ENVIRONMENTAL LAW INSTITUTE
CJP CLIMATE JUDICIARY PROJECT™

How Climate Science Works

Executive Summary[1]

To distinguish between credible and unfounded scientific claims about climate change, judges must be aware of the foundations of climate science and the rich landscape of scientifically rigorous resources available to them. The study of Earth's climate is an inherently multidisciplinary enterprise, bringing together scientists from the fields of physics, chemistry, geology, and biology. Climate scientists use a comparably diverse portfolio of tools, such as sophisticated computer models, direct observations of the atmosphere and oceans, and paleoclimate reconstructions, among other techniques, to establish robust scientific knowledge about the state of the climate system, its changes over time, the causes of such changes, and their impacts.

Scientific knowledge is said to be robust if it has three qualities. First, an accepted scientific theory must be able to explain a wide range of observations and account for many phenomena. For example, the theory of plate tectonics gained credibility in geology due to its ability to explain various apparently independent lines of evidence, such as the configuration of continents, ocean trenches, movement of large landmasses, and the global distribution of rocks and fossils. Second, a theory must be able to predict outcomes under given conditions. Einstein's theories of relativity, for example, predict that clocks onboard orbiting Global Position System (GPS) satellites will tell a slightly different time compared to those on mobile phones at Earth's surface. The predictive nature of Einstein's theories allows for a precise calculation of the offset between the time on these clocks, which is used to determine the exact position of a receiver. Third, a theory must yield a result that is both reproducible and replicable.

Scientific consensus, when virtually all of the scientific experts on a given topic accept an explanation as true, is a high bar for determining scientific fact. This standard has been reached with climate change. Importantly, the approach of establishing scientific fact through consensus goes beyond what the courts have required for scientific testimony to be deemed reliable. On questions related to climate change, consensus among climate scientists may be gauged through the content of special reports and assessments. These reports are written by teams of experts with a mandate to review the whole body of scientific literature on the topic, most notably the reports prepared by the U.N. Intergovernmental Panel on Climate Change, or IPCC. In 2021, the IPCC stated, "It is unequivocal that human influence has warmed the atmosphere, ocean and land." Other highly respected scientific bodies that have produced consensus reports on climate change, such as the National Academies of Sciences, the Advisory Committee of the U.S. National Climate Assessment, and the American Association for the Advancement of Science, have all arrived at the same understanding through their own independent analyses of the body of scientific literature.

While the understanding that human-emitted, heat-trapping greenhouse gases have warmed the planet is rarely contested anymore, some misstatements about climate change have persisted in non-scientific channels. Such erroneous views may rely on poor framing of the evidence. For example, 1998 was an exceptionally hot year due to the existence of a strong El Niño, a recurring natural event in the climate system that is independent of human-caused climate change. The temperature that year was so high that the global temperature trend seemed to be level from it until about 2015. Climate skeptics cherry-picked this period (an interval of 17 years that was much shorter than the usual minimum of 30 years for climatological research) asserting that there had been "no significant warming." Warming had continued apace during this interval, evidenced by the accumulation of data since 2015 and a longer look through the wider lens of time.

The module includes **a discussion of similarities and differences of scientific and legal reasoning in litigation.** Among the points of comparison is that scientific inquiry is a perpetual search for an ever more accurate description of the natural world, while the process of litigation in court decision-making requires coming to a conclusion that is intended to stand over time. This search for finality is built into the legal process, even if it may take years to achieve, and so it requires using scientific evidence and understanding available at the time of a legal proceeding that relies on it, which may change. For this reason at least, it is important to consider the most recent, accepted scientific knowledge in a field like climate science that is developing quickly.

[1] This is a summary of How Climate Science Works by Paul A. Hanle and Michael D. Mastrandrea.