Science is a human approach to understanding the world. Nitirak Rakitiworakun/shutterstock

I've wanted to be a scientist since I was five years old.

My idea of a scientist was someone in a lab, making hypotheses and testing theories. We often think of science only as a linear, objective process. This is also the way that science is presented in peer reviewed journal articles – a study begins with a research question or hypothesis, followed by methods, results and conclusions.

It turns out that my work now as a climate scientist doesn't quite gel with the way we typically talk about science and how science works.

Climate change, and doing climate change research, has changed the way I see and do science. Here are five points that explain why.

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1. Methods aren't always necessarily falsifiable

Falsifiability is the idea that an assertion can be shown to be false by an experiment or an observation, and is critical to distinctions between "true science" and "pseudoscience".

Climate models are important and complex tools for understanding the climate system. Are climate models falsifiable?

Are they science? A test of falsifiability requires a model test or climate observation that shows global warming caused by increased human-produced greenhouse gases is untrue. It is difficult to propose a test of climate models in advance that is falsifiable.

Science is complicated - and doesn't always fit the simplified version we learn as children. Foxy Image/shutterstock

This difficulty doesn't mean that climate models or climate science are invalid or untrustworthy. Climate models are carefully developed and evaluated based on their ability to accurately reproduce observed climate trends and processes. This is why climatologists have confidence in them as scientific tools, not because of ideas around falsifiability.

2. There's lots of ways to interpret data

Climate research is messy. I spent four years of my PhD reconstructing past changes in Australian and Indonesian rainfall over many thousands of years. Reconstructing the past is inherently problematic. It is riddled with uncertainty and subject to our individual interpretations.

During my PhD, I submitted a paper for publication detailing an interpretation of changes in Indonesian climates, derived from a stalagmite that formed deep in a cave.

My coauthors had disparate views about what, in particular, this stalagmite was telling us. Then, when my paper was returned from the process of peer review, seemingly in shreds, it turns out the two reviewers themselves had directly opposing views about the record.

What happens when everyone who looks at data has a different idea about what it means? (The published paper reflects a range of different viewpoints).

Another example of ambiguity emerged around the discussion of the hiatus in global warming. This was the temporary slowdown in the rate of global warming at the Earth's surface occurring roughly over the 15 year period since 1997. Some sceptics were adamant that this was unequivocal proof that the world was not warming at all and that global warming was unfounded.

There was an avalanche of academic interest in the warming slowdown. It was attributed to a multitude of causes, including deep ocean processes, aerosols, measurement error and the end of ozone depletion.

Ambiguity and uncertainty are key parts of the natural world, and scientific exploration of it.

3. Sometimes the scientist matters as well as the results

I regularly present my scientific results at public lectures or community events. I used to show a photo depicting a Tasmanian family sheltering under a pier from a fire front. The sky is suffused with heat. In the ocean, a grandmother holds two children while their sister helps her brother cling to underside of the pier.

After a few talks, I had to remove the photo from my PowerPoint presentation because each time I turned around to discuss it, it would make me teary. I felt so strongly that the year we were living was a chilling taste of our world to come.

Just outside of Sydney, tinderbox conditions occurred in early spring of 2013, following a dry, warm winter. Bushfires raged far too early in the season. I was frightened of a world 1°C hotter than now (regardless of what the equilibrium climate sensitivity turns out to be).

At public lectures and community events, people want to know that I am frightened about bushfires. They want to know that I am concerned about the vulnerability of our elderly to increasing summer heat stress. People want to know that, among everything else, I remain optimistic about our collective resilience and desire to care for each other.

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Communicating how we connect with scientific results is also important part of the role of climate scientists. That photo of the family who survived the Tasmanian bushfire is now back in my presentations.

4. Society matters too

In November 2009, computer servers at the University of East Anglia were illegally hacked and email correspondence was stolen.

A selection of these emails was published publicly, focusing on quotes that purported to reveal dishonest practices that promoted the myth of global warming. The "climategate" scientists were exhaustively cleared of wrongdoing.

On the surface, the climategate emails were an unpleasant but unremarkable event. But delving a little deeper, this can be seen as a significant turning point in society's expectations of science.

While numerous fastidious reviews of the scientists cleared them of wrongdoing, the strong and ongoing public interest in this matter demonstrates that society wants to know how science works, and who "does" science.

There is a great desire for public connection with the processes of science and the outcomes of scientific pursuits. The public is not necessarily satisfied by scientists working in universities and publishing their finding in articles obscured by pay walls, which cannot be publicly accessed.

A greater transparency of science is required. This is already taking off, with scientists communicating broadly through social and mainstream media and publishing in open access journals.

5. Non-experts can be scientists

Climate science increasingly recognises the value of citizen scientists .

Enlisting non-expert volunteers allows researchers to investigate otherwise very difficult problems, for example when the research would have been financially and logistically impossible without citizen participation.

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The OzDocs project involved volunteers digitising early records of Australian weather from weather journals, government gazettes, newspapers and our earliest observatories. This project provided a better understanding of the climate history of southeastern Australia.

Personal computers also provide another great tool for citizen collaborators. In one ongoing project, climate scientists conduct experiments using publicly volunteered distributed computing. Participants agree to run experiments on their home or work computers and the results are fed back to the main server for analysis.

While we often think of scientists as trained experts working in labs and publishing in scholarly journals, the lines aren't always so clear. Everyone has an opportunity to contribute to science.

My new book explores this space between the way science is discussed and the way it takes place.

This isn't a criticism of science, which provides a useful way to explore and understand the natural world. It is a celebration of the richness, diversity and creativity of science that drives this exploration.

Sophie Lewis receives funding from the Australian Research Council. She is the author of the book discussed in this article, and has received remuneration for its publication but does not receive royalties.

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