WORLD CLIMATE RESEARCH PROGRAMME

Session 2: Strategic Initiatives and Issues
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Session Outline

2.1 New and emerging science issues
2.2 New science - Task Team Updates
2.3 GCOS/WCRP collaborations
2.4 Future of Climate Modelling Workshop
2.5 Engagement with the IPCC climate science assessment processes

Duration: 35 mins
Chair: Helen Cleugh and Detlef Stammer
Rapporteur: Narelle van der Wel
Chat Moderator: Nico Caltabiano
2.1 New and emerging science issues

- IPCC AR6 published - illustrates the real challenge of staying below 2 degrees, let alone 1.5 degrees (seems not feasible).

- All scientific assessments seem to point to emissions continuing to grow (although not as fast as, e.g., RCP8.5). Particularly, post COVID seems to have bounced back to pre-COVID emissions.

- The world continues to see accelerating warming and associated impacts, such as weather and climate extremes.
• Increased concentrations of the major greenhouse gases are the primary cause for the temperature increase.

• Despite COP21 decisions, they continued to increase, despite short-term emission reductions in 2020 related to COVID-19.

Friedlingstein et al., 2020
State of Climate Forcing

Changes in Radiative Forcing 1900 – 2020, from baseline measurements at Cape Grim/Kannaook GAW Site in Southern Hemisphere

The increase of energy into the climate system of 3.3 Wm$^{-2}$, compared to 1750, is due to long-lived greenhouse gases.
The past six years have been the warmest years on record and temperature continue to rise.

Associated climate variations show strong regional pattern and variations.
Global sea levels are rising

- Trend in sea-level rise is accelerating.
- Ocean heat storage and acidification are increasing.
- Significant impacts on the ocean’s capacity to moderate climate change.

![Graph showing the rise in global mean sea level with data from ESA Climate Change Initiative (SL_cci), CEMES, and Near-real-time Jason-3. The average trend is 3.31 +/- 0.3 mm/yr.](image)

WCRP GC Sea Level

Year

Sea level (mm)

Increased greenhouse gas emissions from human activity are already causing climate change that is harming people and nature.

Further rapid reductions in emissions, adaptation to climate risks, and widespread adoption of new technologies and behaviors are needed to reach net-zero emissions and mitigate the worst climate impacts.
Climate Change and Risk

- Anthropogenic climate change – even 1.5°C warming brings many significant challenges and risks that affect almost all aspects of life on Earth:
  - Droughts, heavy rain and flooding, heatwaves, extreme fire weather, and coastal inundation.

- These are just some examples of what is already occurring and where amplified risks and impacts in the future will threaten millions of people around the world.
• Which pathway exactly the emissions, and thus temperature, will take is unknown. However, the detailed pathway matters.

• What will a 3 degree or 4 degree warmer world look like?

• WCRP needs to provide this information.
Climate Change and Risk

- Risks will evolve further under progressively greater warming, and the extent of these impacts depends on our success in meeting our emissions targets.

- Climate information is needed at a regional level to allow action at the scale required for adaptation, and understanding at the scale required to assess ecosystem and human impacts.
New science initiatives for WCRP

- Task Team on Climate Intervention
- Task Team on Cycles and Budgets – particularly relevant for annual stocktake and our collaborative work with other partner programs, especially GCOS and Future Earth, including the Global Carbon Project (GCP)
- GPEX and “Water Decade”
- Future of Climate Modelling.
- Strategic planning for CMIP (talk from JF Lamarque, CMIP Panel Chair)
- Post AR6 engagement with IPCC – lessons learned, science gaps, science areas where WCRP needs to prioritise, assessments that WCRP can facilitate etc.
Other High-level Science Questions

- How to improve climate modelling and process understanding?
- What is the impact of different forcings?
- How can we better understand climate sensitivity?
- How can we improve climate predictions?
- What opportunities do new technologies provide?
- What can we expect in regional climate hotspots?
- What is the interaction between climate and development trends?
- How can we better understand climate sensitivity?
- How will reservoirs change in the future?
- What will be the impact of Geoengineering?
- How will climate extremes occur in the future?
- What will happen in the high latitudes?
- What will happen to low-lying islands?
- What will be the impact of Geoengineering?
- Is response action needed?
- What does society need to know?
- What can we expect in regional climate hotspots?
- What will happen in the high latitudes?
- How can we communicate uncertainty better?
- What opportunities do new technologies provide?
- Disruptive technology
- Data-model fusion
- Aerosols
- Aggregation and scaling
- Parameterization
- How can we make predictions more useful and relevant to society's needs?
- Attribution
- Prediction
- Evolution
- Water
- Carbon
- Heat
- Urbanization
- Land-use Change
- Other High-level Science Questions

Considering all scales
2.2 New science - Task Team Updates
2.3 GCOS/WCRP collaborations
2.4 Future of Climate Modelling Workshop
2.5 Engagement with the IPCC climate science assessment processes

IPCC and WCRP planning a joint Workshop in 2022 to discuss …

- **Emerging science needs and opportunities** from IPCC Sixth Assessment Report, and how WCRP can respond through (captured in WCRP’s Science & Implementation Plan).
- How **WCRP can support the IPCC’s** reporting “cycle” through rapid updates, mini-assessments etc.
- Lessons learned re. “**best practice approaches**” to conducting scientific assessments, ahead of IPCC Seventh Assessment Report (AR7).
- Importance of improved coordination **between** IPCC Working Groups.

**Draft Goals (for further discussion and refinement)**

- Identifying knowledge gaps that emerged through AR6, for which new science is needed – incremental or breakthrough (incl. gaps in modelling and observing systems; process understanding; etc).
- Discuss opportunities for WCRP to address some or all of these gaps ahead of AR7.
  - What can WCRP do to facilitate and coordinate the research needed and deliver this in time for AR7?
  - How can this knowledge be developed and delivered in a more rapid and timely way?
- Build awareness in the broader IPCC community of WCRP’s new science initiatives, especially: new Core Projects, RIfS and ESMO; new Lighthouse Activities; emerging science activities focused on Linked Carbon, Water and Energy Cycles, Climate Intervention, and GPEX; and the Open Science Conference in 2023.
- Identify and strengthen some of the key linkages needed across / between the IPCC Working Groups and also the cross disciplinary needs of WCRP activities (**noting that several LHAs have indicated the need to go beyond traditional physical climate science**).
2.5 Engagement with the IPCC climate science assessment processes

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- Importance of improved coordination between IPCC Working Groups.

- **Survey** prior to the Workshop to identify science gaps, needs and opportunities, and Workshop themes.
- **Timing**: Likely in Q4 of 2022 (ahead of WCRP OSC2023, COP28, AR7).
- **Format**: In-person “brainstorming” Workshop, virtual attendance will be accommodated to support goals of sustainability and inclusion (diversity).
- **Attendees**:
  - Invite all Chairs of IPCC WGs; seek their advice on IPCC authors to be invited.
  - WCRP to nominate attendees from Core activities and leadership groups.
End of Session 2