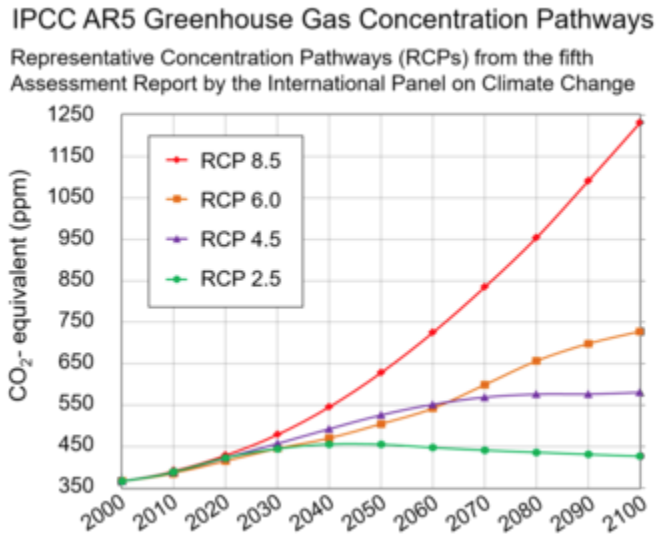

All forcing agents' atmospheric CO_2-equivalent concentrations (in parts-per-million-by-volume (ppmv)) according to the four RCPs used by the fifth IPCC Assessment Report to make predictions.

A **Representative Concentration Pathway** (**RCP**) is a greenhouse gas concentration (not emissions) trajectory adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes Special Report on Emissions Scenarios (SRES) projections published in 2000.

Four pathways have been selected for climate modeling and research, which describe different climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come. The four RCPs, namely RCP2.6, RCP4.5, RCP6, and RCP8.5, are labelled after a possible range of radiative forcing values in the year 2100 (2.6, 4.5, 6.0, and 8.5 W/m^2, respectively).[1][2][3]

Concentrations

The RCPs are consistent with a wide range of possible changes in future anthropogenic (i.e., human) greenhouse gas (GHG) emissions, and aim to represent their atmospheric concentrations.[4] RCP 2.6 assumes that global annual GHG emissions (measured in CO_2 -equivalents) peak between 2010–2020, with emissions declining substantially thereafter.[5] Emissions in RCP 4.5 peak around 2040, then decline.[5] In RCP 6, emissions peak around 2080, then decline.[5] In RCP 8.5, emissions continue to rise throughout the 21st century.[5]

Despite characterizing RCPs in terms of inputs, a key change from the 2007 to the 2014

IPCC report is that the RCPs ignore the carbon cycle by focusing on concentrations of greenhouse gases, not greenhouse gas inputs.[6] The IPCC studies the carbon cycle separately, predicting higher ocean uptake of carbon corresponding to higher concentration pathways, but land carbon uptake is much more uncertain due to the combined effect of climate change and land use changes.[7]

The four RCPs are consistent with certain socio-economic assumptions but are to be substituted with the Shared Socio-economic Pathways which are anticipated to provide flexible descriptions of possible futures within each RCP. The RCP scenarios based on similar socio-economic models as those used to develop the SRES scenarios.[8]

Critique

The high concentration pathways are dependent on assumptions of abundant fossil fuel for future production. It was found that high-concentration pathway such as RCP8.5 may be overestimating future supply of fossil fuels.[9] David Rutledge wrote on coal use: "The estimate for long-term world production is 680 Gt, compared with the reserves plus cumulative production, 1163 Gt. [..] The calculated year of 90% exhaustion is 2070. This gives a time frame for the development of alternatives. This work does not support the use of multiples of coal reserves in the IPCC scenarios." [10]

Projections based on the RCPs

21st century

Mid- and late-21st century (2046–2065 and 2081–2100 averages, respectively) projections of global warming and global mean sea level rise from the IPCC Fifth Assessment Report (IPCC AR5 WG1) are tabulated below. The projections are relative to temperatures and sea levels in the late-20th to early-21st centuries (1986–2005 average). Temperature projections can be converted to a reference period of 1850–1900 or 1980–99 by adding 0.61 or 0.11 °C, respectively.[11]

AR5 global warming increase (°C) projections[11]

	2046–2065	2081–2100
Scenario	Mean and *likely* range	Mean and *likely* range
RCP2.6	1.0 (0.4 to 1.6)	1.0 (0.3 to 1.7)
RCP4.5	1.4 (0.9 to 2.0)	1.8 (1.1 to 2.6)
RCP6.0	1.3 (0.8 to 1.8)	2.2 (1.4 to 3.1)
RCP8.5	2.0 (1.4 to 2.6)	3.7 (2.6 to 4.8)

Across all RCPs, global mean temperature is projected to rise by 0.3 to 4.8 °C by the late-21st century.

AR5 global mean sea level (m) increase projections[11]

	2046–2065	2081–2100
Scenario	Mean and *likely* range	Mean and *likely* range
RCP2.6	0.24 (0.17 to 0.32)	0.40 (0.26 to 0.55)
RCP4.5	0.26 (0.19 to 0.33)	0.47 (0.32 to 0.63)
RCP6.0	0.25 (0.18 to 0.32)	0.48 (0.33 to 0.63)
RCP8.5	0.30 (0.22 to 0.38)	0.63 (0.45 to 0.82)

Across all RCPs, global mean sea level is projected to rise by 0.26 to 0.82 m by the late-21st century.

