

9

Tackling the climate communication challenge

Moments for scientists don't get much more dramatic than the scene in Paris on February 2, 2007, as lead authors of the 2007 report from the Intergovernmental Panel on Climate Change (I.P.C.C.) described evidence pointing to an increasingly human-heated planet.¹ This report, the fourth assessment of the causes and consequences of climate change in the nearly 20-year history of the panel, was the first to conclude with greater than 90 percent confidence that humans had become the main force driving warming and that centuries of rising temperatures and seas could be blunted only if emissions of heat-trapping gases were substantially reduced.

At the news conference following presentations, reporters pressed for the human element. One journalist asked Susan Solomon, one of the two supervising authors and an award-winning atmospheric scientist for the United States government, "to sum up what kind of urgency this sort of report should convey to policy makers." She gave the furthest thing from a convenient sound bite:

"I can only give you something that's going to disappoint you, sir, and that is that it's my personal scientific approach to say it's not my role to try to communicate what should be done . . . I believe that is a societal choice. I believe science is one input to that choice, and I also believe that science can best serve society by refraining from going beyond its expertise. In my view, that's what the I.P.C.C. also is all about, namely not trying to make policy-prescriptive statements, but policy-relevant statements."²

¹ www.ipcc.ch/pdf/press-releases/pr-02february2007.pdf

² <http://www.nytimes.com/2007/02/06/science/earth/06profile.html>

Contrast her stance with the impassioned actions of James E. Hansen, the pre-eminent climatologist for the National Aeronautics and Space Administration of the United States, who in 2004 publicly criticized President George W. Bush and endorsed another candidate for President because of their stands on global warming and who would go on to get himself arrested outside the White House in 2010 and a coal company's offices in West Virginia the year before.³

In 2010, Hansen published a short essay on his Columbia University website explaining that his role as a grandparent fueled, and justified, his activism:

*Stabilizing climate is a moral issue, a matter of intergenerational justice. Young people, and older people who support the young and the other species on the planet, must unite in demanding an effective approach that preserves our planet.*⁴

When I taught a graduate seminar at Bard College in 2007 on the role of communication in setting environmental policy, I split the class into "Hansenites and Solomonites" and had the students debate the strengths and pitfalls of each scientist's approach to climate communication. After the showdown, there was no clear winner, even though virtually the entire class had begun the exercise favoring Hansen.

Welcome to the rough-and-tumble interface of climate science, communication and society. It's a realm with no easy answers or simple menu of solutions, particularly these days as the world of communicating *anything*, let alone a complicated mix of science, ethics, and policy, is in a state of turbulent flux. Climate discourse is an arena in which leading scientists have taken starkly different stands on how to convey the broader meaning of their work, where environmental campaigners and like-minded politicians have been locked for more than a decade in pitched battles with a varied array of professional and amateur skeptics and contrarians, where the lay public – distracted by economic turmoil, constrained by what psychologists call peoples' "finite pool of worry" and buffeted by claims of catastrophe and hoax amplified by conflict-seeking media – has largely chosen to sit this issue out. I've sometimes compared shifting public attitudes on climate to water sloshing in a shallow pan. There's a lot of commotion, and tens of millions of dollars have been spent to try to turn opinion one way or another. But the depth of concern hasn't changed much in the quarter

³ <http://www.nytimes.com/2004/10/26/science/26climate.html>; <http://dotearth.com/blogs.nytimes.com/2009/06/23/hansen-of-nasa-arrested-in-coal-country/>
⁴ http://www.columbia.edu/~jeh1/mailings/2010/20100824_Activist.pdf

century I've been reporting on human-caused climate change, particularly if gauged by the ultimate metric – the relentless upward trend in greenhouse-gas emissions.

