be added to the overall calendar and participants interested in attending a Chapter meeting would request CLAs for connection details
- Live meetings would be held either using GotoWebinar (Plenaries) or GotoMeeting. Zoom (which was identified as a non-inclusive tool as not accessible to about 10% of the participants) would only be used for training sessions necessitating break out rooms.
- All supporting material would be uploaded on the IPCC Document Management System (DMS)
- A News thread would be available on the DMS to inform participants real time and a daily Newsletter summarizing the daily activities and upcoming meetings would be sent

After the June and July stages of the pre-LAM, participants were invited to provide feedback through a survey. In addition, as this was the first time the WGI had run an event of this type and magnitude, participation to the June stage of the pre-LAM was monitored to investigate how well the sessions were attended.

An online calendar was implemented on the Document Management System for authors to see all scheduled activities, each with a dedicated event page with all related material (presentations, notes, recordings, other background material). A daily newsletter was distributed to pre-LAM participants during the peak activity weeks with all the latest information including meeting summaries that those

who could not attend in person could complement with their input. During other periods, the newsletter is distributed once a week.

The TSU also checked that all participants could join the virtual sessions and inquired on the quality of their internet connection through the consultation survey. It offered to refund extra IT expenses (related to additional data, additional 4G internet box, access to high speed internet etc.) that would occur for some participants to be able to attend the meetings.

Surveys were also conducted at the end of each week to check participants feedback and collect information on how to improve the process. At the second Plenary of the July pre-LAM sessions, all participants were invited to say how they were feeling with respect to workload, stress and their productivity. Although some participants stated they had a healthy level of stress that drives productivity, over 70% of the 94 responses felt fatigued or worse with the current working environment.

In December 2020, in view of the coronavirus pandemic and the impossibility of travel, the dates of the LAM4 were maintained but the format changed. The meeting was transformed into a virtual meeting.

Given that this meeting was held much later than usual in the process, the objectives were somewhat different from the usual LAM4s. Aspects related to the organisation of responses to the comments received following the SOD review and the coordination of cross-cutting topics were addressed during the "pre-LAM activities" held between June and September 2020. Time was devoted to discussions and work on discussing the outcomes of the internal review and the final steps towards the approval of the report, including through TSU and Bureau participation at chapter meetings.

A Write-Shop for the Technical Summary (TS) was held as part of the electronic Fourth Lead Author Meeting (eLAM4) for the TS drafting authors will be having sessions on figures, cross-TS section items, as well as section meetings. A meeting has been convened by the TSU and Bureau with the WGI Review Editors (REs) for a briefing on the preparation of the Final report by REs.

A webinar entitled on *The science policy interface - how the WGI assessment feeds the climate policy arena*, was organised with the participation of Laurence Tubiana and Saleemul Huq. The webinar was an opportunity to discuss with our invited speakers about their experience in the international policy arena, of how the WGI report can be expected to contribute and of their knowledge of different stakeholders. The wish has been to provide an inspiring outlook for when the report will be published.

Opening and closing plenary sessions were repeated twice to accommodate for the time zone differences and were designed to bring the full WGI author team together for a conversation and as an opportunity to discuss issues related to the final stages of the report preparation. The opening and closing plenaries were also an opportunity to reflect on the whole experience of WGI authors over the past 3 years, especially the switch to online meetings over the last year. Real time surveys during the closing plenaries, interventions and messages were collected. Participants indicated the additional time that was needed for decision making when working remotely. Many participants indicated the added value of developing a publication capturing the experience of finalising an international assessment report online with inclusive and participatory approaches. Co-Chairs proposed to set up a process to communicate reflexions and recommendations from AR6 WGI authors for consideration in the preparation of the Seventh Assessment Report (AR7).

3. SPM Write Shop

An in-person TS/SPM write shop was initially scheduled in November 2020. The WGI Bureau and CLAs consulted on the possibility of holding the in-person meeting that was scheduled to take place in Oslo, Norway on 4-6 November 2020 on the kind invitation of the Norwegian government.

The following aspects were considered:

- There are increasing infection rates in Europe and travel restrictions in place between many countries
- Participants could be asked to undertake a Covid test before departing, on arrival and on return
- Quarantines could be required for some participants
- We are not able to quantify the risk participants are exposing themselves to.
- Travel is advised only for essential activities. Given WGI experience in working remotely, including to prepare the first SPM/TS draft, this meeting is not deemed to be essential to take place in-person.

However, due to the continuing pandemic situation, WGI Co-Chairs decided to cancel the in-person SPM/TS write shop originally scheduled on 4-6 November 2020 and to hold it virtually.

4. Cross-cutting activities

Links to Working Group II (WGII) and Working Group III (WGIII) have been fostered by Bureau members and TSU. Cross-participation at the pre-LAM, WGIII eLAM and WGII pre-SOD activities has made considerable progress in coordinating cross-cutting aspects of the assessment. Bridge authors from WGII and WGIII are authors in various WGI cross-chapter boxes and participate in regular meetings on WGI assessment topics. A briefing on these activities was provided by Valérie Masson Delmotte to EXCOM at the 81st meeting on 1st July 2020.

