Science AMA Series: We just published a study showing that ~97% of climate experts really do agree humans causing global warming. Ask Us Anything!

ClimateConsensus [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Hello there, /r/Science! We* are a group of researchers who just published a meta-analysis of expert agreement on humans causing global warming. The lead author John Cook has a video backgrounder on the paper here, and articles in The Conversation and Bulletin of the Atomic Scientists. Coauthor Dana Nuccitelli also did a background post on his blog at the Guardian here. You may have heard the statistic "97% of climate experts agree that humans are causing global warming." You may also have wondered where that number comes from, or even have heard that it was "debunked". This metanalysis looks at a wealth of surveys (of scientists as well as the scientific literature) about scientific agreement on human-caused global warming, and finds that among climate experts, the ~97% level among climate experts is pretty robust. The upshot of our paper is that the level of agreement with the consensus view increases with expertise. When people claim the number is lower, they usually do so by cherry-picking the responses of groups of non-experts, such as petroleum geologists or weathercasters. Why does any of this matter? Well, there is a growing body of scientific literature that shows the public's perception of scientific agreement is a "gateway belief" for their attitudes on environmental questions (e.g. Ding et al., 2011, van der Linden et al., 2015, and more). In other words, if the public thinks scientists are divided on an issue, that causes the public to be less likely to agree that a problem exists and makes them less willing to do anything about it. Making sure the public understands the high level of expert agreement on this topic allows the public dialog to advance to more interesting and pressing questions, like what as a society we decided to do about the issue. We're here to answer your questions about this paper and more general, related topics. We ill be back later to answer your questions, Ask us anything! *Joining you today will be: Stuart Carlton aka @jscarlton John Cook aka /u/SkepticScience Sarah Green aka @FataMorgana_LS Peter Jacobs aka /u/past_is_future Stephan Lewandowsky aka /u/StephanLewandowsky Andy Skuce aka /u/AndySkuce Bart Verheggen aka @BVerheggen and perhaps some others if they have time Mod Note: Due to the geographical spread of our guests there will be a lag in some answers, please be patient!

the WINNOWER

REDDIT

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CLIMATECONSENSUS R/SCIENCE

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We're here to answer your questions about this paper and more general, related topics. We ill be back later to answer your questions, Ask us anything!

*Joining you today will be:

Stuart Carlton aka @jscarlton

John Cook aka /u/SkepticScience

Sarah Green aka @FataMorgana_LS

Peter Jacobs aka /u/past_is_future

Stephan Lewandowsky aka /u/StephanLewandowsky

Andy Skuce aka /u/AndySkuce

Bart Verheggen aka @BVerheggen

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READ REVIEWS

WRITE A REVIEW

CORRESPONDENCE:

DATE RECEIVED:
April 18, 2016

DOI:
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I have a few questions and thank you for your time!

1. How many scientists agree that the animal agriculture business contributes to climate change?
2. Is there anyway we could change the outcome of climate change in a fast effective way?
3. Can we reverse it or just ride the incoming tide doing what we can?

Autica

Hello there!

ClimateConsensus , r/Science , Science AMA Series: We just published a study showing that ~97% of climate experts really do agree humans causing global warming. Ask Us Anything!, *The Winnower* 3:e146089.97452 , 2016 , DOI: 10.15200/winn.146089.97452

1. I don't know of any extant survey that has explicitly touched on this, but certainly it is well established science and is part of consensus reports such as those produced by the National Academy of Sciences or the Intergovernmental Panel on Climate Change. However, if this is in any way related to the movie "cowspiracy" I would caution you that the claims made by it are vastly oversold.
2. I don't know what you would consider "fast", but in my view (as a person who looks at climate changes on very long timescales) I would say yes. We have the ability to determine what kind of energy systems power our future which will determine the magnitude of our impact on the climate in the future.
3. It's not a binary proposition, it's a continuum of some to a whole lot of future change. We will see some amount of future change going forward because there is intertia in the climate system (our current emissions haven't been "felt" by the climate system yet) and inertia in the political and engineering decisionmaking chains. But we can certainly have much less of an impact going forward if we choose to than if we choose not to.

-- Peter Jacobs

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Autica

1. I would imagine about 97%, but I don't think anyone has asked that specific question in any survey. Certainly the IPCC attributes the build up in methane in part to agriculture. Methane accounts for about 25% of the greenhouse gas forcing and I understand that agriculture (livestock and rice farming, mostly) contributes about 40% of that. So, yes agriculture is a definite cause of global warming, but it's a small factor compared to CO2 emissions from fossil fuels. http://www.skepticalscience.com/how-much-meat-contribute-to-gw.html

2&3. Rapid emissions reduction is the best way, although that probably won't be rapid enough, by itself, to keep us below 2 degrees C. As a counter-measure for emissions overshoot, many models include some kind of negative emissions technology, like bioenergy carbon capture and storage, but so far this has not been demonstrated at the required scale. As a last resort, we could try solar radiation management, which entails putting sulphate particles in the stratosphere to reflect some incoming sunlight. This would be rapid (and quite cheap) but would have unforeseeable negative consequences and would do nothing to address ocean acidification. Most scientists (I don't have a percentage!) consider this to be too risky to contemplate at this point, whereas others believe that we should research it to prepare for the worst.

