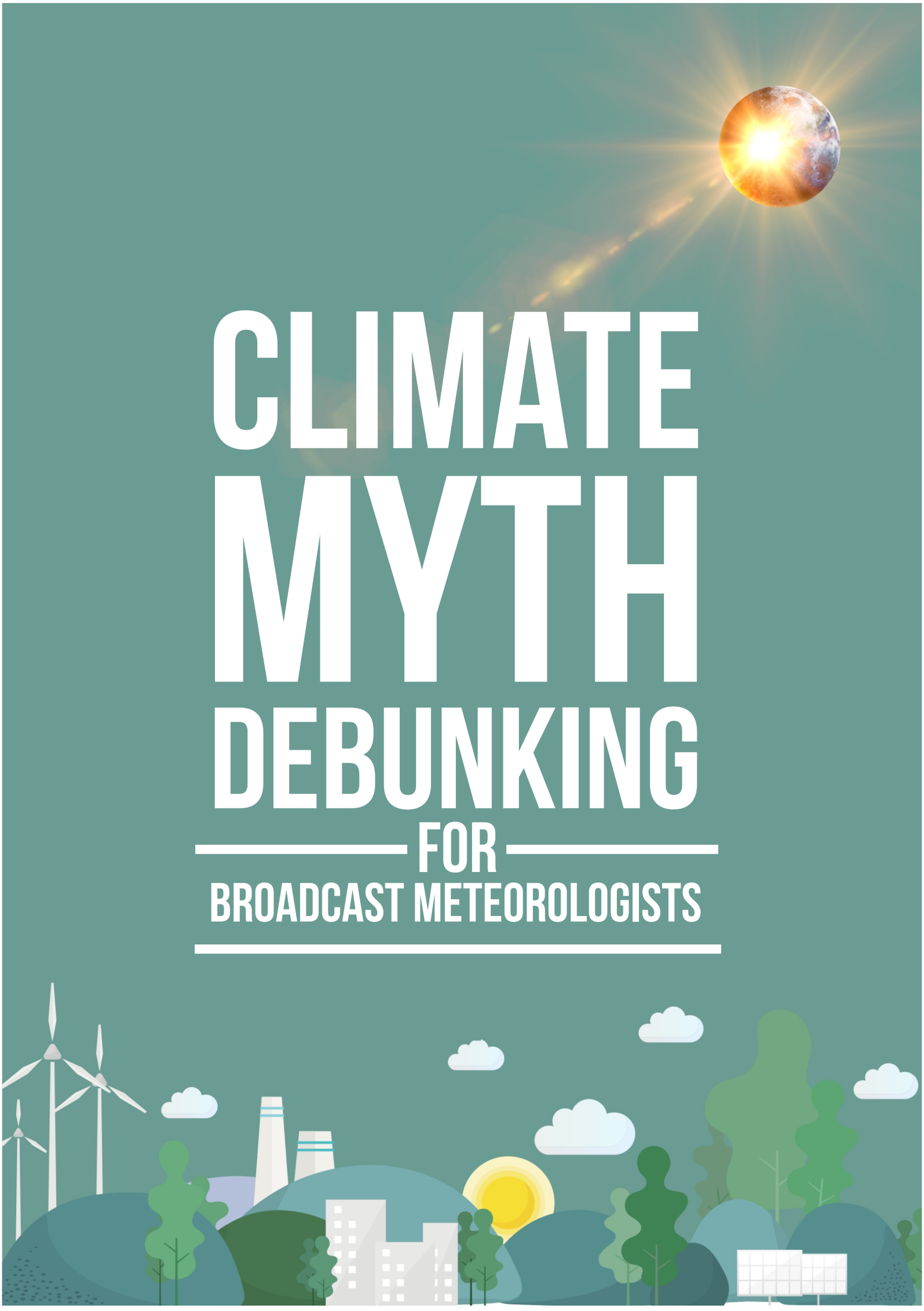
CLIMATE
MYTH
DEBUNKING
FOR
BROADCAST METEOROLOGISTS

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INTRODUCTION

Broadcast meteorologists are in a unique position to communicate with the public about climate change. They are a highly trusted source of scientific information, and studies have shown that when broadcast meteorologists educate their audiences about climate change, their audiences gain new knowledge[5, 18]. However, efforts to communicate about climate change can be canceled out by misinformation[3, 23]. This means addressing misinformation is an important part of engaging the public about climate change. To improve effectiveness, addressing misinformation and misconceptions should be approached as a positive, educational opportunity rather than a negative, confrontational exercise. This toolkit will provide interested broadcast meteorologists with evidence-based guidance on how to address climate change misinformation.

