

Overview of a new scenario framework for climate change research

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The scientific community is developing new integrated global, regional, and sectorial scenarios to facilitate interdisciplinary research and assessment to explore the range of possible future climates and related physical changes; the risks these could pose to human and natural systems, particularly how these changes could interact with social, economic, and environmental development pathways; the degree to which mitigation and adaptation policies can avoid and reduce the risks; the costs and benefits of various policy mixes; residual impacts under alternative pathways; and the relationship with sustainable development.

Developing new scenarios for use in impacts, adaptation, and mitigation research requires more than emissions of greenhouse gases and resulting climate change. Scenarios also require assumptions about socioeconomic development, including a narrative, and qualitative and quantitative assumptions about development patterns. An insight recently gained is that the magnitude and extent of greenhouse gas emissions is relatively independent of demographic and socioeconomic development; that is, multiple demographic and socioeconomic development pathways can lead to any particular emission scenario. A relatively wealthy world with high population density could have low greenhouse gas emissions because of policies that encourage energy efficiency and sufficient low emission technology. The opposite also is possible. Therefore, demographic and socioeconomic development pathways can be described separately from the Representative Concentration Pathways and then combined using a matrix architecture into a broader range of scenarios than was possible with the SRES.

Shared Socioeconomic Pathways (SSPs) define the state of human and natural societies at a macro scale. To encompass a wide range of possible development pathways, five SSPs are defined along two axes describing worlds with increasing socioeconomic challenges to mitigation (y-axis) and adaptation (x-axis). They include a narrative storyline and a set of quantified measures that define the high-level state of society as it evolves over the 21st century under the assumption of no significant climate feedback. The reality that the development pathways may be affected by climate change will be taken into account when combining SSPs with climate change projections to generate a socioeconomic-climate scenario.

The new scenario process, although complex, provides a flexible toolkit to facilitate research and assessment that can characterize the range of uncertainty in mitigation efforts required to achieve particular radiative forcing pathways, in adaptation efforts that could be undertaken to prepare for and respond to the climate change associated with those pathways, and in residual impacts.