Andy Skuce

How would you respond to my dad? Whenever we talk, he brings up the following points:

- "science is not based on consensus". Sure, 97% of scientists agree that climate change is human-caused... but that doesn't mean that they're *right*. He points to 1910 physics and how they thought they were almost done before Einstein came along.
- measurement error. Most of the temperature probes are in cities, which naturally see a 2-3 degree rise. Who says that's not the cause of this 2-3 degree rise we're seeing?
- Sure, climate change is happening. What proof do we have that it's human caused?
- Who says this climate change isn't positive? We've been close to an Ice Age for a while in terms of carbon concentration in the atmosphere (?).
- he points to that fact that in the 1970s we were worried about "global cooling." Does this system change so quickly that we can be worried about global cooling and global warming within 40 years?

skier_scott

First, I'd ask your dad for a cup of coffee as it looks like we'd be sitting down for a long conversation! :-)

Second, re "science is not based on consensus", he has a good point. Ultimately, our scientific understanding is informed by evidence, not a show of hands. In the case of human-caused global warming, we have many lines of empirical evidence that humans are the major cause of recent global warming, which we summarise in this short video "Consensus of Evidence": https://youtu.be/5LvaGAEwxYs

Third, it is true that in the past, the scientific consensus on certain issues has been overturned. So a key question is how do we know whether a scientific consensus is trustworthy (or in philosophical terms, a "knowledge-based consensus")? We look at the characteristics of a knowledge-based consensus, and how the consensus on human-caused global warming is robust, at: https://youtu.be/HUOMbK1x7MI

Fourth, scientists are well aware of the warming effect of cities and correct for it by comparing urban warming trends with warming trends from the surrounding rural areas. The temperature trends from thermometer measurements are consistent with satellite measurements, which aren't prone to spurious urban contamination. In addition, scientists are seeing tens of thousands of species being impacted by warming (e.g., by migrating or shifting seasonal timing). These provide tens of thousands of other lines of evidence that the warming is happening throughout our climate system, not just in cities.

Fifth, the evidence that humans are causing climate change comes from patterns observed throughout our climate system - winters warming faster than summers, upper atmosphere cooling while the lower atmosphere warming, nights warming faster than days, less heat escaping to space, more heat returning to the Earth's surface - these are all "fingerprints" that confirm human causation and rule out natural causes.

Sixth, we are now experiencing a changing climate after thousands of years of relatively stable climate, during which we've built our entire society's infrastructure. In other words, hundreds of millions of people now live on coastal regions based on stable sea level. Our agriculture is based on stable climate conditions. A changing climate will disrupt all aspects of society.

In the 1970s, the majority of climate papers on the topic were predicting warming from greenhouse gases. So the argument that "we were worried about global cooling" is a misrepresentation of the state of the science of the time. More on this at http://sks.to/1970s

-- John Cook

Do the 3 percent have any reasonable arguments? Is there any commanlity within them ? (E.g. tend to be solar researchers instead of atmospheric scientists)

iorgfeflkd

Good question; I wondered that myself.

In my reading of several thousand abstracts (for Cook et al., 2013) I didn't find any consistent argument in papers that disagreed with the consensus. Later I looked at full papers that proposed different theories. No single coherent theory is dominant. Some propose solar cycles, many use curve-fitting to propose other kinds periodic cycles without giving a specific physical cause; some suggest cosmic rays; some point to different feedbacks from clouds.

Scientists are interested in any explanation that might have a real influence, even a small one. So, all those topics have been studied for their impact on current and past climates. Some are very interesting, but none are nearly as important as CO2 for the changes we are now seeing.

To overturn our current understanding of climate, the 3% will need to coalesce around one coherent theory that explains all our observations even better.

-Sarah Green

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iorgfeflkd

There are some studies that looked specifically into the articles that reject the consensus view.

E.g. Benestad et al http://link.springer.com/article/10.1007%2Fs00704-015-1597-5 stating "A common denominator seems to be missing contextual information or ignoring information that does not fit the conclusions, be it other relevant work or related geophysical data. In many cases, shortcomings are due to insufficient model evaluation, leading to results that are not universally valid but rather are an artifact of a particular experimental setup. Other typical weaknesses include false dichotomies, inappropriate statistical methods, or basing conclusions on misconceived or incomplete physics. "

And Abraham et al https://mahb.stanford.edu/wp-content/uploads/2014/05/2014_Abraham-et-al.-Climate-consensus.pdf stating: "significant flaws have often been found"

-- Bart

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iorgfeflkd

I can shed a little light on this, perhaps.

Co-authors and I looked at the climate consensus across scientific disciplines in an earlier study. We found that across disciplines (not just climate science), between 91% and 100% of scientists agreed that mean temperatures have risen since the 1800s. Those who didn't believe that mean temperatures had risen were more likely to believe that solar activity has caused most observed warming, that mean temperatures is not affected by CO2 levels, and that climate models are inherently limited.

Additionally (and probably more significantly), those who don't believe in climate change are less likely to trust climate science and are more likely to be conservative and have hierarchical and individualist cultural values.

Again, our study looked at more than just climate scientists, but it's a useful starting point to understanding why some people might be skeptical.

-- Stuart Carlton

There's a long history of apocalyptic belief in western civilization. Throughout european and american history, many people (mostly for religious reasons) seem to have been drawn to the idea that the world is coming to an end soon.

I'd be curious to know your thoughts about how this history interacts with (or complicates) the task of convincing the public about climate change -- since global warming offers a kind of science-based end-of-the-world scenario.

I wonder if some people become climate-change doubters because they dismiss it as just the latest reason the world is supposed to end. As in, first the world was going to end because Christ was going to return, then it was because nuclear war was going to kill us all, and now it's because of global warming.

Do you think a kind of end-of-the-world fatigue might have set in among much of the public, which makes it difficult to convince people that this time the world (as we know it) really might be in serious trouble?

yoobi40

Good question. But I would be inclined to turn the argument on its head: It is precisely *because* we

heeded the scientific warnings on past threats that they turned out to be less bad than they might have been. For example, when AIDS was a real threat--and believe me, it was: in the 1980s I was surrounded by young people who were dying or knew others who were dying from AIDS--people who heeded the science-based advice (i.e. safe sex) who could protect themselves. Likewise, when the ozone hole became a big issue and a threat (as an Australian, I am very concerned about the effects of the ozone hole on skin cancer), it was the political response based on the scientific advice to phase out CFCs that kept the problem from spiraling out of control.

So, in a nutshell, we avoided previous "doomsday" scenarios not because the risks weren't real but because the scientific evidence was taken seriously, and people responded by managing and reducing the risks.

With climate change, we face the same choice: We can ignore the science and suffer the consequences, or we can do what was done in many previous instances which is to take the risk seriously and thereby avoid the worst of it. --Stephan Lewandowsky

The one subject that never comes up in any of the debates on climate change is overpopulation, even though it seems to me that this is the root cause of all environmental problems we have. What is the point of reducing a person's carbon footprint if every effort we make is negated by an ever increasing population ?