KEY DEBUNKING TERMS

PSYCHOLOGICAL INOCULATION

Creating resistance to misinformation by exposing subjects to misinformation messages, before they are actually encountered “in the wild”, and explaining why they are false/misleading. Explanations are preceded by a warning that those messages will be encountered “in the wild”.

MISINFORMATION

Information that turns out to be false and may not be communicated with the intent to mislead an audience

DISINFORMATION

Misinformation that is deliberately disseminated with the intent to mislead

FAKE NEWS

False information, often of a sensational nature, that mimics news media content

Terms like “misinformation,” “disinformation,” and “fake news” have become staples of our vocabulary. Misinformation can cause widespread societal harm. For example, we have seen how COVID-19 conspiracy theories resulted in resistance to government-recommended safety protocols such as mask-wearing and vaccination[6,7]. In this handbook, we will focus on debunking climate change misinformation through psychological inoculation, so named for its parallels to the process of biological inoculation. Psychological inoculation is a process of exposing people to examples of misinformation techniques, including refutations of the misinformation, so that they build “cognitive antibodies,” enabling them to spot and resist misinformation in the future. Psychological inoculation has proven effective across a number of topics, including climate change[14].

Human-induced climate change is causing changes to our weather, our ecosystems, our infrastructure, and our health, most of which are having adverse consequences. People in families, businesses, communities and governments need to understand what is happening—and what they can do about it—so they can make the best possible decisions about how to respond. However, pervasive misinformation about the causes, scientific consensus, and effects of climate change has resulted in denial and dismissiveness regarding the issue. While only a small minority of Americans hold and defend such dismissive beliefs[11], misinformation has a large impact beyond this minority. Influential individuals and groups continue to sow doubt about the science and have been able to cultivate enough climate skepticism and confusion to derail public understanding and policy responses[12].

That's where broadcast meteorologists come in.

Why Should Television Meteorologists Debunk Misinformation?

Television meteorologists are credible sources for climate change information with a unique opportunity to reach a large, diverse audience.

- Television meteorologists are the only scientists in most newsrooms, and they are the only scientists that most people know by name.
- Many people see their favorite broadcast meteorologists almost every day, figuratively inviting them into their homes.
    - This makes broadcast meteorologists an accessible and trusted source of scientific information—especially climate information.
- Surveys have shown that local news audiences are highly diverse, including members of all education groups, income brackets, and racial and ethnic groups[4,19].
    - This creates a unique opportunity for television meteorologists to bring climate change information to a large, diverse, trusting audience.
- Exposure to climate education provided by a local broadcast meteorologist helps audience members develop a more accurate understanding of the topic[5].
    - In media markets where meteorologists educate their viewers about the local ramifications of global climate change, their audiences show a more accurate understanding about climate change and climate risks[18].

Given broadcast meteorologists' proven effectiveness in explaining climate change to the public in compelling, trustworthy ways, they are also well positioned to aid local communities in overcoming the negative effects of misinformation, disinformation, and fake news through debunking.

Why Misinformation Can't Be Ignored

Misinformation can result in negative consequences for society as a whole. For example, misleading exaggeration and lies about vaccine side effects has led to lower vaccination rates in the US—which in turn was the likely cause of recent measles outbreaks[15]. Similarly, misinformation regarding climate change leads to decreased public support for mitigation efforts that are vital to preventing the consequences of climate change[3].

