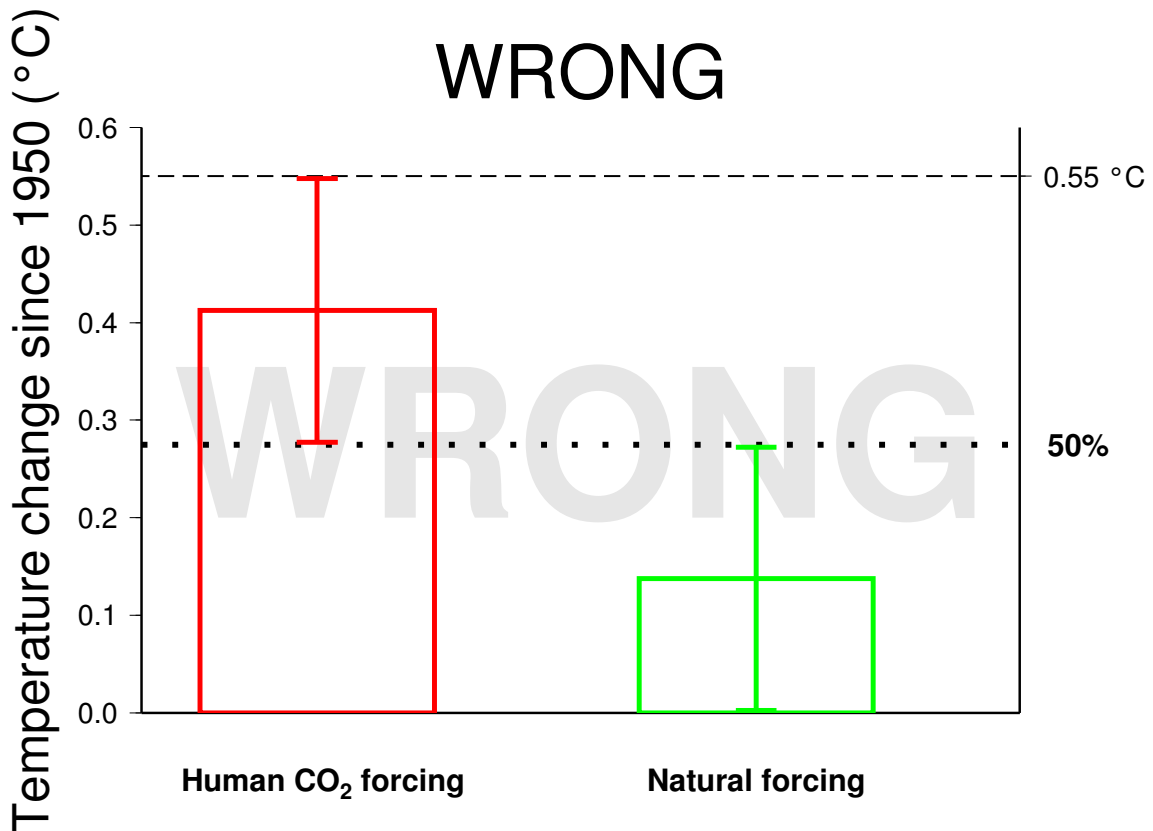


The overwhelming majority of scientists endorse this statement:

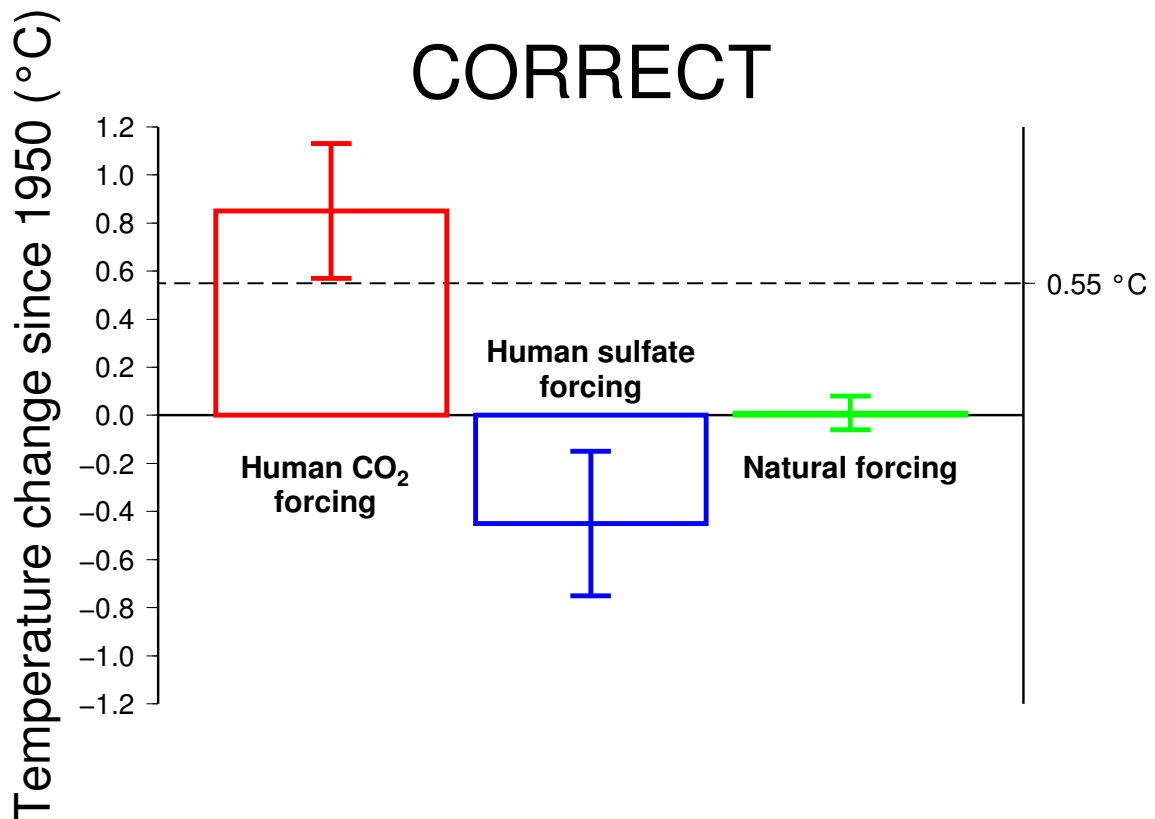
“Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.” [IPCC Summary for Policymakers, 2007]

