American Enterprise Institute for Public Policy Research

April 2003

New Doubts about the Dominant Climate Change Models

By Steven F. Hayward

Two reexaminations of the assumptions of climate science have cast doubt on how well we understand and predict climate change. A group of climate researchers has concluded that, at least in the case of one previous ice age, a warming climate preceded a rise in atmospheric carbon dioxide. Meanwhile, an Australian statistician and a British economist have blown a huge hole in the methodology by which the Intergovernmental Panel on Climate Change has made its long-term estimates of man-made carbon dioxide emissions for the twenty-first century. If this critique is correct, the IPCC has vastly overestimated the amount of man-made CO_2 emissions and will need to remake its climate change models.

According to the framework of Thomas Kuhn's influential book *The Structure of Scientific Revolutions*, science advances not through an orderly, step-by-step process, but through sharp lurches and drastic departures from the existing "paradigm." These sudden upheavals come about when that paradigm cannot adequately explain a significant anomaly.

Climate science may be experiencing such a moment right now. One of the anomalies that climate skeptics have long noted is the fact that much of the modest increase in global temperature occurred during the first half of the twentieth century, before carbon dioxide (CO_2) began building up in the atmosphere. (One explanation offered for this anomaly is "random cooling," which leaves the question of causation ambiguous.[1]) This and other difficulties in understanding the complex interrelationships governing the world's climate have caused a few observers to wonder whether the rising CO_2 levels in the atmosphere might be partially or primarily an effect of climate change generated by some cause other than man-made emissions of greenhouse gases—sunspots or tiny changes in the earth's orbit perhaps.

The March 14 issue of *Science* magazine provides new salience to this debate with an article titled "Timing of Atmospheric CO_2 and Antarctic Temperature Changes Across Termination III,"[2] in which a French-led team of climate researchers reports on its study of gas bubbles in Antarctic ice core samples. Climate researchers have documented past coincidence of varying CO_2 levels and climate changes through ice core samples, which provide us with a way of peering back thousands of years. The ends of several past ice ages were accompanied by significant increases in atmospheric CO_2—as much as 100 parts per million. Hitherto researchers have not been able to tell whether CO_2 buildup preceded warming or vice versa, or what the time lag might have been.

The French team thought this question could be answered by taking a closer look at the ratio of argon to CO_2 in gas bubbles from ice core samples dating back to an ice age that ended 240,000 years ago, an event known to climatologists as "Termination III." This technique is thought to provide a

Steven F. Hayward is the F. K. Weyerhaeuser Fellow at AEI. The 2003 edition of his *Index of Leading Environmental Indicators,* published jointly by the Pacific Research Institute and AEI, will be released on April 21. (To order call 800.276.7600 or 415.989.0833, or go to www.pacificresearch.org/environment03.)

more precise answer because the ratio of argon to CO_2 is highly sensitive to ambient temperature. Changes in the argon-CO_2 ratio can be matched with other temperature records to create a more accurate timeline that sequences changes in temperature and CO_2 levels. This method revealed that warming preceded the rise of atmospheric CO_2 by about 800 years. "Our data suggest that the warming came first, then carbon dioxide increased," lead scientist Jean Jouzel told *Nature* magazine. Jouzel and his team emphasize that this does not fundamentally change the concern with man-made CO_2 emissions today. "This sequence of events," they write in *Science*, "is still in full agreement with the idea that CO_2 plays, through its greenhouse effect, a key role in amplifying the initial orbital forcing." In other words, whatever may have started our current warming trend, additional CO_2 emissions may accelerate warming further. Moreover, they add, the rising CO_2 level of the last century is the result of man-made, not natural, causes. However, these findings certainly lend themselves to the view that our knowledge of climate change may not be as advanced as we have thought. Indeed, the *Nature* magazine news summary of this study was entitled "Bubbles prompt climate-change rethink."[3]

But what if the climate-model projections for increasing levels of CO_2 in the twenty-first century are badly wrong? This is a possibility an Australian statistician, Ian Castles, and a British economist, David Henderson, have raised in recent months. In its 2001 report, the Intergovernmental Panel on Climate Change (IPCC) forecast that average global temperatures could increase by a range of 1.4 to 5.8 degrees Celsius from 1990 to 2100 if nothing is done to mitigate the expected increase in man-made CO_2 emissions during this period. This finding is based on an expected doubling of the concentration of atmospheric CO_2 from man-made sources over the course of this century. The 4.4 degree variation in the range of projected warming represents the still large uncertainty of our climate models. Few have thought to inquire about any uncertainties in our projections of rising CO_2 levels, largely because this is thought to be the simple part of the problem. CO_2 emissions are mostly a function of fossil fuel use, which in turn can be estimated by making assumptions about future world economic growth.

Fundamentally Flawed Forecasting

This is where Messrs. Castles and Henderson come in.[4] Castles and Henderson argue that the IPCC economic forecasts are based on fundamentally flawed economic assumptions that generate huge overestimates of future CO_2 emissions.[5] If Castles and Henderson are correct (and the IPCC has been reviewing their critique in recent weeks), the IPCC will need to start from scratch in its CO_2 estimates for its next periodic climate report, which is due next year.