The din hit a particular crescendo late in 2009, when someone stole or liberated (choose a label depending on your politics; as of this writing the police have yet to call the incident a crime) a decade's worth of e-mail and files written by an international array of climate researchers. The batch of correspondence – presumed by the authors, perhaps naively, to have been private – was laced with attacks on intellectual antagonists and phrases hinting of data manipulation or other dicey behavior, providing red meat for critics of climate science and interest groups fighting restrictions on greenhouse gases. In the end, a series of inquiries concluded that some exchanges were unseemly and others may have violated British freedom of information laws, but there was scant evidence that the e-mails and other disclosed files undercut the broad, deep, and diverse body of research supporting greenhouse-driven warming.⁵

Around the same time, the intergovernmental climate panel faced its own challenges as some errors and sloppy patches were found in its 2007 reports. Inquiries by the InterAcademy Council and a Dutch government committee found plenty of problems, many having to do with how the science was summarized for the public and policymakers. But, again, there was no evidence that the revelations undercut the basic body of knowledge of climate change and its human component, and every sign that the I.P.C.C. could modify practices to boost accuracy, transparency, and credibility.⁶

In 2008, quoting a reader's comment about climate stasis, I posed an unsettling question in the headline of a post on climate and communication on my Dot Earth blog: "Are We Stuck With 'Blah, Blah, Blah . . . Bang?'"⁷ I don't think so. Despite the troubles of late, there's plenty that can be done to improve the chances that climate information can *matter* – that the fruits of research on climate change, energy choices, and human reactions to environmental risk can meaningfully influence decisions by individuals, institutions, companies, and elected leaders in ways that reduce the odds that humans will dangerously disrupt climate and boost human resilience to climate-related hazards. In many ways, the failures so far, together with the explosively rapid changes in

⁵ <http://www.cce-review.org/>

⁶ <http://reviewipcc.interacademycouncil.net/>; <http://www.bbc.co.uk/news/10506283>

⁷ <http://dotearth.com/blogs.nytimes.com/2008/08/04/are-we-stuck-with-blah-blah-blah-bang/>

how information on science flows between scientists and the public (and back again), create a great opportunity for fresh starts.

A first step in finding effective ways to convey climate findings is to recognize the hurdles to doing so. It would be hard to find an area of science that is more fraught with communication challenges than work on climate change. One challenge is simply the nature of the basic science. Evidence that greenhouse gases from human activities are warming the planet and likely to lead to disruptive environmental change doesn't come from a single finding, or a single field, for that matter. The science revealing rising risks of disruptive human-driven climate change has accumulated over 30 years like dots added to a pointillist painting. But the resulting image still lacks the memorable punch of an expressionist work like Edvard Munch's iconic "The Scream."

The result is what seems to be one of the great paradoxes of the early twenty-first century – a planet-scale risk that perpetually hides in plain sight. Parts of the picture of a human-warmed climate are revealed now in high resolution. There is no longer any reasonable way to explain recent changes in atmosphere and ocean temperatures without including a substantial contribution from accumulating human-generated greenhouse gases. But while the general picture of greenhouse warming is robust, the details that matter most to society – the pace at which seas rise, forecasts of how precipitation and temperatures change region by region, even the extent of warming from a given buildup of greenhouse gases – remain laden with persistent uncertainty. Any accurate depiction of the climate challenge must convey the uncertainty as well as what is known. In the meantime, audiences, whether elected officials or the general public, tend to demand "proof" of risk before ambitious actions are undertaken.

This means it's also vital, when discussing the amorphous concept called global warming or climate change, to be sure that one delineates which facet is being explored, and to define terms. Consider that the only conclusion of the I.P.C.C. that was "unequivocal" was that the climate had warmed. In the public discourse, though, that level of certainty often became conflated with the broad package of phenomena wrapped into the idea – that it all was certain. This kind of oversimplification then allowed those eager to perpetuate doubt to shout, legitimately, about overstatement.