For example, we could reduce our environmental impact by 90%, 99% or even 99,9% in a single generation simply by drastically reducing the production of new humans.

Is population control such a taboo subject that no research is being done or is there another reason for this ?

BorgDrone

It's not so much a question of overpopulation as one of a small minority currently being responsible for most of the carbon emissions.

In round numbers, according to most projections, population today is about 7 billion and will increase to a stable 10-11 billion by the end of the century, roughly a 50% increase. According to people like Hans Rosling, population control initiatives have been so successful that we may now be at Peak Child, which is to say that there may never in the future be as many children alive as there are today (Google to find some great YouTube videos). That's the relatively good news.

The bad news is that the richest 10% (that's about 2/3 made up of "middle class" people from rich countries and 1/3 of wealthy people living in developing nations) produce 50% of the world's emissions. As the 90% develop their economies and move up the income scale, if they live like the 10% do today, we would see global emissions perhaps triple or quadruple by the end of the century.

Now that exponential population growth has ended, the problem is not so much with there being too many people as it is with economic growth and the consumption of fossil fuels. Nobody wants to prevent the poor becoming richer, so we have no choice but to find a way to decouple growth from fossil fuel use.

https://critical-angle.net/2015/12/14/2025/

--Andy Skuce

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BorgDrone

I used to also regard overpopulation as the root cause of many environmental problems, but have since found that that's not entirely correct. It is a multiplication factor for the environmental impact of certain actions, but in many aspects consumption patterns are key. Both of course are part of the "Kaya Identity" and as such both influence our emissions and thus climate change.

I expanded on my take on population here:
https://ourchangingclimate.wordpress.com/2010/08/23/what-does-population-have-to-do-with-climate-change/

-- Bart

Hi there I have a few questions, but first I'd like to thank you for your work it's always good to have proof on this.

- Who is part of the remaining 3% and what are their criticisms ? (Why aren't we at 99.9% as to me it looks as clear as lead paint not being healthy)
- Do you know how that statistic changes if you take into account other scientific domaines ? Like what is the the rate of denial across education levels ?
- With regard to publishing papers on climate change and global warming, I know that the language used in the media has changed substantially over the years (now people mostly talk about climate change rather than global warming), but has this also been reflected in published research ? Do you feel as though there are certain taboos when tackling the subject ? EDIT: re reading my comment I can see how my question was poorly phrased, I just meant that despite the terms being accurate and distinct, has public backlash affected the vocabulary now used when talking about these issues either in public or in the literature ?

DrFrenchman

One of my earlier studies was included in the meta-analysis. We looked at belief in climate change across scientific disciplines and found that about 93-94% of scientists believed that climate change is occurring and about 92% believed that *anthropogenic* climate change is occurring.

Among the disciplines we studied, folks who worked in natural resources, chemistry, and agriculture were least likely to believe in the existence of climate change (though again, they were still 91+% likely). Engineers were least likely to believe in *anthropogenic* climate change.

-- Stuart Carlton

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DrFrenchman

Geologist and writer James Lawrence Powell has argued in a Skeptical Inquirer article that the true consensus is 99.99%. He used a different methodology to Cook et al 2013 and looked only for papers that explicitly rejected human-caused global warming (AGW). He assumed that all other papers accepted AGW even if they didn't say so. I disagreed with his approach and result. I wrote about it here:

https://critical-angle.net/2016/04/04/james-powell-is-wrong-about-the-99-99-agw-consensus/

---Andy Skuce

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DrFrenchman

Why aren't we at 99.9%

James Powell made the argument that our estimate was too low. He made the assumption that scientists who didn't explicitly reject the consensus agree with it. My co-author Andy looked at that argument here: http://www.skepticalscience.com/Powell.html

-Sarah G.

If I can convince someone about the 97% figure, I often hear the same followup argument: that scientists are essentially forced to agree about climate change. The idea is that it's very difficult to become/remain a well-respected climate scientist if you don't believe in human-caused climate change. Your papers don't get published, you don't get funding, and you eventually move on to another career. The result being that experts either become part of the 97% consensus, or they cease to be experts.

How would you respond to claims like that?

I tend to think that anyone who found strong evidence against climate change would immediately publish it and collect their Nobel prize. But I'm curious if there's any evidence to support that. And also, my argument doesn't address the idea that skeptical undergrads are getting forced out of climate change research before they're experienced enough to build a real case against it. I don't think that's happening, but I don't know how to argue it.

greenlaser3

How would you respond to claims like that?

Ask them for evidence for this claim and enjoy the silence (since they won't have any).

As a scientist the pressure actually is mostly reversed: You get rewarded if you prove an established idea wrong.

I've heard from contrarian scientists that they don't have any trouble getting published and getting funded, but of course that also only anecdotal evidence.

You can't really disprove this thesis, since it has shades of conspiratorial thinking to it, but the bottom line is there's no evidence for it and the regular scientific pressure are to be adversarial and critical towards other people's ideas, not to just repeat what the others are saying.

--Bart

If I remember correctly, the last research paper that claimed this statistic ended up being wrong because they just assumed certain scientists agreed based on a selective number of papers. They also never consulted the authors and turns out that many of them were pretty upset someone else spoke for them on the issue. And the paper gathered information from other sources that didn't have much to do with climate change. In your research, how have you prevented repeating their mistakes? Have you established confidence levels to the 97% stat? What possible errors (systemic or procedural) did you encounter? And I'm assuming you tested for a type 1 error? Sorry, I don't mean to blast you with questions. I've an AS in applied science and currently working on a BS in earth-space science minor in geology (I want to be a high school science teacher), so I remain skeptical on many things until I feel I've satisfied my science brain hahaha. Otherwise, thank you for the extensive research!

HurleyBurger

The research paper you're referring to is our 2013 paper that looked at scientific papers on global warming:

http://iopscience.iop.org/article/10.1088/1748-9326/8/2/024024/meta

We didn't make any assumptions about what scientists thought - rather, we looked at their published words in the abstracts of their scientific papers. If the abstract stated a position on human-caused global warming, then we noted whether it endorsed or rejected it. We found that among the ~4000 abstracts stating a position, 97.1% endorsed human-caused global warming.