Further, misinformation can cancel out efforts to communicate accurate information. When people are shown conflicting messages (e.g., facts and misinformation) with no way of resolving the conflict, the two cancel each other out[23]. This means that communicating accurate information can be insufficient. If we fail to address misinformation, we leave the public (and our attempts to communicate scientific information) vulnerable to be undermined by misinformation.

Overall, misinformation about climate change works to deny the public of their right to accurate information about the risks they face. Risks from climate change can be lessened and/or adapted to through a variety of strategies. By deterring adoption of policies and providing false information about risk, misinformation robs the public of their ability to effectively respond to climate change.

That being said, addressing misinformation doesn't need to be a negative or combative activity. Educational research has established that explaining scientific concepts by directly addressing misconceptions is one of the most powerful ways of teaching science[22]. Directly addressing misconceptions and misinformation about climate change presents a unique opportunity for scientists to educate the public effectively.

> addressing misinformation doesn't need to be a negative or combative activity

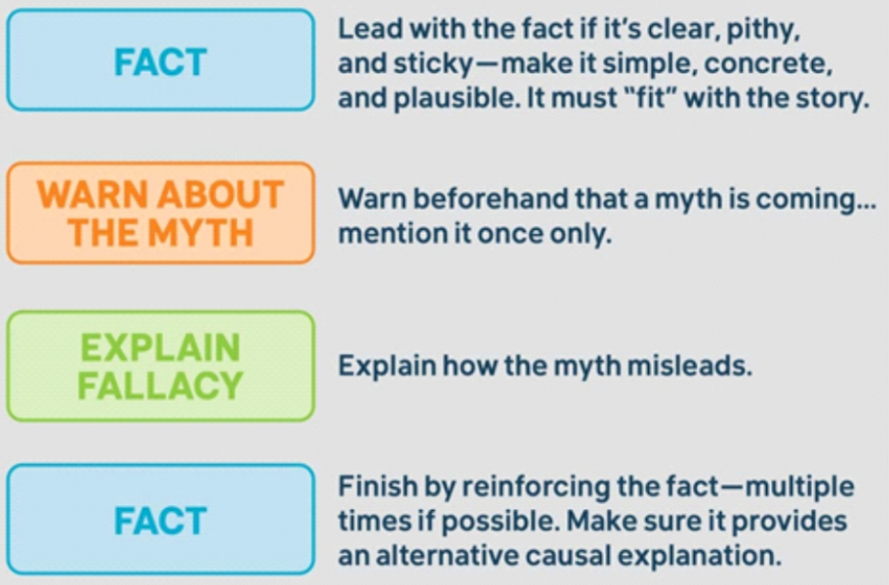
Breaking the Climate Silence

Research has shown that many people choose not to talk about climate change—and other issues —because they fear judgment or pushback from others. This comes from a phenomenon known as pluralistic ignorance—the tendency for people to misperceive others' opinions, thinking that they are in a minority when in reality, most others hold the same opinions[8]. This has been a barrier in the past that prevented broadcast meteorologists from discussing climate change on air. However, a majority (62%) of broadcast meteorologists who share climate-change-related information with their audiences receive mostly positive responses from their audience[21].

While the fear of being disliked or losing respect of the audience after discussing climate change is certainly understandable, broadcast meteorologists can rest assured that 70% of Americans believe climate change is happening, and will appreciate hearing about climate change from broadcasters[8, 21, 10, 11].

How to Structure a Debunking

An effective debunking should aim to incorporate the following elements, following the Fact-Myth-Fallacy-Fact structure[13]:

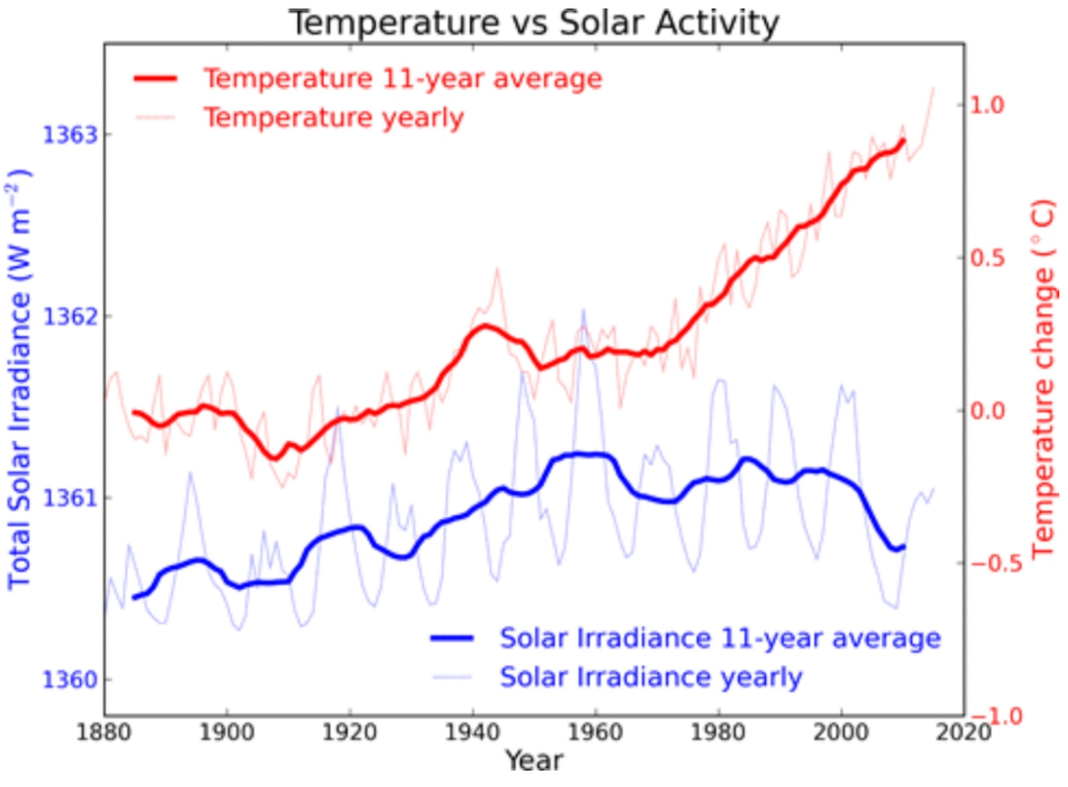


Fact-Myth-Fallacy-Fact Example

> **“Climate change is caused by the sun”**

Breaking the Climate Silence

The sun has been cooling over the past 35 years, while Earth has been warming. Some sources cherry-pick data from earlier time periods where both the sun and the Earth were warming. This draws a false conclusion by ignoring the past 35 years where the sun has cooled while the Earth has continued to warm. Thus, the sun cannot be the main factor controlling Earth's temperature.



Debunkings of Common Myths

Explaining misleading techniques

The FLICC taxonomy is a helpful framework for making sense of the different misleading techniques used in misinformation. FLICC stands for the five techniques of science denial: fake experts, logical fallacies, impossible expectations, cherry picking, and conspiracy theories. See the appendix for a grahical representation of the taxonomy and definitions of commonly used denial techniques. More information on FLICC is available at http://sks.to/flicc.

This section contains the ten most common myths and misconceptions about climate change, as well as simple, clear debunkings of those myths.

Fact	Myth	Fallacy
At least 97% of climate scientists, and virtually all US science organizations are convinced based on the evidence that climate change is happening because of human activities such as the burning of fossil fuels (i.e., electricity generation, transportation). (Full article)	Scientists don't agree on human-caused global warming.	**Fake experts:** A petition contesting the validity of human-caused climate change that was signed by a large number of science graduates has been presented as evidence for expert disagreement. However, virtually all the signatories do not have any expertise in climate or atmospheric science.
Earth's climate has changed before in response to a number of natural factors, including orbital cycles and	Climate is changing now because the climate has always changed.	**Single cause:** This myth wrongly assumes that because natural causes
changes in CO2 levels. However, scientific research has established that none of the natural drivers of climate change are responsible for current changes, which are driven by human activity.(Full article)		drove climate change in the past, natural causes must also be the cause now. But human activity is the main driver of climate change now.