There are other challenges in grasping the nature of the problem. As John D. Sterman, a professor of management at the Massachusetts Institute of Technology, has found, even a well-educated group like M.I.T.

graduate students has a hard time absorbing another facet of the climate problem – created by the long-lived nature of the most important human-generated emission, carbon dioxide. The gas accumulates like unpaid credit card debt or delayed homework assignments as long as emissions exceed the ability of forests, the oceans and other "sinks" to absorb the gas. As Sterman has put it, the atmosphere is like a bathtub with a partially opened drain. Carbon dioxide from burning fuels and forests is flowing in roughly twice as fast as it is being absorbed by plants and the ocean, and there's some evidence that the capacity of such systems to sop up the gas is not keeping up, meaning that the "drain" is, in essence, getting a bit clogged. At the same time, the decades-long useful life of new sources of emissions such as coal-burning power plants means that the "faucet" for carbon dioxide is getting cranked open just when it should be going in the opposite direction.

In a tub, this is a recipe for a flood. In the climate system, Sterman and many climate scientists say, this characteristic calls out for a prompt start in curbing and then cutting emissions to have a decent chance of avoiding dangerous thresholds. But few people seem capable of fully comprehending this kind of problem, he has found.⁸ In one study that Sterman co-authored in 2007, after 212 M.I.T. graduate students were given a primer on the cumulative nature of carbon dioxide, when the participants were asked to draw a graph showing emission tracks that could stabilize the gas concentration, 84 percent instead drew curves that would result in concentrations continuing to climb.⁹ This kind of research can be seen as utterly discouraging, or as yet more evidence of the need – and opportunity – for a lot of creative communication aimed at clarifying the situation.

I spent the first two decades of my journalistic exploration of global warming focused mainly on geophysical, biological, and technical questions related to sources of emissions, anticipated impacts of shifting temperature and precipitation patterns, and choices for policies and technologies that might limit emissions even as humanity's growth spurt peaks in coming decades. In all that work, I don't think anything unnerved me nearly as much as the reporting I've done more recently on the climate challenge within the human mind.¹⁰

⁸ <http://www.sciencemag.org/cgi/content/full/322/5901/532?ijkey=ww8NhGSuSTLSw&keytype=ref&siteid=sci>

⁹ http://jsterman.scripts.mit.edu/On-Line_Publications.html#2007Understanding

¹⁰ <http://dotearth.blogs.nytimes.com/2009/08/05/is-the-climate-problem-in-our-heads/>

To get just a hint of the internal hurdles potentially impeding an effective response, have a look at the following partial list of “psychological barriers” that could impede action, taken from the table of contents of *Psychology and Global Climate Change*, a 2009 report written by a task force of the American Psychological Association:¹¹

- Ignorance
- Uncertainty
- Mistrust and reactance
- Denial
- Judgmental discounting
- Place attachment
- Habit
- Perceived behavioral control
- Perceived risks from behavioral change
- Tokenism and the rebound effect
- Social comparison, norms, conformity, and perceived equity
- Conflicting goals and aspirations
- Belief in solutions outside of human control

You get the idea. The parts of the human mind that judge risks and initiate responses, and the social institutions that provide a backstop, are not (yet, at least) well set up to deal with century-scale, globe-spanning, uncertainty-laden, incrementally building, feedback-laced, cumulative sources of risk. Deeply embedded human traits guarantee that even perfect communication of scientific insights pointing to certain kinds of threats hardly guarantees that people will absorb them, let alone change behaviors or policies as a result. People and communities still tend to focus primarily on the “near and now” and to use what some economists call “hyperbolic discounting” when weighing how much to invest to limit long-term threats. Rather than take up space with more specifics, I encourage anyone eager to learn more about the mental filters that affect how people absorb, or reject, climate findings to read the psychological association’s report and another vital resource, *The Psychology of Climate Communication*, published in 2009 by the Columbia University Center for Research on Environmental Decisions.¹²

Further distortion of the traditional sense of environmental responsibility comes because populations generating the most heat-trapping emissions are mostly separated in space and time from the

¹¹ <http://www.apa.org/science/about/publications/climate-change.aspx>

¹² <http://www.cred.columbia.edu/guide/>

communities or ecosystems most exposed to potentially heightened risks of flooding, drought, and other climate-related hazards. In the meantime, the wealth created through processes that generate emissions – from burning coal to cutting forests – can insulate emitters from some climate-related risks.¹³ On top of these factors, people, largely through the differences in deeply rooted values systems identified by academics and pollsters, have a wide range of views on how much they are obligated to invest to limit risks primarily facing communities in poor, distant places.