On top of that, we also wanted the scientists who authored those papers to speak for themselves so we sent out an invitation to the authors to categorise their own papers. 1200 scientists responded. Among papers self-rated as stating a position on human-caused global warming, 97.2% endorsed the consensus.

This is an important result - inviting the scientists who authored the papers to self-rate their papers provided an independent confirmation of the 97.1% consensus we obtained through rating the abstracts.

So the false accusation that we never consulted the authors is a misleading attempt to smear our research. Ironically, the blog post that made this accusation bases it on asking a handful of scientists (all known to reject the consensus) what they thought about our research and of course they expressed a dim view of our 97% consensus, given their existing beliefs. But the blogger only consulted with a handful of hand-picked contrarian scientists and failed to consult with the much broader community of scientists, while we canvassed the views of 1,200 scientists.

-- John Cook

Many skeptics are concerned that the group of "climate experts" are self selecting, and that they went into climate science because they already believed in AGW, leaving them susceptible to confirmation bias, and social pressure to conform.

They are also concerned that skeptics are not welcome in the community of climate experts, having their papers rejected, and their studies unfunded. Simply put, you're not allowed in the club of climate experts unless you've already accepted the proposition that humans are causing climate change, so it's

a tautology to say climate experts accept the proposition that humans are causing climate change.

Can you address these objections?

marksf

Many climate scientists, esp the older ones, actually went into climate science via first having studies and researched something else, often of a more disciplinary (as opposed to interdisciplinary) nature, such as mathematics or physics. Many went into climate research more or less by chance, because they landed a postdoc position somewhere on a climate related topic. You couldn't really study "climate science" at University 40 years ago.

In science there is pressure to publish, and ideally to publish something novel and noteworthy. If you can prove a well estabilshed idea wrong, you will surely get a high profile publication. I.e. many of the pressures that scientists face actually go against conformity; science is in a sense quite an adversarial process.

Scientists with different opinions are absolutely welcome in the climate science community, but as with any scientific community, respect has to earned by doing good science. If you don't have good scientific evidence to back up a contrarian opinion, then scientists wouldn't think to highly of such a person.

See also e.g. https://ourchangingclimate.wordpress.com/2011/06/22/climate-science-scientific-method-skeptics-not/

Many of these types of objections sound superficially reasonable, but upon closer inspection there's no evidence whatsoever to back them up. They have a bit of a conspiratorial tone to them, and as such you can't disprove them either.

-- Bart

What do you think of environmentalists (who are most likely NOT climate scientists) that spread doomsday scenarios with severe governement intervention as the only solution? I believe that that is a fundamentally anti-humanist approach. I used to have a similiar view, until I started studying geology, and various international and local scientists seemed MUCH more casual, less alarmist, more skeptical and calm about the figurative sky falling, when visiting and lecturing at my school. Do you believe that global warming has been abused by certain groups to further policy? Be it political parties, universities, etc. Do you think dismissing the opinions of geologists is a good thing? After all, they are needed for gathering data on past climates, are they not?

WolfdogWizard

What do you think of environmentalists (who are most likely NOT climate scientists) that spread doomsday scenarios with severe governement intervention as the only solution?

It's not clear to me that this is actually happening. In fact, the environmental movement for more than a decade has been advocating for either cap and trade or a carbon tax, both of which are market-based solutions which require far less government intervention than something like command and control approaches.

I used to have a similiar view, until I started studying geology, and various international and local scientists seemed MUCH more casual, less alarmist, more skeptical and calm about the figurative sky falling, when visiting and lecturing at my school.

I think people who don't work in the field and who only are aware that there are very negative consequences don't know how much effort is being spent to avoid those outcomes. If that makes sense.

As someone who studies the consequences of large climatic changes in Earth's history, I am probably far more pessimistic about what would happen if we didn't stabilize our emissions than someone outside of the field. But I am also probably way more optimistic too, because I am aware of the herculean efforts being made on the physical science, social science, and policy fronts to avoid the

worst outcomes. And a lot of that is "inside baseball" so to speak.

Do you believe that global warming has been abused by certain groups to further policy?

I think probably every threat gets abused by some group or another. I don't think climate change is a particularly great example of this phenomenon, but I am happy to discuss it if you think this is a real problem.

Do you think dismissing the opinions of geologists is a good thing? After all, they are needed for gathering data on past climates, are they not?

This is kind of a "when did you stop beating your wife" type of question. I don't dismiss the opinions of geologists. My introduction to climate as an area of research arose from my geology coursework. I am currently working on paleoclimate topics with senior scientists at the U.S. Geological Survey.

I do think that asking petroleum geologists, whose livelihood depends on fossil fuel consumption, about humans causing climate change sets up some issues of cognitive bias that make them not the best group to use a barometer for expert opinion on climate.

-- Peter Jacobs

I know a "skeptic" who feels very passionate about this subject. As it turns out, he doesn't deny climate change is happening or even that a lot of climate change is likely driven by human activity. He insists, however, that factors like deforestation, soot buildup and land use are the big culprits. He thinks that all this focus of co2 is politically driven and diverts attention and resources from real solutions. He claims that his beliefs are fairly mainstream among skeptics (the better educated ones anyway) and that a biased media misrepresents them as science-denying crackpots. I honestly don't have the expertise to judge his claims or even to competently investigate them. Have you run into similar arguments and do you feel they have any weight?

xaveria

Deforestation and land use are certainly key contributors to climate change. WRI shows a nice chart of the various contributions. http://www.wri.org/resources/charts-graphs/world-greenhouse-gas-emissions-2000

Humans started to influence the climate when they started agriculture. Sometime within the last 10,000 years that factor became significant. See for example the discussions about the "early anthropocene". http://www.realclimate.org/index.php/archives/2016/03/the-early-anthropocene-hypothesis-an-update/

However, the main reason deforestation and land use affect the climate is they change the amount of greenhouse gases in the atmosphere. (Deforestation also affects the albedo, or reflectivity, of the Earth's surface.) And the most important greenhouse gas for long term change is CO2. The atmosphere doesn't care whether the CO2 comes from cut-down trees or burning coal; both cause warming.

