

# “Climate Science is Core to Science Education”

A Policy Statement of the American Meteorological Society  
(Adopted by the AMS Executive Committee, 23 May 2013)

The Next-Generation Science Standards (NGSS) developed in collaboration with 26 states and several scientific organizations is a transformative set of guidelines for teaching science in the United States. For the first time, climate change is recommended as a core concept for U.S. science curricula, including an emphasis on anthropogenic or “human-caused” effects. As an association of scientists and science-based professionals, the American Meteorological Society (AMS) affirms the inclusion of climate change in the NGSS. Climate change science is firmly rooted in peer-reviewed scientific literature; as science, it is as sound as other NGSS subjects such as earthquakes and the solar system.

The preamble of the 2012 AMS Statement on Climate Change<sup>1</sup> states

*“This statement provides a brief overview of how and why global climate has changed over the past century and will continue to change in the future. It is based on the peer-reviewed scientific literature and is consistent with the vast weight of current scientific understanding as expressed in assessments and reports from the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, and the U.S. Global Change Research Program.”*

Efforts to properly teach climate science are regularly challenged by those seeking to frame it as somehow different from other scientific subjects, often with claims that it is either “uncertain” or “controversial.” They advocate the need for a special approach to its teaching, such as added effort to balance perspectives. With this statement, the AMS seeks to confirm the solid scientific foundation on which climate change science rests, and to emphasize that teaching approaches different from other sciences are not warranted. Uncertainty is a natural component of all scientific endeavor. The existence of uncertainty does not undermine the scientific validity of climate change science; to the contrary, it provides a sound example for broader instruction of the scientific method.

**Scientific Validity:** The primary findings of climate change science have been well established in the peer-reviewed science literature and replicated by numerous independent investigators and methodologies. Blue-ribbon panels of scientists convened by organizations such as the National Academy of Sciences have carried out formal evaluations of scientific studies and provide a consensus opinion regarding climate change. Leading scientific organizations beyond the AMS (e.g., American Association for the Advancement of Science, American Geophysical Union, and European Geophysical Union) have considered the state of the science and are in consensus on the topic as well. There are small scientific differences as research continues to refine the details, but there is strong agreement on the primary findings and essentially no controversy with respect to them.

Science is an enterprise that systematically acquires and organizes knowledge in the form of testable explanations and verifiable predictions about the natural world. Despite differences in methods, all activities we recognize as scientific share some common characteristics, principles, and values. Science is always based on observations and experimentation. Scientists insist on disclosure of hypotheses, observations, methods, and interpretation of the results through a process known as peer review, which provides other scientists an opportunity to evaluate their methods and the logic that led to their conclusions. A published result may not be fully accepted until other scientists further investigate the ideas through reanalysis of the original observations,

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<sup>1</sup> See <http://www.ametsoc.org/policy/2012climatechange.html>

taking new observations, repeating their experiments, or running a numerical model—whatever it takes to test the idea. Because of the skeptical nature of scientists, new ideas are accepted very slowly and only after a great deal of scrutiny. In fact, what authority science achieves is based on the openness by which scientific results are presented for review, evaluation, and additional testing. Inclusion in a precollege science curriculum should be limited to topics that meet these rigorous standards, and climate change science as presented in the broad peer-reviewed literature has earned its place within the broader educational framework of the nation.

**Science and Uncertainty:** The 2012 AMS Statement on Climate Change provides the context for the current science of climate change and also conveys where there is uncertainty (e.g., in the role of melting permafrost in the rate of climate change). Scientists acknowledge and work routinely within a framework of uncertainty. The broader public and educational communities may erroneously conclude that such uncertainties render climate science unreliable or in question. By contrast, the public consumes information daily that includes uncertainty. For example, a forecast of an 80% chance of rain contains a statement of uncertainty, but most people would grab an umbrella given that forecast. Aspects of climate science such as the greenhouse effect, the flows of solar and terrestrial radiation, and feedbacks are as scientifically sound as gravity, the human genome, or orbital mechanics.

It falls on educators and policy makers to provide an environment, from elementary through graduate school, that exposes students to the nature and meaning of science as well as the rich cache of scientific knowledge. It is essential that educators instill in the next generation the following: how and why science works; how it is self-correcting; the importance of evidence and the value of uncertainty; why through a series of stops, starts, and sidetracks it will move toward an explanation of reality; and why science is the basis for many of society's technological advancements.

Climate literacy in the next generation of U.S. citizens will ensure a firm foundation of knowledge and discourse as society faces decisions on how to best deal with a changing climate. The nationwide adoption of the NGSS, with its inclusion of climate change science in curricula, will help improve overall climate literacy.

[This statement is considered in force until May 2017 unless superseded by a new statement issued by the AMS before this date.]