Debunkings of Common Myths

In the 1970's, a majority (62%) of published climate science predicted global warming due to increasing greenhouse gases . 10% of published climate science studies predicted cooling and an impending ice age. Six times more studies predicted warming than cooling, and these predictions were subsequently verified by observed warming of the planet. (Full article)	Scientists predicted an ice age in the 1970s.	**Straw man:** This myth misrepresents media coverage as scientific research. Sensational ice age stories were published by the media in the 1970s, giving the impression that most climate scientists werepredicting cooling. The media ignored studies that predicted warming in favor of dramatic headlines about an impending ice age. This skewed coverage distorted public understanding about what climate science actually said, making it easier to cast doubt on the fact that our planet is currently warming due to human activity.
The sun has been cooling over the past 35 years, while Earth has been warming. It has been known since 1896 that changing the chemistry of the atmosphere by increasing CO2 must raise temperatures. (Full article)	Climate change is caused by the sun	**Cherry picking:** Some sources cherry -pick data from earlier time periods where both the sun and the Earth were warming. This draws a false conclusion by ignoring the past 35 years where the sun has cooled while the Earth has continued to warm. Thus, the sun cannot be the main factor controlling Earth's temperature. **Slothful induction:** Talking about the sun as the only

		factor controlling Earth's climate ignores centuries of research on the warming impact of greenhouse gases like CO2.
Negative consequences of climate change outweigh any small benefits. Deaths from heat-related illness are projected to increase, changes in rainfall and seasonal cycles will greatly harm agriculture, and wildfires are already increasing in fire-prone areas. Coastal infrastructure has also seen costly flooding damage. These are just a few of the harmful effects of climate change. There are far more costs to climate change than benefits. (Full article)	A warming planet is a good thing	**Cherry picking:** This myth focuses only on a few positive impacts of our warming climate. It ignores the fact that human-caused climate change will destroy numerous aspects of our planet and our societies.
All evidence and indicators show that Earth's temperature is warming. While this doesn't mean cold weather will entirely disappear, it does mean we're less likely to see cold weather events and more likely to see heat waves. (Full article)	Record cold weather shows global warming isn't happening.	**Anecdote:** We often hear the idea of global warming stopping and/or reversing in response to a large cold-weather event like a blizzard. However, this is anecdotal thinking, drawing conclusions about climate change from local weather events. Climate change is the consistent warming of our planet over the course of decades, and this warming has continued consistently. Cold weather doesn't disappear under global warming - it's just less likely.
Climate models successfully reproduce Earth's temperatures since 1900. Climate models are tested rigorously and verified by the scientists who use them in their research. They have already	Climate models have gotten predictions wrong and are unreliable.	**Impossible Expectations:** Climate models predict a range of possible futures and cannot be expected to make perfect predictions. No climate model is perfect

predicted many of the phenomena and trends that we now have verified with evidence. (Full article)		as they are simulations of the real world, but they provide many useful insights into understanding how our climate works and will behave in the future.
Surface temperature is measured by thermometers in rural and urban areas. Satellites also measure temperature, showing the same warming trend as thermometers. Nevertheless, to ensure that the way thermometer measurements were taken was not influencing the temperature record, scientists at the National Climatic Data Center did a careful study to confirm that the temperature record was accurate. All indicators, including temperature, show that our planet is consistently warming. (Full article)	Temperature measurements are not taken in the right places so the temperature record is unreliable	**Impossible expectations:** Arguing that thermometer measurements need to be perfect in order to trust the temperature record demands an impossibly high standard, while rigorous analysis has shown variations in sitings has no impact on the reliability of warming trends. Additionally, other non-temperature indicators such as rising sea levels and melting land ice confirm that Earth is warming.
Our climate is changing too quickly for species to adapt. A common misconception is that life has adapted to changes in the Earth's past, so it can adapt now. However, past changes occurred over hundreds of thousands of years. Current, human-caused changes to Earth's climate are happening over the span of decades. This is too fast for species to successfully adapt. (Full article)	Plants and animals can adapt to global warming	**False Equivalence:** Plant and animal adaptations to previous, natural, gradual changes to Earth's climate cannot be compared to current rapid, human-caused changes. Current climate change is happening too quickly for species to adapt.
Sea ice around Antarctica showed a slightly increasing trend prior to 2015, but land ice is decreasing. This is an important distinction. Sea ice does not play a role in sea levels, whereas melting land ice is a major contributor to sea level rise. Antarctica's rapidly melting land ice	Antarctica is gaining ice	**Oversimplification:** Arguing that Antarctic sea ice is growing to cast doubt on the impact of global warming on melting ice ignores the complexities of Antarctic sea ice. First, Antarctic sea ice shows great variability with a