All sources of greenhouse gases, including deforestation, are considered to stabilize the climate. For the Paris agreement each country proposed how it would contribute to emission reductions. Countries like Brazil and Indonesia with large tropical forests committed to reduce deforestation; many plan to expand forest cover.

-Sarah G.

What are the career consequences of being in the 3%? Are scientists is disagreement ignored, shunned, or otherwise ostracized by the scientific community in the way a flat-earther might be?

If so, would fear of such bias enough scientists to affect the results?

(I should probably clarify that I'm not making a case for the 3%, just curious about meta analysis)

HugeMisfit

Several well known scientists who would classify themselves in the 3% have prominent academic positions. Judith Curry is at Georgia Tech (where she recently was department chair); Richard Lindzen had a long career at MIT; John Christy is a professor at the University of Alabama, and has a high profile because he frequently testifies at congressional committees.

So taking a contrary position does not doom a career.

I don't know how we could test the idea that people might avoid publishing results contrary to the consensus because they might be shunned. Any ideas?

A scientist should be very motivated to publish evidence if it was strong, because that would make them famous.

-Sarah Green

Why do you think such a large portion of the American public is so resistant to the idea of man-made global warming? That is, why does overwhelming scientific consensus not convince people that the hypothesis is likely to be true?

There is so much sociological and psychological research that discusses the fact that people's incorrect beliefs become *more* solidified when presented with evidence that contradicts their views. There are other studies which present alternative methods for convincing people, such as really trying to see things from their perspective. What do you think the scientific community could do to increase the public's acceptance of mainstream science?

jesterbuzzo

I went into a little detail above, but here's the essence:

For many people, their beliefs about climate change (and other risks...GMOs, vaccines, guns, etc.) are an expression of their *identity*, not their *knowledge*. Things like cultural and political values tend to influence how people interpret the "facts" about climate change.

Indeed, I've seen some evidence (in a paper by Dan Kahan at Yale) that, on average, people who do and don't believe in climate change scored similarly well in a climate change quiz. Knowledge is only a small part of this issue.

-- Stuart Carlton

Didn't Thomas Kuhn demonstrate in his book "The Structure of Scientific Revolutions" that time in again in the history of science status quo consensus is a bad benchmark to decide if something is true or not? Time and again the scientific consensus has been proven wrong by a small group of people willing to question the status quo. How can you be sure that historically the status quo belief has turned out to be 100% wrong, and people outside of that belief were initially ridiculed and ultimately proven right. How can you be sure that isn't the case here.

Plate techtonics is a good example of what I am talking about. *Everyone* said that guy was off his rocker, but in the end it turned out *everyone* was wrong. There are plenty of other examples as well.

https://en.wikipedia.org/wiki/The_Structure_of_Scientific_Revolutions

skeeter1234

Plate tectonics is a great example of a scientific paradigm that replaced older ways of thinking about geology. But it's not quite true that Alfred Wegener's ideas were held in contempt by everyone else. He had some distinguished supporters, all outside of N America, like Arthur Holmes and Alexander du Toit. One of the biggest stumbling blocks was an almost complete ignorance of deep-sea geology prior to World War 2. During the Cold War the US Navy did a ton of geophysical work in the oceans (to help with submarine warfare) and, as this work became known to the scientific community, minds started to change. New results from crustal seismology and palaeomagnetism were crucial, too.

So, although there was a very strong consensus in N America against continental drift (see Naomi Oreskes' excellent book for the reasons for this) there was no worldwide consensus. And, as new data came in, scientists changed their minds very quickly.

From my own experience, I would say that the expert consensus on plate tectonics is now near 100%, but I am not aware of any surveys that formally establish this. Plate tectonics was never politicized and neither did the theory threaten the business models of large industries. The very few geologists who opposed it into the the late 1970s and 1980s never received the level of attention from conservative politicians and the press that climate change contrarians enjoy today. For more discussion:

https://critical-angle.net/2015/11/06/consensus-on-plate-tectonics-and-climate-science/

--Andy Skuce

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https://en.wikipedia.org/wiki/The_Structure_of_Scientific_Revolutions

skeeter1234

Whereas the presence of widespread agreement is obviously not proof of a theory being correct, it can't be dismissed as irrelevant either: As the evidence accumulates and keeps pointing in the same general direction, the experts' opinion will logically converge to reflect that, i.e. a consensus emerges.

Typically, a theory either rises to the level of consensus or it is abandoned, though it may take considerable time for the scientific community to accept a theory, and even longer for the public at large.

Especially for topics on which one is not an expert oneself, the scientific consensus arguably is the best guide towards finding out what the most likely explanation is - even if it's not rock solid proof of course.

See also this article about how to gauge whether a scientific consensus is truly knowledge based or merely people agreeing with other for the sake of it: http://link.springer.com/article/10.1007/s11229-012-0225-5

-- Bart

This analysis appears to show that scientists think the earth is warming and that they believe humans have played an important role in that warming.

Do we have further data about how serious scientists think this is? I can see an argument being made that "sure, humans have played a role in the earth warming, but overall, it's not likely to be a catastrophe and technological progress is likely to save us."

It seems there are several levels of consensus on global warming you could look at:

1) is the earth warming?

2) are humans somewhat responsible for that warming?

3) are humans mostly responsible for that warming?

4) this human caused warming will accelerate because of feedback loops

5) this human caused warming will be harmful to human life

6) this human caused warming will be catastrophic

I'm excluding here things perhaps outside the context of climate scientist specialty, such as solutions to solve, cost benefit analyses of the warming vs the cost of preventing the warming, specific political policy proposals, etc.

It seems this study gets us to a consensus on 2 or 3. Is there a reason the study couldn't look farther? Is there just not enough of a wide body of research on this for a meta-analysis?

travis-42

The current study, and most others it summarizes, do not explicitly address questions 4-6 in a quantitative manner. However, we do have 'consensual' answers to those questions in the form of the various IPCC Assessment Reports, which summarize a very large body of literature on those topics.

