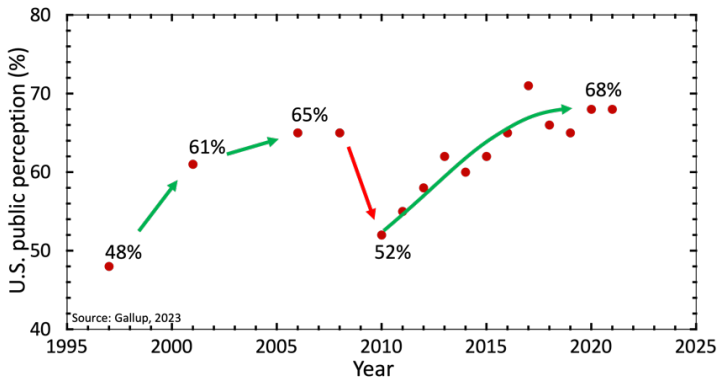
scepticism of this scientific consensus arose in the public arena. How that doubt emerged will be the subject of the next lecture, but let's consider the changing public perception in the U.S.

14.2.3 Public Perception of Consensus



The Gallup environment poll showed that in 1997 only 48% of the U.S. public thought that 'most scientists believe that global warming is occurring'. However, this figure rose sharply such that some 61% of the U.S. public thought this by 2001. This number rose still further to 65% by 2006, but dropped dramatically to 52% by 2010. By 2021, this number rose to 68%, but it seems to stubbornly refuse to rise much higher.

I would argue that this poll is a measure of the U.S. public's perception of the scientific consensus around climate change. Is this reflected in the published, peer-reviewed scientific literature?

The first attempt to determine the level of scientific consensus in the published, peer-reviewed scientific literature was conducted in 2004 by Naomi Oreskes, the co-author of the book *Merchants of Doubt*. Oreskes found that in the 928 papers published in the 10 years between 1993 and 2003 that talked about global warming not one rejected the scientific consensus. Indeed, in a later study of the scientific literature by John Cook and co-authors in 2013, that in a survey of 11,944 abstracts from peer-reviewed journals 97.1% agreed with the scientific consensus that human-induced climate change is real and happening.

	Oreskes (2004)[35]	Cook *et al.* (2013)[36]
papers surveyed	928	11,944
percentage agreed	100%	97.1%
public perception in year of study	64%	62%

There is a disconnect between the public perception of the level of consensus present among scientists studying climate change and the consensus among scientists themselves. This scientific consensus is represented in the reports of the IPCC and is the position of every national and international scientific body.

It is always possible that the scientific consensus might be wrong. If the history of science has taught us anything, it is humility! Many details about climate interactions are not well understood, and there are ample grounds for continued research to provide a better basis for understanding climate dynamics. The question of what to do about climate change is also still open. But there is a scientific consensus on the reality of human-induced climate change. Climate scientists have repeatedly tried to make this clear. Doing nothing is simply not an option!

14.3 Convincing the Scientific Community (I)

We have established that there is a scientific consensus that human-induced climate change is happening, but we need to address the question of how this was established. In this, I mean what was it that convinced the

[35] Oreskes, N. (2004). The scientific consensus on climate change, *Science*. **306(5702):** 1686–1686.
[36] Cook, J., Nuccitelli, D., Green, S. A., Richardson, M., Winkler, B., Painting, B., Way, R., Jacobs, P., and Skuce, A. (2013). Quantifying the consensus on anthropogenic global warming in the scientific literature, *Environmental Research Letters*. **8(2):** 024024.

scientific community to take such a consensus position? What are the observational data and computer modelling that is so persuasive?

There are a number of questions that need to be answered. First, does the observational record show that average global temperatures are rising? Second, is the temperature rise unusual? Third, are atmospheric greenhouse gas concentrations also increasing? Fourth, is the rise in carbon dioxide due to the burning of fossil fuels? And finally, do we understand human-induced climate change? In this part of my lecture, I will address the first three questions, and address the final two in the next, and last part, of my lecture.

14.3.1 Instrumental Temperature Record

Figure 167: Logos of the National Aeronautics and Space Administration (public domain), the National Oceanic and Atmospheric Administration (public domain), UK Meteorological Office (fair use), and the Japan Meteorological Agency—the four keepers of records on global temperatures.

Let's consider the instrumental average global surface temperature record. The first issue that we are faced with when looking at the instrumental record is which instrumental record. There are four major keepers of records on global temperature. From the United States, there are the NASA and NOAA datasets, but there are also datasets from the United Kingdom and Japan.

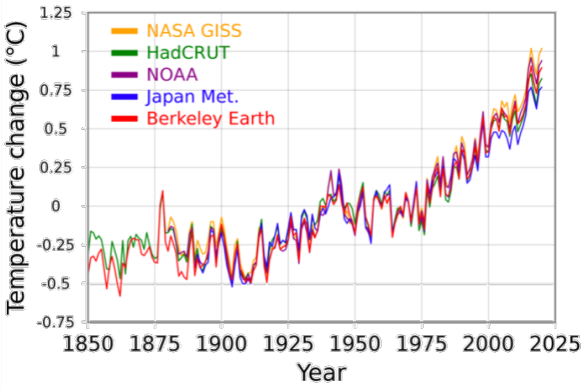


Figure 168: Average global temperatures from NASA, UK Met Office, NOAA, Japan Meteorological Agency, and Berkeley Earth (CC by 4.0).

In general, the datasets agree, but there are small differences as illustrated in Figure 10. Note that a fifth dataset from Berkeley Earth is also included. These datasets use the 1951–1980 period as the baseline for temperature change.

The average pairwise correlation between the five datasets illustrated here is 99.04%, but why don't the five datasets agree perfectly?

The answer to this question lies in the nature of the sources of the data used in these constructions. The data used in these constructions are collected at thousands of meteorological stations, buoys, and ships around the globe. The longest-running temperature record is the Central England temperature data series, which started in 1659. However, the longest-running quasi-global record starts in 1850.

Although all four major datasets have strong similarities in how they track and analyse temperatures, there are subtle differences. The NASA record tends to run slightly higher than the Japanese record, while the United Kingdom and NOAA records are usually in the middle.