letters

Western US droughts: Climate happens

In her report on the drop in Lake Mead's water level (PHYSICS TODAY, April 2008, page 16), Barbara Goss Levi concludes that when the impact of greenhouse gases and aerosols is included in global climate models, the drop in water level seems to be related to greenhouse gases and not to natural variability.

A NASA article about Lake Mead (see http://www.nasa.gov/vision/earth/lookingatearth/Lake_Mead2004.html) suggests that the current drop in water level is associated with a drought that began in that area of the Southwest in 1999. Furthermore, the NASA article points out that a more severe drought occurred in the same area over a five-year period in the 1950s.

I agree with Levi that local climate variations can contribute to repeated droughts in an area; that connection is substantiated by tree-ring data in the Southwest from back before human impact was even a factor. Since we cannot correlate those early droughts with increases in anthropogenic greenhouse gases, we must be careful with assertions that everything can be deduced from global climate-model simulations, especially when the simulations are downscaled to finer grids. While you can certainly make the block averages of properties equal in fine and course grids, you cannot reproduce the initial spatial correlations that would exist when starting with a fine-grid model based on actual data. Furthermore, from my experience in flow simulation models, I know that any forecasts derived from those models depend on grid cell size and orientation.

We also need to further understand the causes of repeated events, like droughts, in the climate of an area before we make the jump to a global climate model; the correlation lengths of local and global climate phenomena are not equivalent. We must be careful with our assertions of global climate change and be aware of the limitations in our models, especially in the absence of actual data.

Joseph G. Gallagher Jr
(josephgallagherjr@sbcglobal.net)
Stevensville, Montana

The April 2008 issue of PHYSICS TODAY features a short item about the Colorado River basin's current drought (page 16). The writer of that story, Barbara Goss Levi, tries to tie the drought to anthropogenic global warming.

The US Geological Survey publication *Climatic Fluctuations, Drought, and Flow in the Colorado River Basin* (USGS Fact Sheet 2004-3062, http://pubs.usgs.gov/fs/2004/3062) helpfully supplies a graph of the Colorado flow since measuring began in 1890; it identifies for the reader four droughts since then, roughly centered on 1900, 1933, 1960, and 2003—one every 30–40 years.

According to the USGS report, tree-ring data show that droughts more severe than any of the 20th- and 21st-century ones occur fairly often; there have been 13 since 1226.

Colorado River droughts are not new. Climate varies.

A fancy computer-simulation giving human activity as an explanation of the current Colorado River basin drought is not needed. It will suffice to say that the current drought has the same cause that produced the drought of 1896–1906 and two or three per century for the last millennium. Climate happens.

Robert Ayers
(astroayers@gmail.com)
San Jose, California

Levi replies: Joseph Gallagher has misunderstood what I wrote in my news story. The first part of my story dealt with the western US as a whole, not Lake Mead in particular. I reported on a study led by Tim Barnett, of the Scripps Institution of Oceanography; the study made no assertions about particular local conditions. As I stated in my story, "Only by including greenhouse gases and aerosols in the model simulations could [the researchers] adequately reproduce the spatial and temporal pattern of the changes [in temperature-related hydrological variables] that have been observed over the past 50 years." I mention the low water levels in Lake Mead among my examples, but I did not mean to imply that the study could impute the causes of such local conditions.

Later in the story, I discuss Lake Mead in more detail. Both Gallagher and Robert Ayers have read more into that part than is actually there. I made no assertions about the current drought but rather reported on a prediction about possible *future* drought conditions. In particular, I cite work by Barnett and David Pierce, who estimated that the current level of water withdrawals from Lake Mead is unsustainable if one folds in climate model predictions that river runoff into the region will fall 10%–30% by 2050. Barnett and Pierce are not claiming that the current dry conditions are due to global warming.

Barbara Levi
PHYSICS TODAY
Santa Barbara, California

Talking points on talking points

Stephen Benka's article "Who Is Listening? What Do They Hear?" (PHYSICS TODAY, December 2008, page 49) is possibly the most valuable one published in the several decades I have been reading the magazine. The images on pages 51 and 52 showing the form and function of a successful talk should be embedded in every call for papers by every scientific society.

An even more significant corollary to Benka's thesis is the subset of occasions when the audience is the general public or another nontechnical audience—for

Letters and opinions are encouraged and should be sent by e-mail to ptletters@aip.org (using your surname as "Subject"), or by standard mail to Letters, PHYSICS TODAY, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842. Please include your name, affiliation, mailing address, e-mail address, and daytime phone number on your attachment or letter. You can also contact us online at http://www.physicstoday.org/pt/contactus.jsp. We reserve the right to edit submissions.

example, K–12 or college students—where 99% have never heard of "wotoiks" or "vefarps."

My experience provides a special case of Benka's theme: "Eliminate nonessential technical details and broaden the take-home message." Regrettably, many well-meaning scientists go in exactly the opposite direction when dealing with the public. Impress them! Get them to say, "Wow!" Use "nano" at least three times, and drop a "Higgs boson" occasionally. That'll turn them on to science!

As scientists committed to the truth, we should reject all attempts to bamboozle lay audiences with the arcane language of science. At this time of national change, we, as citizens, must heed President Dwight Eisenhower's warning, from his valedictory speech of 17 January 1961, about the twin dangers of "the military industrial complex" and the "scientific and technical elite."

Benka has the right guidance for scientists who have the task of addressing legislators: "It's the audience, stupid!" Respect them.

Rustum Roy
(rroy@psu.edu)
Pennsylvania State University
University Park

Every first-year graduate student in the physical sciences should be required to read Stephen Benka's great article. I have observed that a key difference between research scientists and engineers who have truly remarkable careers and those who get stuck in a technical box is their verbal communication skills.

When I started as a graduate student in chemistry at the University of California, Berkeley, in 1972, the department chairman David Shirley told the entering students that they should attend seminars regularly because they needed to develop the ability to learn by listening to other people talk. He should have added that students also need to develop the ability to speak in such a way that their audience learns something.

Joe Smith
Bellaire, Texas

"He just keeps shouting, 'It's mutable! It's mutable!' "

Engines for the 21st century

In the article "Research Needs for Future Internal Combustion Engines," (PHYSICS TODAY, November 2008, page 47), authors Dawn Manley, Andrew McIlroy, and Craig Taatjes examine some of the physics issues involved in improving the efficiency of the internal combustion engine. However, some alternative approaches may be more efficient yet.

For 20th-century automobiles, internal combustion engines had several advantages: They could produce power from a cold start and were reasonably efficient across a wide range of output power. For the 21st century, other, potentially more efficient heat engines, such as the Brayton gas-turbine cycle and the Stirling engine, are also worth noting. Hybrid cars eliminate most of the disadvantages of such heat engines by using electric motors for the primary drive function, so that the heat engine is needed only for the production of electrical power to charge the battery. The heat engine can thus be run under its most efficient conditions, not at a compromise setting to maximize torque.

A high-efficiency heat engine concept on which we have done considerable work at NASA's John Glenn Research Center is the free-piston Stirling engine. This remarkable design eliminates the kinematic couplings and thus reduces the engine to only two moving parts, the displacer and power pistons; a linear alternator produces power directly as electricity. Small, light, and efficient, the Stirling engine—and not the internal combustion engine—may be the real future of the automobile engine.

Geoffrey A. Landis
(geoffrey.a.landis@nasa.gov)
NASA John Glenn Research Center
Cleveland, Ohio ■