Although these issues are nuanced, it is safe to say wrt to: 4. it is highly likely that*in the absence of mitigation* warming will accelerate. However, intensive mitigation efforts can avert that. 5. if by "human life" you mean "quality of life" then yes, over time unmitigated climate change will be harmful to most of us, and the effects will be quite diverse: Some people will suffer because of sea level rise, others because of increased frequency and/or severity of droughts, others because of flooding, and so on. Those detailed consequences are difficult to predict for specific locations but globally we can be pretty sure that they will occur in one place or another. 6.) this depends on what we do. It is possible, in theory, for us to cause climate change that will be "catastrophic" in some parts of the world if we continue to increase our emissions. However, if we avoid that rather self-destructive path then the consequences, while still serious, will be short of "catastrophic." I should add that I don't like that word (catastrophic) at all.

(Apologies if I have overlooked an existing reply, the interface has changed since my last AMA) --- Stephan Lewandowsky

[removed]

[deleted]

Hello there!

I'm convinced that 90% of the disagreement on the issue stems from people not clearly stating that humans are a cause of climate change, and not the only cause of climate change. This might appear obvious to scientists, but the effect of the language is noticeable on places like Reddit when the issue is discussed and it's getting old.

What makes you convinced of that? The reason I ask is that it's not at all evident in the extant surveys of public opinion that this is a major source of confusion.

the majority of people who get branded as climate change deniers (an unhelpful label meant to compare them to Holocaust deniers and the like) are nothing of the sort

Why do you believe that the word denier is meant to invoke Holocaust denial, rather than the plain meaning of denial that existed long before the Holocaust ever occurred? This is a meme among climate contrarians but there are actually only a handful of such comparisons and those were not made by scientists.

Denial is a real concept. Denial that the climate is changing, or that humans are changing it, is a real phenomenon. There is no need to bring the Holocaust into it, other than to feign outrage and victim bully.

they're simply pointing out that the climate of the planet is always changing and that we're not the only thing causing it.

Climate contrarians reject the overwhelming body of evidence for human's role in changing the climate. They also love to play word games so as not to seem as out of touch with the science as they are. There's not much that can be done about that. The people who claim vaccines cause autism play similar games about vaccine safety. I'm not quite sure if you have a question here or not.

-- Peter Jacobs

Has there been any information gathered on what deniers see as motivation behind climate change science? Basically, why do deniers think that scientists would lie or be led astray on this?

greysector

Yes, we know that the primary variable that determines someone's rejection of the scientific evidence is their worldview or "ideology". That is, people who are particularly fond of free markets are most likely to reject the science. They do this because they feel threatened by the *solution* to climate change, which will inevitably involve some political intervention, such as a price on carbon. Any such intervention is threatening to people who believe that free markets are the only way to distribute goods and services. In order to manage that threat, they blame the scientists for making it up--this explains why the rejection of science is usually accompanied by accusations of a conspiracy (e.g., the "world government" or that it's all a "hoax" and so on). --Stephan Lewandowsky

Hello and thank you all for doing this AMA!

It was a very interesting read, I have a few question about some social aspects.

Have you found that there are any experts in your field that vehemently deny this, or are the other 3% just sceptical of the results rather than refusing to agree?

Also, what has the backlash been like (if any) from publishing this? Both within the scientific professions *and* the general public. Thanks!

KandiKrocodile

Concerning the 3% and their responses, the reactions have been very mixed. Some are vehement others silently skeptical.

There has been no backlash within the scientific community: for the most part the reception has been very positive (and the download figures speak for themselves; nearly 1/2 million for Cook et al. 2013).

Likewise, the public has been very supportive as indicated by the media coverage and responses to that coverage.

There has, however, been a very small number of political operatives and other ideologially-motivated critics who have created considerable noise on the internet and on Twitter to disparage our work. This is not unusual but an aspect of modern technology, which permits a handful of operatives to create disproportionate amount of noise. --Stephan Lewandowsky

What are your thoughts on nuclear power plants in the US?

chakrablocker

This is not a science question per se. My personal view is that we cannot afford to reject any source of clean energy out of hand. I think a market-based solution like a carbon tax would be an efficient way of determining our energy mix in the future. If nukes are competitive, great.

I will say that reddit in general seems to vastly underestimate the economic and security hurdles that nukes face and would probably be surprised when speaking to actual energy analysts about just how much we can realistically increase their deployment.

-- Peter Jacobs

Does that 97% all agree to what degree humans are causing global warming?

general_nuisance

Different studies use different definitions. Some use the phrase "humans are causing global warming" which carries the implication that humans are a dominant contributor to global warming. Others are more explicit, specifying that humans are causing most of global warming.

Within Cook et al. (2013), several definitions are used for the simple reason that different papers endorse the consensus in different ways. Some are specific about quantifying the percentage of human contribution, others just say "humans are causing climate change" without specific quantification.

We found that no matter which definition you used, you always found an overwhelming scientific consensus.

-- John Cook

Does that 97% all agree to what degree humans are causing global warming?

general_nuisance

No. The questions in the various studies we looked at used different ways to assess the consensus. For example, here are some sample questions from different surveys:

Climate change is mostly due to human activity. *Pew survey*

Anthropogenic greenhouse gases have been responsible for 'most' of the 'unequivocal' warming of the Earth's average global temperature over the second half of the 20th century. *Anderegg et al (2010)*

Many experts have concluded that more than 100% of warming since 1950 has been caused by humans. How can it be more than 100%?... Because without greenhouse gasses the sun and other natural forcing would be causing cooling. Gavin Schmidt has a good summary of the IPCC statement on attribution at RealClimate:

...anthropogenic trend is around 100% of the observed trend, implying that the best estimates of net natural forcings and internal variability are close to zero.
http://www.realclimate.org/index.php/archives/2013/10/the-ipcc-ar5-attribution-statement/

-Sarah

I was discussing politics with my boss the other day, and when I got to the topic of global warming he got angry, said its all bullshit, and that the climate of the planet has been changing for millennia.

