

# GLOBAL WARMING IS HAPPENING

## FACT

## MYTH

## FALLACY

<p>Our planet has continued to build up heat since 1998 - global warming is still happening.</p>	<p>"Global warming stopped in 1998."</p>	 <p><b>Cherry picking:</b> looking at one region or a short period ignores the full picture.</p>
<p>Global warming is like rigging the weather dice, making it more likely to get hot days.</p>	<p>"It's cold outside, so global warming must have stopped."</p>	 <p><b>Impossible Expectations:</b> global warming doesn't mean no more cold weather, just fewer cold days compared to hot days.</p>
<p>Overall, glaciers across the globe are shrinking at an accelerating rate, threatening water supplies for millions of people.</p>	<p>"Glaciers around the world are increasing, disproving global warming."</p>	 <p><b>Cherry picking:</b> picking a handful of growing glaciers ignores the vast majority of glaciers that are shrinking.</p>
<p>Greenland on the whole is losing ice, at a rate of over 2 Mount Everests worth of ice every year</p>	<p>"Greenland Ice sheet is thickening in the middle so it must be gaining mass."</p>	 <p><b>Cherry picking:</b> looking at the whole ice sheet shows it's thickening in the middle but ice loss at the edges is accelerating.</p>
<p>The West Antarctic ice sheet is losing hundreds of billions of tonnes of ice every year, making it a major contributor to global sea level rise.</p>	<p>"Antarctic sea ice is on the increase and casts doubt on global warming."</p>	 <p><b>Over simplification:</b> A number of factors may contribute to the increase in sea ice - but in no way does it change the fact that climate change is happening.</p>
<p>We can measure temperature in many ways and they all say the same thing - our planet is warming.</p>	<p>"The thermometer record is unreliable."</p>	 <p><b>Jumping to conclusions:</b> just because measurements have uncertainty doesn't mean it's unknowable. The uncertainty is smaller than measured global warming.</p>
<p>Urban heat has had minimal effect on the climate record, with much warming happening where there is little urban development.</p>	<p>"Urban development is responsible for much of global warming over the last century."</p>	 <p><b>Jumping to conclusions:</b> just because urban heat might affect the climate record doesn't mean it does. Scientists have confirmed it has negligible effect.</p>
<p>Slowing jet stream is causing Arctic cold air to leak down into Europe and North America, like an open fridge leaking cold air into the kitchen</p>	<p>"Record cold winters disprove global warming."</p>	 <p><b>Jumping to conclusions, cherry picking:</b> a cold winter doesn't disprove global warming, you need to look at the big picture.</p>
<p>Climate change and global warming have both been used for decades.</p>	<p>"They changed name from 'global warming' to 'climate change'."</p>	 <p><b>Misrepresentation:</b> they didn't change the name.</p>

# WE'RE CAUSING GLOBAL WARMING

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<p>For thousands of years, our atmosphere has been in balance. Humans have upset the balance.</p>	<p>"Human CO2 emissions are tiny compared to natural CO2 emissions so our influence is negligible."</p>	 <p><b>Over-simplification:</b> considers only natural CO2 emissions and ignores natural CO2 sinks.</p>
<p>Human emissions are responsible for all of the increase in CO2 in the air over the past two centuries.</p>	<p>"Volcanoes produce more CO2 than humans."</p>	 <p><b>Jumping to conclusions:</b> volcanoes do produce CO2, but over recent centuries the amounts are too small to account for the observed changes in the air.</p>
<p>If we stopped emitting CO2, it would take thousands of years for the atmosphere to return to pre-industrial levels.</p>	<p>"CO2 has a residence time of only 4 years so CO2 levels would fall quickly if we stopped emitting."</p>	 <p><b>Red herring:</b> how quickly a CO2 molecule moves around the climate system is different to how long it takes CO2 level to return back to normal.</p>
<p>Greenhouse gases are like a blanket. They trap heat, sending it back down to Earth where we measure it.</p>	<p>"Greenhouse effect violates the 2nd law of thermodynamics."</p>	 <p><b>Misrepresentation:</b> 2nd law talks about net flow of energy and doesn't forbid some flow from cool to hot.</p>
<p>Emitting more CO2 means more heat is being trapped high up in the atmosphere where the air is thinner.</p>	<p>"The greenhouse effect is saturated so adding more CO2 won't affect it."</p>	 <p><b>Over-simplification:</b> considers atmosphere as a single layer when it's multiple layers.</p>
<p>Ice cores tell us warming causes the ocean to emit more CO2. Combined with greenhouse effect, this is a reinforcing feedback.</p>	<p>"CO2 lagging temperature means greenhouse effect is minimal."</p>	 <p><b>False dichotomy:</b> it's not one or the other but both. CO2 causes warming and warming causes CO2 to rise.</p>
<p>One human fingerprint is a cooling upper atmosphere with a warming lower atmosphere. Satellites have measured this pattern.</p>	<p>"One fingerprint of human-caused global warming is the tropospheric hot spot which hasn't been observed."</p>	 <p><b>Red herring:</b> hot spot is irrelevant to greenhouse warming.</p>
<p>Satellites measure the warming effect from CO2 - the increased greenhouse effect is an observed reality.</p>	<p>"CO2 is a trace gas so it's warming effect is minimal."</p>	 <p><b>Red herring:</b> trace amounts of substances can have a strong effect and this is irrelevant to the warming potential of CO2.</p>
<p>Changing patterns in the yearly and daily cycle confirm human-caused global warming, rule out the sun.</p>	<p>"The sun is causing global warming."</p>	 <p><b>Cherry picking:</b> ignores human fingerprints and recent period where sun and climate move in opposite directions.</p>

