

Topic 4 – How Might Climate Change in the Future?

The same factors, both natural and man-made, which have affected the climate of the last 50 years, will continue to affect the climate of the next century. We can assume that volcanic eruptions will occur randomly over that period, but that they will not have a long-term impact on average climate. We can also assume that there will not be large changes in the amount of solar energy the Earth receives. If these assumptions are correct, then natural causes of climate change would result in global average temperature varying over a range of about 1°F, as it did from 1850 to 1950 (See Figure 9).

However, unless global efforts are made to control them, man-made greenhouse gas emissions, especially carbon dioxide emissions, are expected to increase dramatically over the next century, resulting in significant warming. The amount by which carbon dioxide emissions increase will depend on population, level of economic development, the energy technology used, and the degree to which CO₂ emissions are controlled. These factors are unknowable a century into the future.

To deal with an uncertain future, climate modelers use a scenario approach. These scenarios are not predictions of the future; they are a set of plausible ways in the world might develop over the course of the next century. They cover a wide range of possible outcomes, and therefore a wide range of possible emission levels.

Climate modelers refer to their results as projections, not forecasts or estimates. A projection is the result of a calculation using a specific model and a specific set of input conditions. Change the model or change the input conditions, and you'll get a different projection.

In 2000 the UN's Intergovernmental Panel on Climate Change published a set of six scenarios referred to as the SRES scenarios. The SRES scenarios assume that no action is taken to control greenhouse gas emissions, but total carbon dioxide emissions in the six scenarios vary by a factor of eight between 1990 and 2100 because of different assumptions about population, technology development, and the degree to which the world embraces sustainable development. They are the scenarios most widely used by climate modelers, and the basis for projections that between 1990 and 2100 global average temperature might rise by 2 to 11.5°F. The wide range of projections of temperature rise to 2100 is the result of both the wide range in projections of future emissions and the differences between climate models. These two factors contribute about equally to the difference in projections.

Since most man-made greenhouse gases stay in the atmosphere for very long times, it is necessary to control their emissions to near zero to stop the increase in their atmospheric

concentration, and the increase in greenhouse warming. Moderate reductions in greenhouse gas emissions will slow, but not prevent, further warming.

While projections of temperature rise are typically given for some time during the 21st century, even if emissions were to drop to very low levels by 2100, temperature would continue to rise slowly for the next few centuries. This is because it takes a long time for the oceans to warm up and come into equilibrium with the atmosphere.