

Science Questions from IPCC

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- Overview of WG I Report and headline science topics
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- Overview of WG II Report and headline science topics
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AR6 WG I Chapters

Science topics

1: Framing, context, methods

2: Changing state of the climate system

Key indicators of change

3: Human influence on the climate system

Attributing change/model evaluation

4: Future global climate: scenario-based projections
and near-term information

Observational constraints/decadal prediction

5: Global carbon and other biogeochemical cycles and feedbacks

Remaining carbon budgets

6: Short-lived climate forcers

Air quality

7: The Earth's energy budget, climate feedbacks, and
climate sensitivity

Emissions metrics/climate sensitivity

8: Water cycle changes

Water cycle

9: Ocean, cryosphere, and sea level change

Cryosphere and sea level

10: Linking global to regional climate change

Regional process/model evaluation

11: Weather and climate extreme events in a changing climate

High-res. obs/attribution

12: Climate change information for regional impact and for risk
assessment

Multi-variables/high-res. hazards

Atlas: Regional Climate Information

Regional observations

WG I science questions relevant to policy on climate change - I

Relevant to many chapters is the monitoring and attributing changes in key climate variables:

- More detail required on cryosphere variables such as winter sea-ice/snow and permafrost for a more complete picture of change at global level;
- Regionally, many areas are poorly observed, especially for precipitation and related hydrological variables (e.g. snow water equivalent, soil moisture);
- More detail on sea-level rise components/drivers would increase accuracy regionally;
- For many (regional) applications, multiple variables are required (e.g. for ecosystems, compound hazards/risks, so consistent datasets of these would be of significant value;
- Reanalyses can be/are being used to fill gaps but these need high quality data inputs and for assessing fitness-for-purpose;
- Improved datasets on regional extreme events would enable more complete coverage of attribution of these and their impacts;
- For all of the above, increasing the length of datasets (e.g. via use/rescue of older data) would be very valuable.

WG I science questions relevant to policy on climate change - II

Quantifying key system properties/budgets/cycles is important for process (and other) chapters:

- Constraining climate sensitivity is key to determining the carbon budget relative to global warming levels and as many projected changes scale with warming (means and extremes);
- Accurate estimates of carbon from land use (change)/forestry, in the oceans, wetlands and permafrost are required for better constraint of the carbon budget;
- Many aspects of the water cycle such as streamflow, snow, cloud-aerosol-precipitation effects require more accurate observation/understanding to inform global/regional budgets.

All the above are also key to assessing fitness-for-purpose of/constraining results from models:

- More data on permafrost change and resulting methane (including from wetlands) would help validate models and constrain their projections;
- Improved cloud-aerosol models/understanding would aid energy budget/attribution studies;
- Regional-scale process-based model assessments (which are relevant to both attribution and projection) are generally lacking;

Working Group II AR6

1: Point of departure and key concepts

2: Terrestrial and freshwater ecosystems and their services

3: Ocean and coastal ecosystems and their services

4: Water

5: Food, fibre, and other ecosystem products

6: Cities, settlements and key infrastructure

7: Health, wellbeing and the changing structure of communities

8: Poverty, livelihoods and sustainable development

9-15: Africa, Asia, Australasia, Central and South America,
Europe, North America, Small Islands

16: Key risks across sectors and regions

17: Decision-making options for managing risk

18: Climate resilient development pathways

Cross-chapter papers: Biodiversity hotspots (land, coasts and oceans): Cities and settlements by the sea: Deserts, semi-arid areas and desertification: Mediterranean region: Mountains: Polar regions: Tropical forests.

Monitoring key physical
and ecological variables

Attributing change

Model evaluation

Regional changes

Monitoring key variables

Attributing change

Model evaluation

Regional changes

Observations relevant to cross WGI-WGII-WGIII issues

- Land use changes and implications
- Geophysical limits and climate change (biomass, energy)

Observations relevant to cross WGI-WGIII issues

- Separation of CO₂, CH₄, N₂O, other GHGs
- Short-lived climate forcers/pollutants and health co-benefits of mitigation

Summary

Overarching aim is to provide greater certainty on current ($\sim 1.1^\circ\text{C}$) and future climate change ($< 2^\circ\text{C}$) relevant to policy/action on mitigation/adaptation/loss and damage (UNFCCC/Paris Agreement) as well as climate-sensitive aspects of sustainable development and risk.

From the EO/CCI community integrating satellite and ground-based observations can provide:

- evidence for monitoring key climate, physical and ecological variables;
- verification of key system properties, e.g. climate sensitivity, carbon budgets, water cycle
- information relevance to “regional” issues, e.g. on trends, impacts where poorly observed
- evidence to assess fitness-for-purpose of and constrain results from climate/impact models