Castles and Henderson's critique is highly technical, but can be simplified as follows: The forty different economic growth scenarios in the IPPC's last report all rely on estimates of growth in GDP around the world measured in dollar terms. This involves using currency exchange rates to convert the world's disparate economies into a common unit of measurement. This is the wrong way to make economic comparisons, let alone projections, Castles and Henderson argue. For example, $20,000 in the United States is not equivalent in purchasing power to $20,000 converted at currency exchange rates to, say, Swedish kroner. This is why transnational economic comparisons have been using "purchasing power parity" for many years now. In fact, that is the method the Organization for Economic Cooperation and Development, the United Nations, the World Bank, and other international economic institutions use for comparing and projecting national economies.

But the IPCC used exchange rate GDP estimates instead because that is the economic measurement most existing peer-reviewed climate models use, and the IPCC was bound to follow the existing methodology even though some IPCC researchers acknowledge that this method may be prone to error. The problem is that measuring and projecting world economic growth with nominal GDP leads to understating the true baseline economies of most developing nations, which in turn leads to overstating future rates of economic growth and CO_2 emissions.

In fact, the GDP approach leads the IPCC to expect much greater economic growth in the developing world than in the developed world throughout this century, which leads to some absurd projections about CO_2 emissions for many emerging nations. In a paper presenting the case for reviewing the IPPC emissions forecasts, Castles offers South Africa as a case in point:

> The dimensions of the problem can be illustrated by the case of South Africa. In 2000, this country's GDP per head, converted from nominal values using exchange rates, was only 12% of the U.S.

> level. By 2050, the A1 marker scenario projects that the per capita income of South Africans on this basis will have reached more than four times the U.S. level in 2000, and about twice the level that the U.S. will have reached in 2050. And by 2100, this scenario projects that the per capita income of South Africans will be approaching twenty times the U.S. level in 2000, and more than four times the U.S. level at the end of the 21st century. . . . The total output of goods and services in South Africa in 2100, according to these downscaled A1 scenario projections, will be comparable to that of the entire world in 1990.[6]

Among the nations the IPCC projects will have a higher real incomes than the United States in 2100 are Libya, Algeria, Argentina, and North Korea. *North* Korea—that is not a typo.

This seems unlikely, to put it mildly. The nub of the problem is that using the GDP approach inflates CO_2 emissions unrealistically. The World Bank, for example, claims that developing countries use 3.8 times more energy per dollar of GDP than developed nations do. However, Castles and Henderson point out that if economies are compared on a PPP basis instead, developing nations use only 1.2 times as much energy per dollar of output than developed nations. This means that CO_2 emissions will not rise as dramatically as developing nations grow.

Castles asks:

> What are the implications for the SRES [IPCC Special Report on Emissions Scenarios] projections of emissions of these very high projected rates of growth in economic activity? It is not possible to be precise without undertaking a major reworking of the scenarios. But there is no obvious reason for supposing that the overstatement of prospective growth rates and output levels in developing countries would NOT have led to a significant overstatement of projected emissions.

Even the lowest of the IPCC's emissions projections is probably too high, which means that the projections of global warming may be too high as well.

Castles and Henderson note that since the IPCC projections use 1990 as their baseline year, we can already look at a decade's worth of growth in emissions to see how well it matches up with the projections. The mean IPCC projection for the 1990s was that worldwide CO_2 emissions would increase by about 15 percent. In fact, worldwide CO_2 emissions grew by only about 6 percent according to the U.S. Department of Energy. Methane emissions in OECD nations were projected to increase slightly; in fact, early data suggests methane emissions in OECD nations fell about 8 percent in the 1990s.

If Castles and Henderson are correct, then even if the climate models are fully accurate in their projections of the linkage between CO_2 and global climate change, the models would need to be rerun from scratch with a more realistic economic forecast of future CO_2 emissions. As the IPCC moves toward its Fourth Assessment Review next year, Castles and Henderson are being given a serious hearing. Stay tuned—a new climate paradigm may be on the way.

Notes

1. See Patrick Michaels, *Sound and Fury: The Science and Politics of Global Warming* (Washington, D.C.: Cato Institute, 1992), 81–87.

2. Nicolas Caillon, Jeffrey P. Severinghaus, Jean Jouzel, Jean-Marc Barnola, Jiancheng Kang, and Volodya Y. Lipenkov, "Timing Atmospheric CO2 and Antarctic Temperature Changes Across Termination III," *Science* (299), March 14, 2003, 1728–1973.

3. www.nature.com/nsu/030310/030310-12.html.

4. Castles and Henderson bring impressive credentials to this debate. Castles is the former head of Australia's national office of statistics, and Henderson is a former chief economist of the OECD.

5. A complete set of the papers outlining Castles and Henderson's arguments can be found at: www.lavoisier.com.au/papers/articles/PPCissues.html. *The Economist* offered a cogent summary in the February 13, 2003, issue of the magazine. The piece was entitled "Hot Potato: The Intergovernmental Panel on Climate Change Had Better Check Its Calculations."

6. Ian Castles, "IPCC Emissions Scenarios: The Case for a Review" (available at www.lavoisier.com.au/papers/articles/IPPCissues.html#anchor1592472).