What are RCPs?

Representative Concentration Pathways (RCPs) assist in the development of GCM results that account for "…different combinations of economic, technological, demographic, policy and institutional futures…" (Moss et al. 2010: 751) and are used to "…initiate climate model simulations for developing climate scenarios for use in a broad range of climate-change related research and assessment" (IPCC 2007: 1). RCPs are used as inputs for climate modeling and are affected by concentrations of a variety of greenhouse gases, as well as land-use, air pollution, changes in technology, population, energy production and a variety of additional factors (van Vuuren et al. 2011).

The international climate modeling community has adopted four RCPs through the Intergovernmental Panel on Climate Change (IPCC) (Cubasch et al. 2013; IPCC 2007; van Vuuren et al. 2011). The scenarios range from RCP 8.5, which corresponds to a "non-climate policy" scenario translating into high severity climate change impacts, to RCP 2.6, which is a future requiring stringent climate policy to limit greenhouse gas emissions, translating into low severity impacts (van Vuuren et al. 2011: 21). Two middle scenarios, RCPs 4.5 and 6.0, were selected by the IPCC to be evenly spaced between RCPs 2.6 and 8.5 (see table). Together, these scenarios represent the range of radiative forcings[1] available in the peer-reviewed literature at the time of their development in 2007 (Cubasch et al. 2013; Moss et al. 2010).

The term "representative" indicates that that the RCPs represent a largest set of scenarios available in the literature. The term "concentration pathway" emphasizes that the RCPs are not finalized, fully integrated scenarios comprised of a complete set of socio-economic, emission and climate projections, but are rather "…internally consistent sets of projections of the components of radiative forcing that are used in subsequent phases." Further, unlike the previous SRES scenarios, the term "concentration" emphasis the use of concentrations as the output of RCPs for use in climate models, rather than emissions (van Vuuren et al. 2011: 7).

RCPs were adopted by the IPCC for generation of climate model results for the fifth IPCC Assessment Report (AR5). Previously, climate change scenarios published in the IPCC Special Report on Emission Scenarios (SRES) were applied by the climate modeling community to represent different future greenhouse gas emissions scenarios (IPCC 2000). For the purposes of comparison, RCP 8.5 results in a future climate change scenario slightly more severe than the SRES A2 scenario. RCP 2.6 provides a scenario that would lead to lower climate change severity than all SRES scenarios (Cubasch et al. 2013).

Comparison of RCPs

RCP	Description	CO_2 concentration (ppm) equivalent	Pathway	Scenario severity	Comparison to SRES
2.6	A peak in radiative forcing of approximately 3 W/m^2 before 2100, declining to 2.6 W/m^2 by 2100. Also referred to as RCP3PD (Representative Concentration Pathway 3 Peak-Decline).	Peak of ~490 and then decline by 2100	Peak and decline	Lowest	Lower than all SRES scenarios
4.5	Stabilization at 4.5 W/m^2 by 2100 without overshoot.	650 (stabilized after 2100)	Stabilization without	Medium-low	Similar to SRES B1

[1] "Radiative forcing is the change in the net, downward minus upward, radiative flux (expressed in W m^{-2}) at the tropopause or top of atmosphere due to a change in an external driver of climate change, such as, for example, a change in the concentration of carbon dioxide or the output of the Sun…for the purposes of this report, radiative forcing is further defined as the change relative to the year 1750 and, unless otherwise noted, refers to a global and annual average value" (IPCC 2013b: 1460)

			overshoot		
6.0	Stabilization at 6 W/m^2 by 2100 without overshoot.	850 (stabilized after 2100)	Stabilization without overshoot	Medium-high	Similar to SRES A1B
8.5	Rising pathway resulting in 8.5 W/m^2 by 2100. Radiative forcing continues to rise beyond 2100.	>1,370 in 2100	Rising	Highest	Somewhat higher than SRES A2 (by 2100)

Sources: Cubasch et al. 2013; IPCC 2007; Moss et al. 2010; van Vuuren et al. 2011

References

Cubasch, U., D. Wuebbles, D. Chen, M.C. Facchini, D. Frame, N. Mahowald, and J.G. Winther, 2013: Introduction. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC, 2013: Annex III: Glossary [Planton, S. (ed.)]. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC (Intergovernmental Panel on Climate Change). 2007. Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies. IPCC Expert Meeting Report 19–21. September, 2007 Noordwijkerhout, The Netherlands. Technical Summary. Geneva, Switzerland: IPCC, 25 pp.

IPCC, 2000. Special Report on Emissions Scenarios. Nebojsa Nakicenovic and Rob Swart (Eds.). Cambridge University Press, UK, 570 pp.

Moss RH, Edmonds JA, Hibbard KA, Manning MR, Rose SK, van Vuuren DP, Carter TR, Emori S, Kainuma M, Kram T et al (2010) The next generation of scenarios for climate change research and assessment. Nature 463:747–756.

van Vuuren, D., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., Hurtt, G., Kram, T., Krey, V., Lamarque, J.F., Masui, T., Meinhausen, M., Nakicenovic, N., Smith, S. and Rose, S.K. 2011. The representative concentration pathways: An overview. *Climatic Change* 109: 5-31.