is a major cause for concern regarding sea level rise. (Full article)		dramatic drop in sea ice from 2015. Second, Antarctic sea ice is influenced by a complicated set of factors such as increasing wind from the Antarctic continent.

About the AMS and the Climate Matters Partnership

Climate Matters is a collaboration between George Mason University, Climate Central, the American Meteorological Society, NOAA, NASA, and broadcast meteorologists throughout the United States. The program provides broadcast meteorologists and journalists with reporting materials about the current and future projected impacts of climate change in their market area, and on response options. Climate Matters began in 2010 and now supports more than 1,000 broadcast meteorologists throughout the United States at more than 500 stations. The resources offered by Climate Matters include a weekly package of resources based on a timely climate topic. The package includes a full narrative, bullet points, experts to interview, external supplemental resources, and broadcast-quality data-based graphics in English and Spanish. In addition, Climate Matters produces climate reporting workshops, topical webinars, conference sessions, and additional resources to help media professionals.

The American Meteorological Society is promoting the notion of regarding broadcast meteorologists as the "station scientists," and equipping them to cover a broader range of science topics for their station, in addition to tomorrow's weather. This would include environmental and space issues, weather and climate impacts on public health, transportation, agriculture, energy use, and other topics. This committee has dedicated itself to assisting broadcast meteorologists in filling that role at their individual stations. Their mission is to provide fellow broadcasters with the latest scientific information about the atmosphere and climate and to empower and inspire them to educate their viewers.

This document was prepared by coordinating authors Margaret Orr and Amanda Borth. Coordinating author Dr. John Cook and contributing authors provided feedback and suggestions. The document was then translated by translators listed previously. Graphic design was done by Richard Amoako.

