"CMIP5 projections of future climate change: uncertainty and robust features"

The questions below can be addressed using the "CMIP5 Global Climate Change Viewer", which is available at: regclim.coas.oregonstate.edu/visualization/gccv/cmip5-global-climate-change-viewer/index.html

Q1: For the United States, what is the range of the projected annual mean and multimodel mean (i.e., "Mean Model") temperature change by 2071-2095 across the different emissions scenarios?

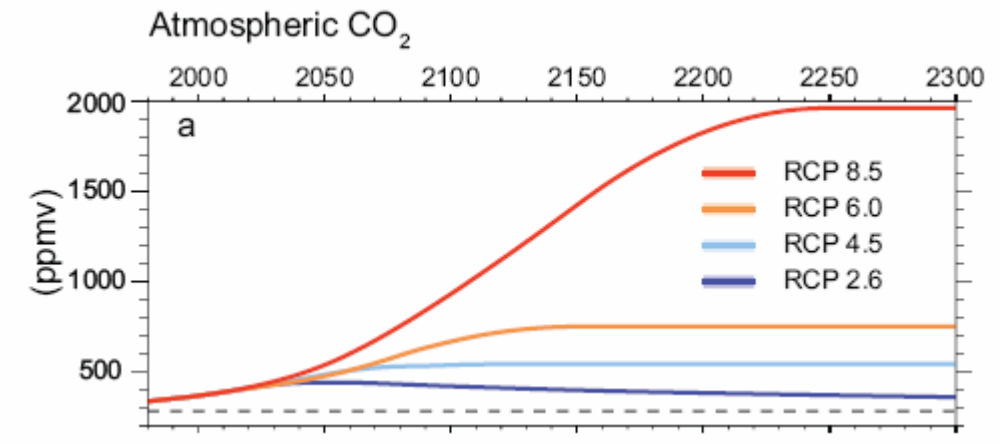
A1: The range of the projected temperature change is 1.62°C (2.92°F) under RCP 2.6, to 4.99°C (8.98°F) under RCP 8.5.

Q2: For the United States under a "business-as-usual" emissions scenario (RCP 8.5), what is the range of the projected annual mean temperature change by 2071-2095 across the different models?

A2: The range of the projected temperature change is 3.38°C (6.08°F) for the GISS-E2-R model, to 6.74°C (12.13°F) for the HadGEM2-CC model.

Q3: Repeat Q1 and Q2, but for the temperature change by 2025-2049. On this shorter time horizon, which represents the larger source of uncertainty, the choice of emissions scenario or the choice of model?

A3: The choice of model. For a given emissions scenario (RCP 8.5), the projected warming over the U.S. ranges from 1.02°C (1.84°F) in the inmcm4 model, to 2.75°C (4.95°F) in the HadGEM2-ES model. This uncertainty range is about 3 times larger than the range across the different emissions scenarios (1.42-2.01°C, or 2.56-3.62°F) for a given model (the multimodel mean). Thus, on this shorter time horizon, the choice of model matters more, since the different emissions scenarios do not begin to diverge significantly until the second half of the 21st century (see the figure).



Q4: Examine the spatial pattern of projected temperature change by 2071-2095 in a few different models and emissions scenarios. Where and when (i.e., at what time of year) is the projected warming the greatest?

A4: The projected warming is the greatest over the Arctic during late fall and winter. This is referred to as the "polar amplification" of climate change, and is a robust feature of climate model simulations.

Q5: Examine the spatial pattern of projected annual mean precipitation change by 2071-2095 in a few different models under the RCP 8.5 scenario. Where is the projected precipitation increase the greatest?

A5: The projected precipitation increase is the greatest over the tropical oceans in the equatorial rainbelts. These same regions are the wettest regions on Earth in the present climate. In fact, the overall pattern of model-simulated precipitation change is characterized by wet regions becoming wetter, and dry regions becoming drier (also sometimes referred to as the "rich get richer, poor get poorer").