

## Scientist communicators

The slowdown in Earth's surface temperature increase has made headlines worldwide — but mainly to dismiss climate science.

Man-made climate change has been in the news for many years. Previously the message presented to the public was clear: climate change is global warming and that means the temperatures are going to rise unless we do something. This claim seemed to be supported by measurements of continuous increases of atmospheric CO<sub>2</sub> — at a rate not seen before in the historical record — and associated temperature increases. Additionally, projections from climate models seemed to confirm that this was the new normal.

But does the public understand how climate models work? The projections from models are presented without much additional information on how they were obtained. A model is a simplified representation of the Earth's climate system based on knowledge of its various components — physical, biological and chemical processes — and their interactions and feedbacks. A projection of future climate can be made by applying a selected scenario of anthropogenic emissions (and therefore concentrations) or radiative forcing, which is a possible representation of what will happen. The outcome will depend on the scenario and model used as well as the initial conditions. Projections are reported from a number of runs, an ensemble, to capture the most likely future climate. Models for climate change projection using emissions scenarios work best by forecasting over the longer term. But most of us think in the here and now, so the message on climate change might have been heard on a different timescale from what the scientists intended. To complicate things even more, in the past decade the climate hasn't warmed at the rate projected, and evidence of the slowdown in temperature rise has sparked a lively scientific and public debate, as highlighted this month by a collection of articles in our Focus 'Recent slowdown in global warming'.

The media reporting of a 'hiatus' came as a surprise to the public. Prior to this, the message had been of continuous warming — to be suddenly told that this was not true led to confusion. Questions started to arise as to whether the previous message had been incorrect — was global warming not happening? This, at least, was the take of sceptics who almost immediately organized their campaign to weaken the case for governments' action on climate



change, as Bob Ward explains in his interview on page 170. Their campaign, thanks also to some media representations, was unfortunately successful as the seeds of doubt were quickly sown in the minds of the public. In a Commentary on page 156, Maxwell Boykoff specifically examines the media reporting and highlights how easy it was to confuse the public discourse around the complexity of climate change. The scientists did not help either, as they were quite slow at responding and, according to Ward, showed a lack of understanding of the rules of public engagement.

The response from the scientific community was to emphasise that climate change is a long-term concern, while the hiatus is a temporary phenomenon, and to highlight that natural variability has a role to play in the shorter term. The climate system consists of many natural cycles operating on differing timescales, and in combination they result in short-term natural variability. These can work to lower, or raise, the global mean surface temperature through heat uptake or release from the oceans, among other processes. There is a lot of uncertainty associated with these cycles that carries through to model representations and projections. As Ward explains, whilst reducing uncertainty is a key research question, it should not be the starting point in communication. The surprise of the slowdown in warming and the subsequent

media engagement by scientists, with a focus on uncertainties, leaves the public questioning what is actually known.

Researchers should have reiterated that the science on long-term climate change is solid and widely agreed on — 97% of scientists working in the subject support the principle of anthropogenic climate change (W. R. L. Anderegg, J. W. Prall, J. Harold and S. H. Schneider, *Proc. Natl Acad. Sci. USA* **107**, 12107–12109; 2010). Then, the questions about why the timing of the hiatus had not been predicted should have been addressed.

In the recent IPCC 5th Assessment Report, Working Group I — who assess the physical science basis of climate change — made it clear that the climate system has been warming unequivocally and that many of the observed changes since the 1950s are unprecedented over decades to millennia. Over the same period of time, greenhouse gas concentrations have increased and the atmosphere and ocean have warmed, the amounts of snow and ice have diminished and sea levels have risen (IPCC *Climate Change 2013: The Physical Science Basis* (eds Stocker, T. *et al.*) Cambridge Univ. Press; 2013). This is what is known and is what communication efforts should focus on. But communication does not work if it is not tailored to the targeted audience — in this case the general public. And addressing the public is an ongoing job scientists should proactively take on. □