

Climate modelling activities in support of the Climate Model Intercomparison Project - phase 6 (CMIP6)

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The World Climate Research Programme's (WCRP) Climate Model Intercomparison Project (CMIP) makes simulations from climate models around the world publicly available in a standardised format. Simulations from CMIP5, the fifth phase of this project, underpinned the projections of future climate change in the Intergovernmental Panel on Climate Change's fifth assessment report (IPCC-AR5). The next phase of this project, CMIP6, features new scenarios and revised experiments to keep pace with advances in climate modelling and our understanding of the climate system. CMIP6 and the 21 associated Model Intercomparison Projects (MIPs) are the most comprehensive suite of international climate modelling experiments ever conceived. The specific experimental design is focused on three broad scientific questions: How does the Earth system respond to forcing? What are the origins and consequences of systematic model biases?; How can we assess future climate changes given climate variability, predictability and uncertainties in scenarios? Through the CMIP6 database, the simulations will be used by researchers worldwide to produce peer-reviewed publications. These publications will inform the forthcoming IPCC-AR6, which will provide governments around the world with objective, scientific information on climate change, its likely impacts and mitigation strategies. The CMIP5 database of global climate model simulations has significant limitations with respect to ongoing utility for climate science, projections formulation and policy development. Firstly, the Representative Concentration Pathways (RCP) on which the future simulations for CMIP5 are based are obsolete, in particular all but the highest emission RCP did not anticipate the major growth in anthropogenic CO₂ emissions that has occurred during the past decade. Further, integrated assessment modelling, which is used to formulate the RCPs, has advanced substantially since CMIP5. This is driven, in part driven, by the advent of the Shared Socioeconomic Pathway program which systematises integrated assessment modelling according to specific socioeconomic storylines. Secondly, our knowledge of climate change agents (such as changes in aerosol emissions and the impact of volcanic eruptions) over the historical

era has improved significantly since CMIP5, and this is important for utilising models to understand climate change in the recent past. Thirdly, the advent of the WCRP Grand Science Challenges since CMIP5 requires a recalibration of the model experimentation to ensure a focus on the most important science uncertainties, that impede the utility of climate science in projections formulation and policy development. The WCRP are proceeding with CMIP6, which will feature new RCP scenarios and extensively revised experimental procedures, to address these deficiencies.