Some highlights include:

- An informal discussion group with representatives of WGIII meets weekly to prepare a probabilistic set of climate response outcomes of various emissions scenarios that emulate and are constrained by the expert assessment from the WGI report for WGIII. This will support the WGIII assessment of the characteristics of mitigation scenarios in line with keeping warming to specific temperature levels and, to this end, to classify several hundreds of published scenarios based on their physical climate implications, mainly global-mean temperatures.
- An informal discussion group meets regularly with representatives of WGII, visual design and communications experts on the use of 'deep uncertainty' to characterise certain aspects of the assessment, focusing on communicating uncertainties in sea level projections.
- Bi-weekly calls take place on drafting the cross-chapter box 2.3 on updates in the assessment of global surface temperature since the AR5 including authors from WGII and WGIII. Given the cross-cutting implications of this assessment, a cross-WG webinar is being held on 16 September 2020, together with an internal review of the latest draft.
- Discussion started with WGIII authors and bureau members on the assessment and use of emission metrics in WGI and WGIII.
- Cross-cutting teams are developing an update to the Glossary definitions of carbon budgets and net zero / neutrality.
- A cross-WG guidance note on the risk framework has been finalized with authors and Bureau members from all three Working Groups (WGs).
- The cross-WG group on scenarios is contributing to the development of a cross-chapter box on linking scenario-based findings to the assessment based on global warming levels.
- A cross chapter box on Climate and air quality implications of the COVID-19 containment, new since the SOD, is being prepared with bridge authors from WGII and WGIII.

5. Internal Review of the AR6 WGI Final Government Draft (FGD) – 30 November-14 December 2020

In view of the extension of the drafting period of the Final Government Draft (FGD) since the SOD review, and in order to encourage the authors to read again the different chapters of the report in order to homogenize the content and ensure the coherence of the evaluation, in particular with regard

to cross-chapter coordination, WGI coordinated an internal review of the FGD from 30 November to 14 December 2020. All the texts were made available to the authors (WGI, invited authors from WGII and WGIII, and some external experts identified by the CLAs), members of the WGI Bureau and members of the WGII and WGIII Bureaux involved in the cross-chapter topics coordination. A total of 7218 comments from 151 reviewers were received and made available to WGI authors on 16 December.

6. Internal Review of the Technical Summary

As the Technical Summary only benefits from one official review during the AR6, WGI Bureau members wished to set up an informal internal review of this part of the report to ensure coherence.

The revised Technical Summary, as well as four Cross-Chapter boxes and one Annex were made available to the WGI authors and to about a hundred invited experts for a review which took place from 1st to 8th February 2021.

397 experts registered and 120 provided a total of 2672 comments that were made available to authors on 10 February 2021.

7. Task Group on Data Support for Climate Change Assessments (TG-Data)

WGI TSU representatives have participated actively in TG-Data activities including virtual meetings of the Executive group and Outreach and capacity development sub-group.

Outreach and capacity development sub-group

The TGICA¹ guidance material currently hosted on the Data Distribution Centre (DDC) website will be reviewed. WGI TSU will seek guidance from WGI Bureau members, in particular Greg Flato who has been identified by WGI Co-Chairs to represent them on TG-Data matters. The review will consider whether information is up to date and identify any gaps. New guidance material will include material that is being developed for the Interactive Atlas and on the implementation of FAIR data principles in the IPCC assessment.

WGI Bureau and TSU will prepare a proposal for outreach activities for 2021, including on the Interactive Atlas and on accessing data and code that underpins WGI visual and tabular information.

FAIR sub-group

An IPCC-wide FAIR² guidance document is being prepared by the FAIR sub-group, led by Anna Pirani.

The WGI TSU is developing a mechanisms to properly archive and disseminate final data. “Final data” are data directly underlying tables, maps or graphics included in the assessment reports. It is usually the result of an analysis drawing on one or multiple ancillary datasets. A workflow is being implemented by which data and metadata from authors is validated by the TSU, then handed over to the DDC to be assigned a Digital Object Identifier (DOI) and archived.

Peer review of code is part of the best practices for the development of open source code. The TSU and Atlas team are working on instructions and procedures for a pilot informal review of the code underpinning the Atlas (Atlas GitHub (2020), [doi:10.5281/zenodo.3691646](https://doi.org/10.5281/zenodo.3691646)).

The review will be undertaken via GitHub, it will seek input on style and format of the code as well as the substance of the analysis. Part of the objective of this review is to seek feedback not only on the code itself (Atlas code is written in R), but also on the instructions and guidelines to review chapter scripts. Reviewers will also provide feedback to improve the review process as a whole before we

¹ Task Group on Data and Scenario Support for Impact and Climate Analysis

² Findable, accessible, interoperable, reusable

consider how this approach could be extended to other chapters and increasing participation to data/climate scientists more broadly.

Data prioritisation sub-group

The WGI TSU is coordinating the archival of datasets for the WGI report, including plotted data and input datasets that are not currently curated. They are also assisting with the identification of CMIP6³ datasets used as input to the report and which will be archived. In addition, the TSU is leading on the archival of code used to generate figures. These efforts are being undertaken in close partnership with CEDA⁴ and DKRZ⁵, and WGI authors.