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Appendix

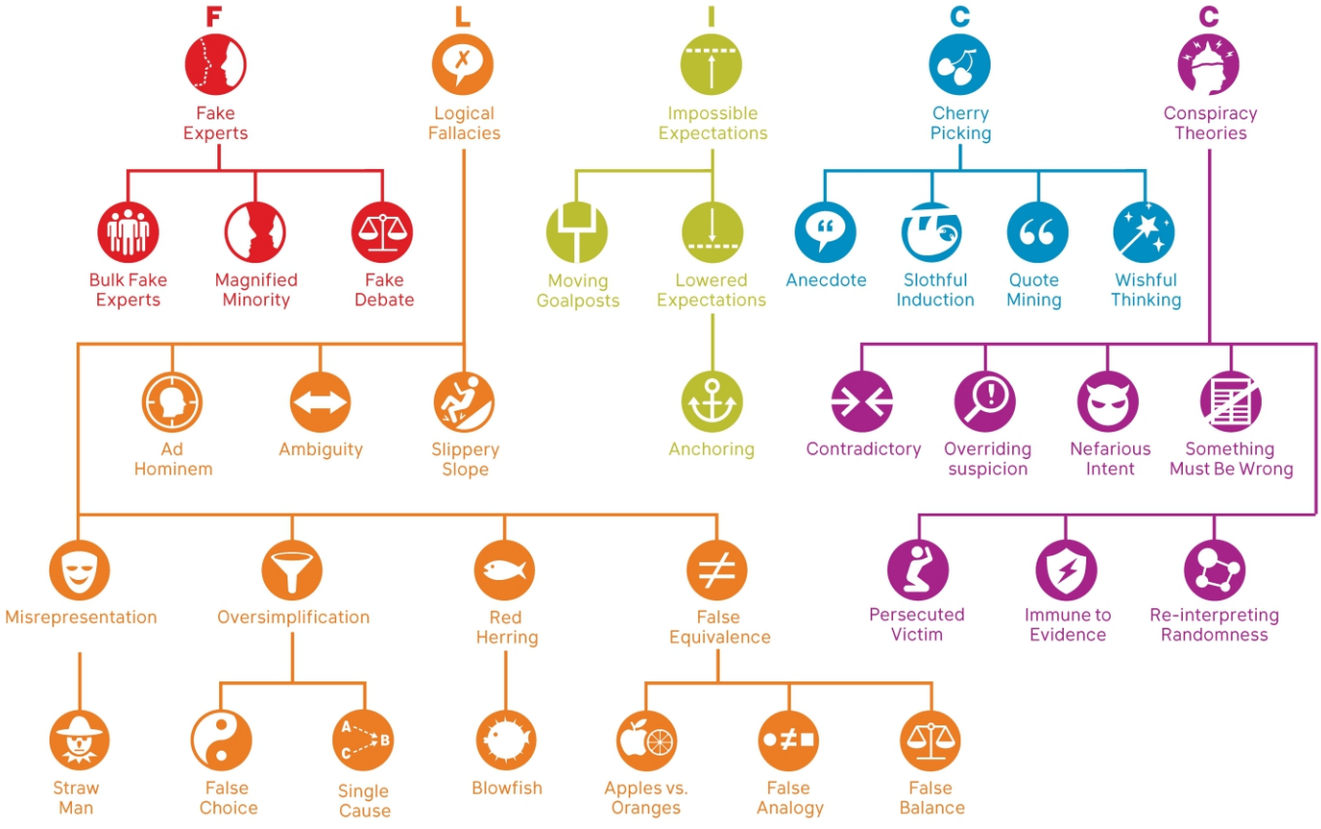

Figure: The FLICC taxonomy of science denial organizes denial techniques into five categories: fake experts, logical fallacies, impossible expectations, cherry picking, and conspiracy theories

Table: definitions of common denial techniques. For a full list of all techniques, see: https://crankyuncle.com/a-history-of-flicc-the-5-techniques-of-science-denial/

Technique	Definition	Example
Ad Hominem	Attacking a person/group instead of addressing their arguments.	"Climate science can't be trusted because climate scientists are biased."
Cherry Picking	Carefully selecting data that appear to confirm one position while ignoring other data that contradicts that position.	"Global warming stopped in 1998."
Fake Experts *(appeal to false authority)*	Presenting an unqualified person or institution as a source of credible information.	"A retired physicist argues against the climate consensus, claiming the current weather change is just a natural occurrence."
False Choice	Presenting two options as the only possibilities, when other possibilities exist.	"CO_2 lags temperature in the ice core record, proving that temperature drives CO_2, not the other way around."

Appendix

False Equivalence *(apples vs. oranges)*	Incorrectly claiming that two things are equivalent, despite the fact that there are notable differences between them.	"Why all the fuss about COVID when thousands die from the flu every year."
Impossible Expectations	Demanding unrealistic standards of certainty before acting on the science.	"Scientists can't even predict the weather next week. How can they predict the climate in 100 years?"
Logical Fallacies (*non sequitur)*	Arguments where the conclusion does not logically follow from the premises.	"Climate has changed naturally in the past so what's happening now must be natural."
Red Herring	Deliberately diverting attention to an irrelevant point to distract from a more important point.	"CO_2 is a trace gas so it's warming effect is minimal."
Single Cause	Assuming a single cause or reason when there might be multiple causes or reasons.	"Climate has changed naturally in the past so what's happening now must be natural."
Straw Man	Misrepresenting or exaggerating an opponent's position to make it easier to attack.	"In the 1970s, climate scientists were predicting an ice age."

Climate Myth Debunking for
Broadcast Meteorologists