While I've seen hundreds of different articles about how the entire scientific community is in agreement and that climate change is indeed happening because of us, I don't actually know enough about it to stand my ground in an argument with him (though given his reaction, he probably won't be swayed), so where should I go to best understand all of the facts?

Oldsodacan

Skeptical Science has a list of common myths and what the science says.
http://www.skepticalscience.com/argument.php?f=taxonomy

But often facts are not enough, especially when people are angry and emotional. The Skeptical Science team has made a free online course that addresses both the facts and the psychology of climate denial: http://sks.to/denial101x

You can access the individual Denial101 videos at: http://www.skepticalscience.com/denial101x-videos-and-references.html

Also, remember that you may not convince him, but if you approach him rationally and respectfully you may influence other people who hear your discussion.

-Sarah

I guess I'm confused about this whole thing. What's the point of making a paper showing that the majority of scientist in this field of study agree on something? Is this a scientific version of shaming the remaining scientists who disagree so you can move forward with your studies? Why waste the time persuading someone when you can just act on your own research?

sound-of-impact

The point of quantifying the scientific consensus is straightforward - it's to clear up the public misconception that climate scientists disagree over human-caused global warming. Manufacturing doubt about the consensus is one of the most common strategies of opponents of climate action. In fact, this strategy was explicitly recommended by a Republican pollster as a way of confusing the public in order to win the public debate on climate policy.

-- John Cook

What happened in 2014? Why did the percentage suddenly drop to 91 percent? Was there some kind of a discovery?

whyseopenny

We look at a number of consensus estimates over time. One estimate found 91% in 2014. Another estimate found 97% in 2015. The difference in estimates is not a measure of changing consensus over time. Rather, it is a reflection of the different methodologies of different studies. They use different samples and ask different survey questions so that there will inevitably be variations in their results.

However, the key finding is that despite variations in methodology, they all find an overwhelming consensus among climate scientists that humans are causing global warming. Contrast this with the public perception of consensus, where only 12% of Americans think that over 90% of climate scientists agree on human-caused global warming. Reducing this "consensus gap" is why communicating the consensus is so important.

-- John Cook

My questions are around **how you eliminated any bias** in your study.

1) What steps did your group take to ensure that your work was unbiased? (i.e., were any members of the research group part of the 3% that weren't already convinced of global warming?)

2) You show that the level of agreement with the consensus view increases with expertise. Obviously, it goes without saying that the more we can convince the general public and the government that more drastic action is required, the more funding will be given to climate scientists. Some might argue that these individuals with more expertise in the field of climate change would benefit the most from this, and perhaps this is the true reason behind the correlation. Simply put, it could be argued that climate scientists may be predisposed to seeing climate change as more serious, because they want more funding. What's your perspective on that?

EDIT: added the second question.

Emzam

1) The current study was a summary of the existing literature which used a diverse range of

approaches to control for bias. I can highlight two for illustration, but there are plenty of others: (a) Cook et al 2013 asked the authors of papers to provide their own rating. Those ratings, from 1200 authors, confirmed the authors' own ratings. So unless you suspect that authors of scientific articles don't know what they have written, then that puts to rest whatever putative problems of "bias" one can cite. (b) An article by Shwed, U. & Bearman, P. S. The temporal structure of scientific consensus formation American Sociological Review, 2010, 75, 817-840 used a completely computerized citation network analysis that was free of any human (and hence subjective) input and they found the same thing, namely a clear and pervasive scientific consensus. 2) Any climate scientist who could convincingly argue that climate change is not a threat would be (a) famous (b) get a nobel prize (c) plus a squintillion dollars in funding and (d) a dinner date with the Queen and (e) lifelong gratitude of billions of people. So if there is any incentive, it's for a scientist to show that climate change is *not* a threat.

--Stephan Lewandowsky

Do we have any insight on what non-climate scientists have to say about Climate Change being caused by CO2? Thank you for doing this AMA by the way.

GoBigRedWhoDat

I've studied this. In a paper published last year, colleagues and I surveyed biophysical scientists across many disciplines at major research universities in the US. We found that about 92% of the scientists believed in anthropogenic climate change and about 89% of respondents disagreed with the statement that "Climate change is independent of CO2 levels". In other words, about 89% of respondents felt that climate change is affected by CO2.

-- Stuart Carlton

Since when does it matter what percent of scientists agree on something? If you're concerned about science-driven policy, then it's just a matter of waiting for people who think the old idea to retire.

The most interesting ideas are often minority positions. For example:

“I had been told as an undergraduate at M.I.T. that good scientists did not work on foolish ideas like continental drift,” recalled Lynn Sykes, an emeritus professor of earth and environmental sciences at Columbia. (1960s)
-NYT, Kenneth Chang, 2011

I think you actually drive people to find out more about the minority position by showing masses of people closing ranks against them, or by making others seem socially outcast by expressing doubts, or curiosity. That's how priesthoods operate.

lowrads

If you're concerned about science-driven policy, then it's just a matter of waiting for people who think the old idea to retire.

If we waiting on climate it will be too late to fix.

It is interesting, however, to notice how many people who sign the anti-climate action letters and petitions are retired engineers or emeritus faculty. So, that process is apparently underway already.

Our study is not meant to convince scientists; they are already convinced. It is meant to show others that the scientific consensus is strong enough to support policy action.

-Sarah G.

Not sure if the session is over yet, but I'll ask a question I continue to ask. Once you get past the ivory towers, the topic of climate change seems more like a psychological endeavor. Why has the core premise, which is quite simple -

1) CO2 is a heat-trapping gas (accepted by all scientists)

2) humans are increasing those levels,

3) ergo, humans will increase temperatures

so difficult to articulate to the mass public?

pantsmeplz

You're exactly right: people's psychology is often a strong influence on their risk perceptions. With climate change, it has been showed that political ideology and cultural values influence climate change beliefs. Those who are more conservative, have more hierarchical and/or individualist cultural values are less likely to believe in climate change, even if they have the same grasp of the facts.

As I've put elsewhere, belief in climate change is often an expression of identity, not an expression of knowledge.