Here, “most” means at least 50% of the 0.55°C rise since 1950. Some mistakenly call this an “alarmist exaggeration” but it actually *understates* the human contribution because it’s easy to incorrectly conclude that the other 50% of the trend might be caused by natural forcing variations:



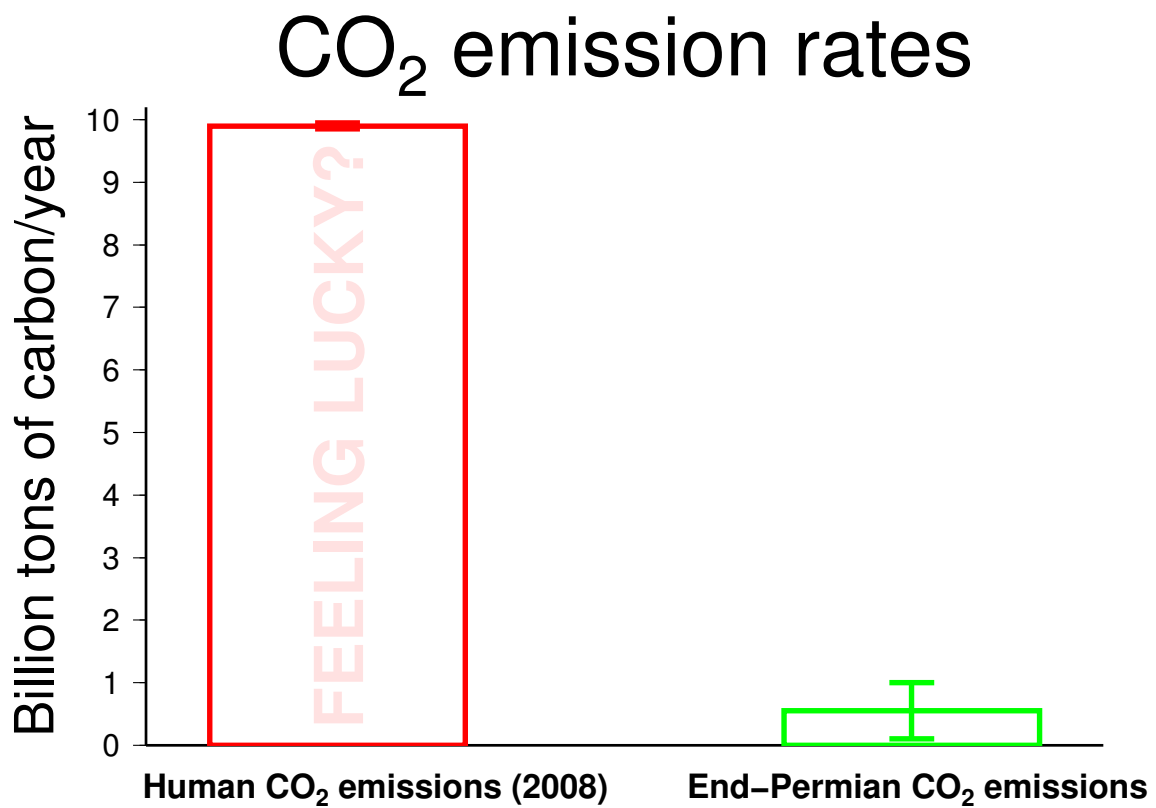
Actually, the percentage of the observed temperature trend due to natural forcing variations (changes in the Sun's brightness or volcanic eruptions, etc.) can't be as large as 50%. In fact, the trend due to natural forcing variations since 1950 is nearly zero.

The percentage of the observed temperature trend due to human CO<sub>2</sub> emissions is probably higher than 100%. This is possible mainly because humans emit greenhouse gases like CO<sub>2</sub> which warm the surface over the long term, *and* sulfates which cool the surface over the short term. Upper and lower uncertainties are also shown:



Source: [Huber and Knutti, "Anthropogenic and natural warming inferred from changes in Earth's energy balance," Nature Geoscience, vol. 5, pp. 31-36, 2012.](#)

Some say we should increase sulfate emissions to compensate for the long-term warming due to our CO<sub>2</sub> emissions. However, the CO<sub>2</sub> would still acidify the oceans, which probably caused mass extinctions in the past. For instance, 250 million years ago, 90% of all species on Earth died. This “end-Permian” extinction was preceded by massive emissions of greenhouse gases, including CO<sub>2</sub>. This ancient evidence is uncertain, but even the highest estimated end-Permian emission rate is  $\sim 10x$  slower than the modern human emission rate:



Source: [Honisch, et al., “The Geological Record of Ocean Acidification”, Science 335, 1058, 2012.](#)