Can communication, using the best possible mix of words, imagery and other content, break through these barriers? Here’s how David Ropeik, a consultant in risk communication on everything from nuclear power to car safety and the author of *How Risky Is It, Really*, explored this question:

In order to be successful, any communication has to respect not just what the communicator wants to say, but what the audience wants and needs to know, and present the information at a length and in a language and form designed more to reach the audience than satisfy the communicator. Scientists too often fail to let go of their paradigm of “knowledge”. . . detailed, nuanced, erudite . . . and as a result fail to take the audiences’ needs and interests more to heart.

Scientists communicating climate change must also accept what social sciences tell us, that no matter how clearly they communicate, the information will be interpreted through the subjective lenses of the reader’s perceptions. Frustrating as it is, scientists communicating facts must understand that what seems like fact to them will only be one input among many that contributes to how people think and feel and act. This is particularly so with a contentious issue, and a risk issue. Both characteristics trigger powerful subconscious subjective information-filtering processes. The objective of communicating, then, is to add information to the tools people have for making up their minds, not to make them “get it,” as in understanding things the way the scientist wants them to.

In other words, those diving in to help foster public awareness and response on climate change, and the actions that would be required to blunt climate risk, in part have to let go of the expectation that some single new explanation, future I.P.C.C. report, consensus statement by scientific academies, or prize-winning documentary will magically lead to traction. Deeper human traits, and feelings, are involved in how people react to something as profound as the idea that actions that have built today’s prosperity – mainly the unfettered combustion of fossil fuels – are imperiling future prospects, both economic and

¹³ <http://www.nytimes.com/2007/04/03/science/earth/03clim.html>

ecologic. Because of cultural filters, a more informed public can actually be a more *divided* public on an issue like global warming. In the United States, the *Six Americas* study of climate attitudes by researchers at Yale and George Mason University and periodic surveys by the Pew Research Center both have shown that more education tends to deepen opposing convictions of both climate skeptics and those very worried about warming.¹⁴

For all these reasons, and many more, some researchers – already familiar with a class of economic and social problems deemed “wicked” because of layers of potentially conflicting cause and effect and interests – have proposed calling the climate challenge “super wicked.”¹⁵ To me, it’s not a stretch to say the challenge is “*beyond* super wicked.”

Old models for explaining the challenges posed by climate change are clearly not up to the task, given the many levels of complexity and the profound divisions in society. The “woe is me” frame, epitomized by the 2006 *Time* Magazine cover proclaiming, “*Be Worried. Be Very Worried,*” was bound to fail, as some sociologists warned at the time.¹⁶ The “shame on you” approach hasn’t done much better. One long-standing vision of the “climate story” has been to cast it as a political battle between a scientifically enlightened left and economically motivated right. Mind you, there’s been ample disinformation over the years, much of it financed by money from conservative philanthropists or companies dependent on fossil fuels for their profits. But it’s far too simplistic, many social scientists have said, to think that if such efforts were exposed, if the scientific realities defining risks from human-driven warming were undistorted, the world would somehow magically move to abandon polluting energy choices. The epic scope of the climate challenge and the related energy challenge as humanity’s numbers and appetites crest in coming decades will necessitate sustained engagement and communication on a host of fronts involving a wide range of audiences and a wide range of communicators.