Role of Bureau

The role of Bureau in the oversight the work done by TG-Data would benefit from further clarification, both in terms of the participation of Bureau members in TG-Data and in endorsement of guidance material that is provided to authors and externally related to the assessment. The terms of reference to TG-Data are very clear that close liaison with the WG co-chairs or their representatives is needed. However, the Secretariat has removed Greg Flato, first as an ex-officio member, then as an "Other Expert Recommended by Working Group Co-Chairs". The terms of reference define a core set of ex officio members (DDC, relevant TSU staff) but this does not appear to be exclusive of other ex officio members or permanent invitees to join TG-Data meetings.

Given the importance of climate model intercomparison projects and climate model data for the WGI report, and the expertise and experience of Greg Flato and his role within CMIP/WGCM, it is crucial to ensure that the liaison with WGI co-chairs through the participation of Greg Flato to TG-Data can continue. Formal advice has been sought from the IPCC legal officer on this matter.

8. SPM Figures

The TSU entered the co-design work on the WGI SPM visuals in October 2020 with multiple meetings involving the SPM authors. These initial discussions on the general narrative of the SPM set up the main lines for the overall visual narrative – they were also a useful input for the SPM write shop in November. Further discussions allowed to refine the SPM figure teams and start the design work on the figures. As part of the design work, the TSU design team and the Author figure teams take a great care in:

- Designing simple figures communicating clearly one or two key findings each.
- Achieving a coherent visual narrative across the whole set of SPM figures
- Achieving a visual balance within the set of figures (i.e. avoid a visual redundancy in the graphical representation - maps, tables, line graphs, etc) but also between the text length and number of figures.
- Ensure that the SPM figures are supported by their respective TS counterpart.

In order to create figures that respond to the audience's needs, the TSU design team is directly engaging with the primary users (IPCC delegates) through in-depth conversations (interviews during IPCC-52, 1:1 calls in December 2020) and user testing surveys (March 2021). For the latter, the TSU design team is currently preparing the prototypes of the SPM figures on which the survey questions will be based. In parallel, the team will start developing an "outreach" version of each SPM figures.

9. Climate Outreach project

From November 2019, the WGI TSU has commissioned a project in collaboration with Climate Outreach to support IPCC authors in conducting public engagement and outreach. The first phase of this project delivered the Climate Outreach Communications Handbook for IPCC Authors in 2018 explaining six core communication principles based on social science literature.

³ Coupled Model Intercomparison Project Phase6

⁴ Centre for Environmental Data Analysis

⁵ Deutsches Klimarechenzentrum, Germany

The second phase of the project was finalized in October 2020 which focuses authors' experience in different regions engaging with different audiences and how the communication principles are implemented in regional contexts. A report has been prepared that includes recommendations. This is complemented with a website that is hosted by Climate Outreach and was launched with detailed case studies from authors around the world.

<https://climateoutreach.org/case-studies-from-ipcc-authors/>

A third phase is being scoped whereby the outcomes of this project will feed into the training that WGI authors receive on communicating with the media and for outreach activities. Tailored resources for authors will be developed for example worksheets on storytelling, how to prepare for an outreach event and videos on developing presentation skills.

10. Media Training

In order to prepare the communication around the report, a clear plan was drawn up in collaboration with the TSU Communications Officer, the IPCC Secretariat and Susan Escott, Communications Specialist.

Preparatory meetings were held in January and February 2021: nearly 60 authors benefited from a one-hour media training session with Sue Escott. The aim of these sessions was to provide participants with the knowledge and skills needed to develop interview plans for interviews with the media, particularly broadcast interviews. TSU and Sue Escott are debriefing on the authors' aptitude to potentially become effective spokespeople for the WGI report. These meetings were the beginning of a process that will continue with tailored training until the report is approved and are financially supported by the IPCC Secretariat.

11. Worlds Apart infographic

The infographic about the Cross-Chapter Box 8 1.5°C Warmer Worlds has been translated in the 5 UN language and a webpage has been setup to improve the user experience. This is a WGI product and will be launched as such in March 2021. <https://www.ipcc.ch/sr15/multimedia/worlds-apart/>

12. Launch of the WGI Blog

In order to communicate on its activities as well as on those carried out by WGI Bureau members and authors, WGI has developed a blog that will be updated on a very regular basis. This application has been developed on the open-source software Drupal and has been active since early February 2021. <https://wg1.ipcc.ch/>

13. Launch of the WGI Figure Manager

The WGI Figure Manager tool, developed internally, was launched early February 2021 and is now accessible to all WGI authors. The objective of this tool are:

- To centralize all relevant information about the figure – and keep track of what is missing
- To support the work around the traceability of figures, the production of the report and the transfer of the figures to AR6 WGI microsite.
- To be a central location where authors and TSU can communicate final needs/updates on specific figures
- To trace back the history of each figure – even the dropped ones
- To allow an “at a glance” view of the figures in each chapters
- To visualize the interconnections between Chapters, TS and SPM figures
- To upload figure files that will be needed for the production of the figure and for the post-editing