# PAST & FUTURE CLIMATE CHANGE

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<p>Past climate change tells us climate is sensitive to the warming effect of CO<sub>2</sub>.</p>	<p>"Natural climate change in the past implies current climate change is also natural."</p>	 <p><b>Jumping to conclusions:</b> past climate change actually sends the opposite message than what the myth concludes.</p>
<p>Natural influences that ended the Little Ice Age have been swamped by recent human activity.</p>	<p>"Current warming is just the continuation of natural recovery from the Little Ice Age."</p>	 <p><b>Red Herring:</b> the natural factors that ended the Little Ice Age are no longer significant.</p>
<p>In the past when the sun was cooler, CO<sub>2</sub> was higher. The two roughly balanced each other. We are now raising CO<sub>2</sub> levels with a warmer sun.</p>	<p>"CO<sub>2</sub> was higher in the past but the world didn't boil away so the greenhouse effect is weak."</p>	 <p><b>Cherry picking:</b> ignores the role of the sun which was cooler in the past.</p>
<p>While the Medieval Warm Period saw unusually warm temperatures in some regions, globally the planet was cooler than now.</p>	<p>"The Medieval Warm Period was warmer than current conditions. This implies recent warming is not unusual and must be natural."</p>	 <p><b>Cherry Picking:</b> For average temperature over wide regions, the hot regions were cancelled out by other cool regions.</p>
<p>Models are based on fundamental physical principles.</p>	<p>"Models are unreliable."</p>	 <p><b>Impossible expectations:</b> no model is perfect but they are useful tools that can reproduce the past and provide insights into the future.</p>
<p>Models have made a number of successful predictions.</p>	<p>"Models predictions have failed, making them unreliable."</p>	 <p><b>Impossible expectations:</b> climate models have had great success at predicting long-term effects like greenhouse warming.</p>
<p>Climate models simulate climate which is weather averaged over time.</p>	<p>"Scientists can't even predict weather."</p>	 <p><b>Red herring:</b> Confusing weather with climate distracts from the fact that short-term predictions have little relevance to long-term climate predictions.</p>
<p>In the 1970s, the majority of climate papers were predicting warming.</p>	<p>"In the 1970s, climate scientists were predicting an ice age."</p>	 <p><b>Misrepresentation:</b> confuses mainstream media reports with scientific papers which overwhelmingly pointed towards warming.</p>
<p>Even if the sun fell to Maunder Minimum levels, it would only delay global warming by a decade.</p>	<p>"We're heading into another ice age because of the cooling sun."</p>	 <p><b>Misrepresentation:</b> overstating the role of solar activity on climate - it actually has had little effect.</p>
<p>The IPCC is 20 times more likely to underestimate rather than exaggerate climate impacts.</p>	<p>"Climate models and the IPCC are alarmist."</p>	 <p><b>Cherry picking:</b> selectively looks at a few examples where the IPCC overestimated climate change, ignoring the much larger number of examples of underestimation.</p>

# CLIMATE IMPACTS

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<p>The amount of water vapor in the air depends on temperature. Warming causes water vapor to rise, which causes further warming: a reinforcing feedback.</p>	<p>"Water vapor is the strongest greenhouse gas."</p>	 <p><b>Red herring:</b> the fact that water vapor is a strong greenhouse gas means it amplifies the warming from greenhouse gases.</p>
<p>Clouds provide a reinforcing feedback but the effect isn't strong. Clouds play a minor role in climate sensitivity.</p>	<p>"Clouds provide negative feedback."</p>	 <p><b>Oversimplification:</b> acting as if clouds only have a cooling effect ignores that they can also warm.</p>
<p>Mass extinctions happen when climate changes too fast for species to adapt. Currently species are going extinct at similar rates to past mass extinctions.</p>	<p>"Species can adapt to climate change."</p>	 <p><b>Jumping to conclusions:</b> just because species can adapt to some climate change doesn't mean they can adjust to the rapid climate change happening now.</p>
<p>Polar bears need sea ice to hunt so the shrinking of Arctic sea ice is endangering their populations.</p>	<p>"Polar bear numbers have increased so they're in no danger from global warming."</p>	 <p><b>Oversimplification:</b> one threat (hunting) has been removed but replaced with an increasing threat (melting sea ice).</p>
<p>Ocean acidity has increased 30% and poses serious threats to coral reefs that are also threatened by warming oceans and bleaching.</p>	<p>"Ocean acidification isn't serious."</p>	 <p><b>Misrepresentation:</b> ocean acidification means oceans are decreasing in pH so they are getting more acidic, even if they are not actually acid.</p>
<p>Climate change is having negative impacts on all parts of society.</p>	<p>"Global warming is good."</p>	 <p><b>Cherry picking:</b> this focuses on a few good impacts of global warming but ignores the overwhelming number of bad impacts.</p>
<p>A pollutant is any substance that disrupts the environment - CO2 does that by trapping heat.</p>	<p>"CO2 is not a pollutant."</p>	 <p><b>Red herring:</b> quibbling over technical definitions of pollutant is a distraction from the realities of the negative impacts of global warming.</p>
<p>Climate change impacts agriculture through extreme weather: heat stress and flooding.</p>	<p>"CO2 is plant food."</p>	 <p><b>Oversimplification:</b> CO2 fertilisation is just one factor affecting plant growth. The full picture shows that negative impacts outweigh benefits.</p>
<p>Risk from extreme weather is increasing, albeit some forms of extreme weather are more confidently linked to global warming than others.</p>	<p>"Extreme weather not linked to global warming."</p>	 <p><b>Jumping to conclusions:</b> just because extreme weather happened in the past doesn't mean climate change isn't having an influence now.</p>