While the conventional path of conducting a study or review, writing a paper or report, drafting a press release and then waiting for an experienced science reporter to call will persist for a while, it will

¹⁴ <http://environment.yale.edu/climate/news/global-warmings-six-americas-june-2010/>; <http://pewresearch.org/pubs/282/global-warming-a-divide-on-causes-and-solutions>

¹⁵ http://www.law.georgetown.edu/faculty/lazarus/docs/articles/Lazarus_SuperWickedProblems.pdf

¹⁶ <http://www.time.com/time/covers/0,16641,20060403,00.html>; <http://www.nytimes.com/2006/04/23/weekinreview/23revkin.html>

never again be the norm. Conventional, and particularly specialized, media are a shrinking slice of the world’s fast-expanding pie of communication portals. It would behoove anyone interested in making an impact to experiment with new media, to test boundaries, to interact with audiences of all kinds (making sure to listen as much as expound) and, in the end, to absorb fully that scientific knowledge of climate change is merely a starting point for progress – not a means in itself.

MANY CLIMATE CHALLENGES, MANY PATHS

In July 2010, as the leadership of the I.P.C.C. finished assembling the hundreds of authors for the chapters in its fifth climate assessment, the chairman, Rajendra K. Pachauri, sent a letter to the participating scientists admonishing them to “*keep a distance from the media.*” The defensive tone of the letter was predictable, given the months of assaults on the integrity of the panel from commentators, politicians and groups trying to sustain status-quo energy policies.

But even strong supporters of the climate panel, including scientists who’d signed up to devote a substantial part of the next four years of their lives helping to write the fifth assessment, loudly complained. Edward R. Carr, one of the new panel authors and an associate professor of geography at the University of South Carolina, blogged that this line reflected the same “*bunker mentality*” that had created problems for the panel through the preceding year.

For the panel, and for anyone or any institution trying to communicate clearly and credibly on the state of the climate and choices facing the world’s nations in seeking to limit risks, this is the time to engage, not hunker down. For too long, as Mike Hulme, a professor of climate change at the University of East Anglia has put it, there has been an artificial oversimplification of “global warming” or “climate change” into a single phenomenon, even a badge of identity for some. Hulme, the author of *Why We Disagree About Climate Change*, described the situation in an essay in the *Royal Society Arts Journal* in 2010:

[C]limate change has come to signify far more than the physical ramifications of human disturbance to the composition of the Earth’s atmosphere and its energy balance. Climate change has become as much a social phenomenon as it is a physical one. Arguments about the causes and consequences of climate change – and the solutions to it – have become nothing less than arguments about some of the most intractable social, ethical and political disputes of our era: the endurance of chronic poverty in a world of riches; the nature of the social contract between state and citizen; the cultural authority of scientific knowledge; and the role of

*technology in delivering social goods. Climate change has become a metaphor for the imagined future of human life and civilisation on Earth.*¹⁷

The utter divergence in views of the climate challenge among people with different interests and situations was vividly on display during the two long weeks I spent covering the tumultuous round of treaty negotiations in Copenhagen in December, 2009. There was barely any overlap in positions as angry African delegates stormed through the halls demanding money to help them avoid climate calamity, Chinese diplomats coolly and flatly described their primary need for economic growth, American officials stated flatly they could only offer what was politically possible at home, and environmentalists unveiled a daily "Fossil of the Day" award for countries seen as obstructing commitments to cut emissions.

To my mind, the first step in accurately, and potentially effectively, conveying the science pointing to a rising human influence on the climate system is to separate that body of understanding from the next stages in the debate. These include discussions of the anticipated impacts, along with the uncertainties, and of course how to respond – both through boosting resilience to climate hazards and blunting the rise in concentrations of greenhouse gases.

The next is to embrace the reality that science merely delineates the choices facing societies, and often with very fuzzy – if not entirely blurry – portions of the picture. This is where values come in, including the values of scientists. Scientists happen to be human beings outside their work, and many find themselves both frustrated with stasis and passionate about doing whatever they can to prod society to act in ways that can reduce the chances of big regrets down the line. So what is the right path for a concerned scientist to take?

In a way, there is no best route – as can be seen in the variegated set of paths chosen by Susan Solomon, James Hansen, and dozens of other climate researchers who've decided to take the time and energy required to come out of the computer laboratory or back from field studies to testify at hearings, appear on television, develop blogs, or write columns and books. But there are certainly basic principles that can help scientists and their institutions shape their choices, choose their medium and frame their messages.

