Climate Change and Climate Science

There is a paradoxical gulf between the importance of Earth’s climate and the level of public interest in it. To be sure, tornadoes, killer heat waves, and floods make the headlines, but it’s important to remember that weather is not climate. Some of the public’s confusion may relate to a certain failure to make that distinction, as in the occasional newspaper speculation that a particular weather event may be a consequence of global warming. For any given case, we simply don’t know.

But we do know quite a lot about climate and how it is being changed. The basics are straightforward: As we add greenhouse gases like carbon dioxide and methane to the atmosphere, they form a blanket that intercepts infrared radiation as it leaves Earth. This “greenhouse effect” has been well understood for more than a century. Models that have tracked average global temperature over its fluctuations during the past 10 centuries show that it has followed natural events (such as volcanic eruptions and variations in solar flux) quite well until the 20th century. Then it entered a rapidly rising phase, associated with an increase in atmospheric carbon dioxide from its preindustrial level of 280 parts per million (ppm) to the present level of 380 ppm—a value still accelerating as we continue business as usual. That’s why the Intergovernmental Panel on Climate Change now attributes much of the present warming trend to human activity.

The results are everywhere, except in popular accounts of what’s going on. Those, unfortunately, often emphasize distant possibilities rather than probable outcomes. A recent Pentagon scenario-building exercise suggested a sudden breakdown in the North Atlantic circulation, producing a dramatic regional cooling. A disaster film called The Day After Tomorrow, released a couple of weeks ago, suggests an apocalyptic future not foreseen by most serious climatologists. In fact, we do not know whether global warming will continue to increase on a steady ramp or possibly cross the threshold of some nonlinear process. We’re in the middle of a large uncontrolled experiment on the only planet we have.

It’s only natural that there is lively disagreement among scientists about what the future may hold. Modeling is an inexact science, although the general circulation models used in the world’s major centers have become more sophisticated and now produce results that generally agree. Debate centers on the possibility of altered relationships between oceans and atmosphere, the role of clouds and aerosols, the influence of changes in Earth’s ability to reflect light, and the regional distribution of climate effects. Unfortunately, these disagreements have often persuaded thoughtful newspaper readers that since the scientists can’t agree, the issue can safely be ignored.

It shouldn’t be, and for two reasons. First, the models project that a doubling of the atmospheric concentration of carbon dioxide from preindustrial levels, which is probable by this century’s end, would increase average global temperature by somewhere between 2° and 5°C, and they predict an increase in the average frequency of unusually severe weather events. Second, the modest increases we have already seen in this century are changing the rhythms of life on our planet. The effects of global warming have been most appreciable in the Arctic, where dramatic glacial retreats and changes in the reflectivity of the land have occurred. Even at low latitudes, mountain glaciers have shrunk; so much that the photogenic snowcap of Mount Kilimanjaro in Kenya will be gone by 2020. Plants and the organisms that depend on them have changed their schedules in many parts of the world, advancing their flowering and breeding times at a rate of about 5 days per decade. Sea levels have risen 10 to 20 centimeters in the past century, and more is in store for us.

We think the public deserves a considered consensus on the important matter of climate change, so the American Association for the Advancement of Science (AAAS), with support from the William and Flora Hewlett Foundation and cosponsorship from the Conference Board, will hold a symposium on 14 and 15 June in its headquarters at 1200 New York Avenue, Washington, DC. Eleven distinguished experts on climate science will brief the press, policy-makers, and the public. The objective is straightforward: to make clear distinctions between certain knowledge, reasonable hypotheses, and guesswork. Our climate future is important and it needs more attention than it’s getting.

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