

where researchers tend to be less specialized than in the industrialized West. I have been teaching 3-week short courses in the Caribbean for more than 20 years. In those courses, journalists get access to scientists for 2 weeks, to develop real news stories, and then teach the scientists they have been interviewing better ways to get their research across to the public. The long-term results do not suggest that co-option is a danger.

And while society has warmed slowly to technologies such as the horseless carriage and pasteurization and (now) genetically modified crops, humans although cautious are perhaps not as risk-averse as scientists often complain. After all, new technology has been slipping into society since the first toolmakers appeared about 2 million years ago. There is one caveat. The authors complain that universities do not have the resources to communicate their research well. That is certainly not the case in North America. Money and staffing are available. Often, however, the will is not. Communicators are generally relegated to staff positions and swing into action too late to help shape policy.

Edwards, P. N. (2010). *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. Cambridge: MIT Press. 518 pp.

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For communication scholars, the oft-cited dynamics of the climate debates are all too familiar: media covering science as a conflict between opposite viewpoints, public relations wars by entrenched interests to sow doubt and uncertainty, and the lenses of political ideology and worldview defining the arc of public perceptions. Science itself at times seems to serve as a bystander to the interplay of these forces. *A Vast Machine* provides a new perspective on climate discourses in the United States by shedding light on the ways that climate science, and particularly the discipline of computer modeling, have influenced our evolving understanding of—and response to—global climate change.

Author Paul Edwards, an associate professor at University of Michigan's School of Information, says that he often tells his students to ask the question: "How do you know?" The *raison d'être* for this book is, as he writes, "Everything that we know about the world's climate—past, present, and

future—we know through models.” Within the climate debates, those skeptical of climate science have championed the primacy of observational data over theory. Critics such as physicist Freeman Dyson have claimed: “The climate-studies people always tend to overestimate their models. . . . They forget they are only models.” Edwards argues that these claims presuppose a clear distinction between the three realms of climate science—modeling, theory, and observation—that in fact do not exist. Observational data sets from sources as varied as satellites, ships records, and tree rings require models to assimilate them and interpolate the information onto the global grids required by . . . models. Theory merges with observations within models to represent phenomena such as clouds that cannot be fully expressed by theoretical equations.

Wars over data are an artifact of the way that climate science is conducted, writes Edwards. Taken across the globe over hundreds of years, weather records are subject to the idiosyncrasies of people and their equipment. For meteorologists conducting regional forecasts over short periods of time, these differences matter little, but to climate scientists aggregating myriad global records over centuries, they become enormously important. Edwards terms the continual reinterpretation of historical data *infrastructural inversion*.

Citizen science has at times played a controversial role in this regard, Edwards notes. The challenge to climate scientist Michael Mann’s 1998 Hockey Stick graph reconstructing historical temperature trends—and demands for the Climatic Research Unit data from the University of East Anglia that were revealed during “Climategate” as this book was being completed—are two examples of public attempts to force review of the data. “Climate controversies constantly lead down into the guts of the infrastructure, inverting it and reviving, over and over again, debates about the origins of numbers,” the author writes.

Modern climate politics was born of scientific infrastructure: the “vast machine” of satellites, computers, communication technology, and organizations that create global climate knowledge. For those who follow climatology, the evolution of this structure makes for absorbing reading, but the true relevance for communicators of Edwards’s question “How do we know?” perhaps lies in the layers of the climate debates that are revealed as he peels back the science to find the answer.