Stephen H. Schneider, the Stanford University scientist who passed away in 2010 after spending the better part of four decades

¹⁷ <http://www.thersa.org/fellowship/journal/archive/spring-2010/features/heated-debate>

studying both climate science and policy, always tried to stress the importance of delineating where data left off, expert judgment kicked in and – in the end – where personal values determined choices. He was a big fan of concerted action to cut emissions, but always acknowledged this was his personal view, not a matter of science. Here's how he put it in an e-mail message in 2006:

To be risk averse is good policy in my value system – and we always must admit that how to take risks – with climate damages or costs of mitigation/adaptation – is not science but world views and risk aversion philosophy – and whether you fear more the type one error (wrong forecast so you wasted resources by acting on it) or type two error (right forecast but too uncertain so you didn't act and it happened and you really got hurt by not hedging) is a value tradeoff.

He also frequently stressed the importance of scientists, once familiar with the boundaries laid out above, getting engaged in public discourse. As he put it in the abstract for a talk on climate and communication at the 2010 annual meeting of the American Association for the Advancement of Science:

*Despite controversy, scientists should not be discouraged on principle to enter the public debate on policy issues (climate change in my case) either as scientist-advocates or as scientist-popularizers. If we do not enter the debates, then popularization of complex issues will occur without our direct input and will likely be more inaccurate.*¹⁸

To provide a range of perspectives, I invited some scientists and specialists in science communication to provide some practical advice for those who do jump into the breach.

Susan Joy Hassol, a climate communication consultant and writer:

We can convey the science both accurately and effectively by speaking in simple, plain language ("anthropogenic," for example, is not simple, plain language), leading with what we know, and placing new findings in the context of the core message that climate is warming and that human activities are the primary cause. It's also important to make clear that this conclusion is based on evidence, not opinion or belief. (The term "consensus" can sound like it's referring to opinion.)

One thing to avoid is using words that have different meanings to the public than to scientists. For example, scientists frequently use the word "enhance" to mean increase, but to lay people it means to improve (as in "enhance your appearance"), so the "enhanced greenhouse effect" sounds like a good thing! Try "intensify" or "increase" instead . . . "Positive" connotes good and "negative" connotes bad to nonscientists. So "positive trends" and "positive feedbacks" sound like good things!

¹⁸ <http://aaas.confex.com/aaas/2010/webprogram/Paper2399.html>

To most laypeople, a "theory" is just an unsubstantiated hunch, opinion or conjecture, not what scientists mean at all. See my Eos article, "Improving How Scientists Communicate About Climate Change," for more examples and suggestions for alternatives.¹⁹

Randy Olson, a marine biologist turned filmmaker and, more recently, author, sent a line from *Don't Be Such A Scientist: Talking Substance in an Age of Style*, his book for scientists who want to be understood:

The time has come, in our new media environment, which is so cluttered with information that it is often hard to tell fact from fiction, for new attention to be paid to "errors of boredom," in which the speaker fails to hold anyone's interest.

He then added this thought:

Communication is about "voices." People listen to voices they like. They don't listen to voices they don't like. The bosses at BP figured this out the hard way last spring. Shortly after the Gulf spill they began running television commercials featuring BP CEO Tony Hayward and his British accent. Guess what. Within a month they wised up, dumped those spots, and came out with a whole series of commercials featuring working class Gulf of Mexico residents with their deep southern drawls. It's about voice. Al Gore is a very courageous man, but he speaks with the voice of an affluent, white, older, male Democrat. "An Inconvenient Truth" did an effective job of reaching the affluent, white, older, male Democrat crowd. Now it's time to radiate the message out to other ethnicities, income levels, and sexual persuasions. It's about voices.

