

## Climate Change 9 — Global Climate Predictions

Future climate is predicted by using computer simulations, called models. A number of different models have been run. Several factors can cause these models to differ from each other, including how quickly humans decrease their emissions of GHGs. Over the last few years, improvements in our understanding of climate have caused these models to converge more closely. The following predictions are from the Executive Summary of the Report of Working Group 1, Intergovernmental Panel on Climate Change:<sup>i</sup>

- The earth will continue to warm. As decades go by, how much and how quickly it warms will increasingly depend on what we do about GHG emissions. Under the most optimistic and pessimistic scenarios, average global surface air temperature is forecast to increase by 1.8 to 4.0 °C (3.2 to 7.2°F) by the end of the century. The magnitude of warming will, of course, affect the magnitude of all of the following changes.
- Warming under all scenarios will be greater at the poles, less at the equator. Warming will also be greater over land, less over the oceans.
- Snow cover will contract. So will the permafrost; in areas where permafrost doesn't vanish, it will thaw to a deeper depth each summer. The polar ice cap will shrink; it will be thinner in winter and may disappear entirely in summer.
- By the end of the century, sea levels are forecast to rise by .28-.43 meters (11-17 inches), depending on how quickly we reduce our GHG emissions.
- The ocean will become more acidic; surface pH will decrease .14-.35 units.
- Extremely hot days, heat waves, and heavy precipitation events (severe storms) will increase.
- Hurricanes will become more intense, although they may become less frequent.
- The Meridional Overturning Current will slow, but it is unlikely to undergo a large abrupt transition.
- Precipitation is likely to increase at the equator. The equator is already wet, and is home to the world's tropical rainforests. Subtropical areas north and south of the equator will become drier. These areas are already dry, home to the world's most famous deserts. Areas at higher latitudes (near the poles) are likely to become wetter.

The above changes are all general global patterns; their effects would ripple through every aspect of life in every region of the globe. Vanishing polar ice may threaten some species<sup>ii</sup>, make it possible to explore the Arctic Ocean for oil, and cause additional warming by reducing albedo<sup>iii</sup>, all at the same time. Shellfish may not be able to form their shells if the ocean becomes more acidic. This includes krill and coral, without which much of the life in the ocean cannot exist.<sup>iv</sup> Longer, hotter dry spells may transform regions from forests to scrub deserts—such a transition may already be occurring in Northwest New Mexico.<sup>v</sup> On the other hand, increased concentrations of carbon dioxide in the atmosphere may make crops grow better.<sup>vi</sup>

Global climate models are not able to predict outcomes at such a fine level of detail. Exactly what these global predictions mean for individual regions and individual species will have to be filled in by further scientific analysis, and by the passing of the years.

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<sup>i</sup> IPCC. (2007). Summary for Policymakers. In Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.): *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* []. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

<sup>ii</sup> Polar bears eat primarily seals, which they are able to capture at breathing holes in the polar ice. Take away the ice and they can't catch the seals. They starve.

<sup>iii</sup> Albedo is the degree to which the earth absorbs the sun's radiation, vs. reflecting it back into space. Polar ice is white, hence it is very reflective. Water is dark blue, however; it absorbs most of the sun's radiation. Take away the polar ice, and the polar ocean will absorb much more energy from the sun than the ice ever did.

<sup>iv</sup> Krill is a tiny shrimp-like animal that exists by the trillions in the ocean. It is a primary food source near the bottom of the food chain on which many, many species depend. Coral is the animal that forms reefs. Reefs are the essential habitat on which much of the life in the ocean depends. For a story on the implications of ocean acidification, see Blumenthal, Les. (12/15/2007). Oceans' growing acidity alarms scientists. *St. Louis Post-Dispatch*. Downloaded 12/15/2007 from [www.stltoday.com](http://www.stltoday.com).

<sup>v</sup> *Underlying cause of massive pinyon pine die-off revealed*. (10/14/2005). Science Daily. Downloaded 3/4/2008 at <http://www.sciencedaily.com/releases/2005/10/051011073510.htm>.

<sup>vi</sup> Animals breathe oxygen and exhale carbon dioxide. Plants do just the opposite, breathing carbon dioxide and exhaling oxygen. Thus, a carbon dioxide rich atmosphere may be like a breath of fresh air for them.