










# GLOBAL WARMING IS HAPPENING

## FACT

## MYTH

## FALLACY










Our planet has continued to build up heat since 1998 - global warming is still happening.	"Global warming stopped in 1998."	 <b>Cherry picking:</b> looking at one region or a short period ignores the full picture.
Global warming is like rigging the weather dice, making it more likely to get hot days.	"It's cold outside, so global warming must have stopped."	 <b>Impossible expectations:</b> global warming doesn't mean no more cold weather, just fewer cold days compared to hot days.
Overall, glaciers across the globe are shrinking at an accelerating rate, threatening water supplies for millions of people.	"Glaciers around the world are increasing, disproving global warming."	 <b>Cherry picking:</b> picking a handful of growing glaciers ignores the vast majority of glaciers that are shrinking.
Greenland on the whole is losing ice, at a rate of over 2 Mount Everests worth of ice every year	"Greenland Ice sheet is thickening in the middle so it must be gaining mass."	 <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.
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.	"Antarctic sea ice is on the increase and casts doubt on global warming."	 <b>Oversimplification:</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.
We can measure temperature in many ways and they all say the same thing - our planet is warming.	"The thermometer record is unreliable."	 <b>Jumping to conclusions:</b> just because measurements have uncertainty doesn't mean it's unknowable. The uncertainty is smaller than measured global warming.
Urban heat has had minimal effect on the climate record, with much warming happening where there is little urban development.	"Urban development is responsible for much of global warming over the last century."	 <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.
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	"Record cold winters disprove global warming."	 <b>Jumping to conclusions and cherry picking:</b> a cold winter doesn't disprove global warming, you need to look at the big picture.
Climate change and global warming have both been used for decades.	"They changed name from 'global warming' to 'climate change'."	 <b>Misrepresentation:</b> they didn't change the name.

# 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>Oversimplification:</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 space 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>Oversimplification:</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 its 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

## FACT

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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 and ignoring 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>