Edward Maibach, the director of the Center for Climate Change Communication at George Mason University, speaks as often as he can about the need for "simple, clear messages, repeated often, by a variety of trusted sources." Here's more from him:

This formula for public education/outreach has worked rather well for the public health community on a wide range of health issues, and it is also working rather well for the fossil fuel industry in their efforts to oppose climate legislation. Conversely, the community of climate scientists – like many communities of scientists – hasn't embraced this approach yet. Simplicity of the messages? Message repetition, again and again, at every possible opportunity? Engaging other communities of trusted professional in also stating these messages (again and again)? I don't mean to be harsh, but I think the community of climate scientists is batting 0 for 3 by this measure.

But I have to return to David Ropeik for one more reminder that the most important, and possibly toughest, challenge for climate scientists

¹⁹ <http://www.climatecommunication.org/PDFs/Eos.pdf>

engaging others on this issue is to remember that information is not meaning. Here's how he put it in a note he sent for my blog:

Alone, facts are lifeless stones on the ground. They only become the living walls of our perceptions and ideas based on our interpretations of how they fit together. It's exciting, and cause for hope, that we understand a lot about how this subjective information processing happens. So let's move past the rationalist pretense that there can ever be "perfect" knowledge, and use the rich evidence we have about the subjective ways people process information to help the species think past our instincts and truly grasp that we're living unsustainably in a finite biological system.

With such awareness, scientists or others seeking to captivate and energize the public can dive into the astonishing menu of communication

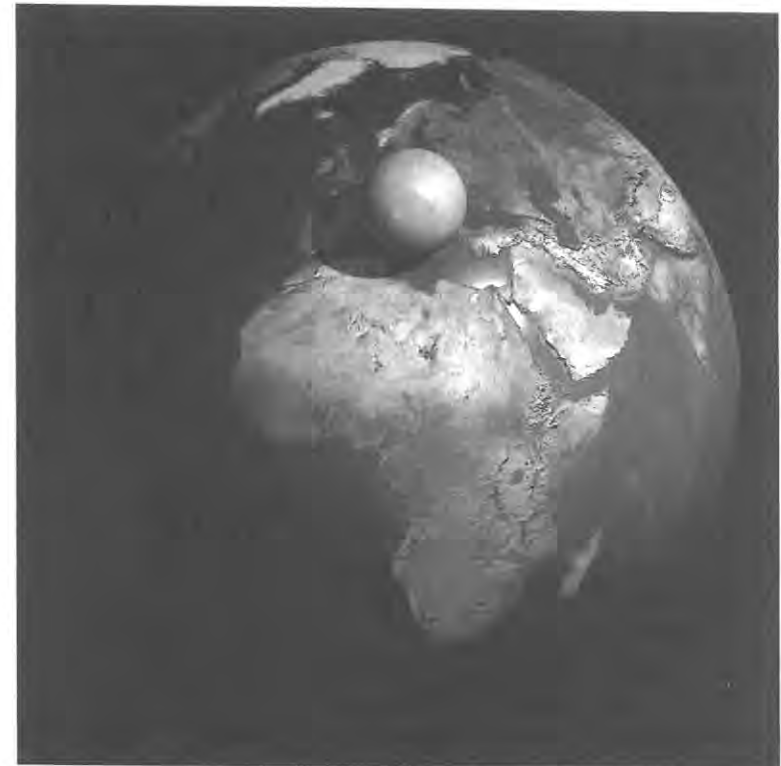


Figure 9.1 Global air volume at sea-level pressure. Conceptual computer artwork of the total volume of air within the Earth's atmosphere, seen as a sphere, centred over Europe. It dramatically shows how finite the available air supply actually is. The sphere measures 1999 kilometres across and weighs 5140 trillion tonnes. (© Adam Nieman/Science Photo Library.) See colour plate section.

pathways to test ways to make information work. For some this may be through a blog like Realclimate.org, a comic strip like the Throbgoblins climate cartoons drawn by Marc Roberts, an eye-opening illustration like Adam Nieman's depiction of the volume of the Earth's atmosphere as a sphere that, when placed alongside the Earth, is not big enough to hide western Europe (Figure 9.1). For others, it may be as simple, and important, as visiting local schools or writing a column for the local paper. There is always the option of doing the work, writing a press release, and waiting for a phone call. But I wouldn't count on that changing the world.