23rd century

AR5 also projects changes in climate beyond the 21st century. The extended RCP2.6 pathway assumes sustained net negative anthropogenic GHG emissions after the year 2070.[4] "Negative emissions" means that in total, humans absorb more GHGs from the atmosphere than they release. The extended RCP8.5 pathway assumes continued anthropogenic GHG emissions after 2100.[4] In the extended RCP 2.6 pathway, atmospheric CO_2 concentrations reach around 360 ppmv by 2300, while in the extended RCP8.5

pathway, CO_2 concentrations reach around 2000 ppmv in 2250, which is nearly seven times the pre-industrial level.[4]

For the extended RCP2.6 scenario, global warming of 0.0 to 1.2 °C is projected for the late-23rd century (2281–2300 average), relative to 1986–2005.[12] For the extended RCP8.5, global warming of 3.0 to 12.6 °C is projected over the same time period.[12]

References

1. "Representative Concentration Pathways (RCPs)" . IPCC. Retrieved 13 February 2019.

2. Richard Moss; Mustafa Babiker; Sander Brinkman; Eduardo Calvo; Tim Carter; Jae Edmonds; Ismail Elgizouli; Seita Emori; Lin Erda; Kathy Hibbard; Roger Jones; Mikiko Kainuma; Jessica Kelleher; Jean Francois Lamarque; Martin Manning; Ben Matthews; Jerry Meehl; Leo Meyer; John Mitchell; Nebojsa Nakicenovic; Brian O'Neill; Ramon Pichs; Keywan Riahi; Steven Rose; Paul Runci; Ron Stouffer; Detlef van Vuuren; John Weyant; Tom Wilbanks; Jean Pascal van Ypersele & Monika Zurek (2008). *Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies* (PDF). Geneva: Intergovernmental Panel on Climate Change. p. 132.

3. Weyant, John; Azar, Christian; Kainuma, Mikiko; Kejun, Jiang; Nakicenovic, Nebojsa; Shukla, P.R.; La Rovere, Emilio; Yohe, Gary (April 2009). *Report of 2.6 Versus 2.9 Watts/m^2 RCPP Evaluation Panel* (PDF). Geneva, Switzerland: IPCC Secretariat.

4. Collins, M., *et al.*: Section 12.3.1.3 The New Concentration Driven RCP Scenarios, and their Extensions, in: Chapter 12: Long-term Climate Change: Projections, Commitments and Irreversibility (archived 16 July 2014), in: IPCC AR5 WG1 2013, pp. 1045–1047

5. Figure 2, in Meinshausen & others 2011, p. 223

6. IPCC 2013: Technical Summary (PDF) (Report). "the uncertainty is now estimated to be smaller than with the AR4 method for long-term climate change, because the carbon cycle–climate feedbacks are not relevant for the concentration-driven RCP projections"

7. IPCC AR5- Technical Summary- TFE.7 Carbon Cycle Perturbation and Uncertainties (PDF) (Report). "With very high confidence, ocean carbon uptake of anthropogenic CO2 emissions will continue under all four Representative Concentration Pathways (RCPs) through to 2100, with higher uptake corresponding to higher concentration pathways. The future evolution of the land carbon uptake is much more uncertain, with a majority of models projecting a continued net carbon uptake under all RCPs, but with some models simulating a net loss of carbon by the land due to the combined effect of climate change and land use change. In view of the large spread of model results and incomplete process representation, there is low confidence on the magnitude of modelled future land carbon changes."

8. Ward, James D.; Mohr, Steve H.; Myers, Baden R.; Nel, William P. (December 2012). "High estimates of supply constrained emissions scenarios for long-term climate risk assessment". *Energy Policy*. **51**: 598–604. doi:10.1016/j.enpol.2012.09.003 .

9. Wang, Jianliang; Feng, Lianyong; Tang, Xu; Bentley, Yongmei; Höök, Mikael (February 2017). "The implications of fossil fuel supply constraints on climate change projections: A supply-side analysis". *Futures*. **86** (2): 58–72. doi:10.1016/j.futures.2016.04.007 .

10. Rutledge, David (2011-01-01). "Estimating long-term world coal production with logit and probit transforms". *International Journal of Coal Geology*. **85** (1): 23–33. doi:10.1016/j.coal.2010.10.012 . page 32

11. IPCC: Table SPM-2, in: Summary for Policymakers (archived 16 July 2014), in: IPCC AR5 WG1 2013, p. 21

12. Collins, Matthew, *et al.*: Executive summary, in: Chapter 12: Long-term Climate Change: Projections, Commitments and Irreversibility (archived 16 July 2014), in: IPCC AR5 WG1 2013, p. 1033

Note: The following references are cited in this article using Template:Harvard citation no brackets:

- IPCC AR5 WG1 (2013), Stocker, T.F.; et al. (eds.), *Climate Change 2013: The Physical Science Basis. Working Group 1 (WG1) Contribution to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (AR5)* , Cambridge University Press, Archived from the original on 12 August 2014. [Archived
- Meinshausen, M.; et al. (November 2011), "The RCP greenhouse gas concentrations and their extensions from 1765 to 2300 (open access)", *Climatic Change*, **109** (1–2): 213–241,

doi:10.1007/s10584-011-0156-z .

External links

- RCP Database
- Special Issue: The representative concentration pathways: an overview, *Climatic Change*, Volume 109, Issue 1-2, November 2011 . Most papers in this issue are freely accessible.
- The Guardian: A guide to the IPCC's new RCP emissions pathways
- G.P. Wayne: The Beginner's Guide to Representative Concentration Pathways
- Jubb, I., Canadell, P. and Dix, M. 2013. Representative Concentration Pathways: Australian Climate Change Science Program Information paper

Last edited 2 days ago by Kku