-- Stuart Carlton

So I showed my climate change denying dad this. He has his masters in geology, so not an idiot. His reply was this:

"I've seen this. My problem with it is that they reviewed abstracts of climate based scientific papers. They did not actually question climate scientists. To much room for bias using the methods they used. If someone used the same methods to debunk man made climate change, it would be called out as not a good method. Bottom line is man made climate change is based on computer based models that are demonstrated and have not come true for the past 15 or so years. There are to many variables and no one really knows what they are. Making us pay for it is irresponsible. BTW CO2 levels were recently at an all time low in the 4.5 billion year history of the earth. There are now scientists that claim we may have saved life on earth by using carbon based fuels. If the powers that be really cared, we would be using Nuclear power. It's all about political power, not the environment."

How do I respond to this?

stardust721

The paper that we're presenting here is a meta-analysis of seven different papers looking at the scientific consensus about climate change. Some are based on document reviews, some are based on directly surveying scientists, including climate scientists. All seven found an overwhelming majority (90+%) agreed that anthropogenic climate change is occurring. So, for what it's worth, the statement that "they did not actually question climate scientists" is not correct.

I won't comment on the climate models because I'm not qualified to do so (I'm a social scientist who studies attitudes, beliefs, and behaviors related to environmental and natural resources controversies). However, your dad's position on the existence anthropogenic climate change is not consistent with that of nearly all climate scientists.

-- Stuart Carlton

What is it that they agree on that is the main cause? I see everyone rallying around fossil fuels but what about the affect of animal farming for food production?

MetalGearGauss

In most of the individual studies the consensus position was defined regarding anthropogenic causes of global warming, but not into how that can be further refined to different contributing sectors (industry, agriuculture, traffic, household, etc)

--Bart

How can I explain this to my dad? All he always says is "how did all the ice melt 10000 years ago". He thinks it is a cyclical event.

mateorayo

Your Dad is right. Glacial/Interglacial cycles are cyclical on an approximately 100,000 year time scale. This is driven by natural cycles in Earth's spin and orbit around the Sun. So the glacial/interglacial cycle is forced by solar input (as the Earth gets closer and further away, etc.). CO2 is in there and plays a feedback roll, but it's not the main driver of those glacial cycles. What's happening now is different and unprecedented in Earth's History. We are pumping way more CO2 into the atmosphere than is supposed to be here under natural processes. CO2 traps heat and so the planet warms above the natural levels. Right about now there are also feedbacks that kick in as it gets warmer that affect the global heat budget. It gets very complex and beyond sound bites, but I'd ask your Dad a question. Ask him to consider how he knows and seems to believe that all the ice melted 10,000 years ago? The answer will be that it is scientists who have reported on this through careful measurement and experimentation. The same groups who model past climate are also involved in using the past to model the future. If he accepts that the climate has fluctuated in the past based on the research of scientists, it's cherry-picking to accept that and not the future predictions of accelerated warming made by climate scientists. -Peter Doran

I am curious how you answer your critics. Specifically this one by Dr. Richard Tol---

"Unfortunately, Environmental Research Letters does not believe in open discussion and forced me to hide the rather severe methodological critique on Cook's 2013 paper behind a superficial literature review."

"This allows Cook 2016 to hide their response to my critique; but they admit that Cook 2013 misleads the reader on the independence of the raters and on the information available to the raters. This is normally sufficient for a retraction: the data behind Cook 2013 are not what Cook 2013 claim they are."

Cook 2016 ducks my other critiques:

(1) sample size is unknown;

(2) there are systematic differences between the raters; and

(3) the people who collected the data in phases 2 and 3 had access to the results of phase 1 and phases 1 and 2, respectively (while there are systematic differences between the results from phase 1, 2, and 3).

"As to the consensus on the consensus, if you carefully pick results from the various studies, then you see agreement. If, on the other hand, you look at all the data, then the various consensus studies strongly disagree with each other."

timo1200

Thankfully, Richard Tol published the journal's reviewer comments so we can check whether his characterisation matches reality:

http://richardtol.blogspot.com.au/2015/09/more-nonsenus.html

The ERL reviewer asked Tol to place the Cook et al. (2013) results in the context of other consensus research. Curiously, Tol characterises this entirely appropriate and desirable approach as forcing him to hide his critique behind a superficial lit review. Putting aside the conspiratorial overtones in his characterisation, the key development is that this request led Tol to misrepresent a number of other consensus studies in his zeal to discredit Cook et al. (2013). This distortion was widely condemned by the authors of the studies that Tol was misrepresenting:

http://www.realskeptic.com/2015/09/21/scientists-respond-to-tols-misrepresentation-of-their-consensus-research/

As for Tol's characterisation of our rating process, he seems to be wilfully misunderstanding exactly how our rating process worked. Each time one of our raters rated abstracts, they were given 5 abstracts selected at random from the ~12,000 abstracts in our database. This means it was practically impossible for raters to "collude" with other raters - the very design of the system enforced independence between raters because there was no way for two raters to consult on the rating of any specific abstract.

Our response to other methodological nitpicking by Tol are published in the Supplemental Info document which is publicly available at http://iopscience.iop.org/1748-9326/11/4/048002/media/erl048002_suppdata.pdf

An important point to make is that the methodological nitpicking by Tol covers over one simple fact - all his criticisms of our methodology do not apply to the self-rating process, where we invited the scientists who authored the climate papers to rate their own research. This independent process yielded 97.2% consensus. In contrast, our abstract rating, that Tol has spent the last few years criticising, yielded 97.1% consensus.

The fact that the two independent approaches yield consistent results falsify Tol's accusations that our consensus estimate is biased or significantly affected by what he claims are methodological flaws. Tol refuses to take that step back and view the larger picture.

In fact, when the ERL reviewer requested that he take a step back and position our results in the context of other consensus studies, his response was to distort a number of other studies into consensus. Ultimately, this misrepresentation of the body of consensus research led to the authors of seven consensus studies coming together to publish a synthesis of the consensus research. And this is a positive development that I hope will contribute to closing the gap between public perception of consensus and the actual overwhelming agreement between climate scientists. Our synthesis of consensus research is freely available at http://sks.to/coc

-- John Cook

What's the general reasoning of the other 3%?

GoinFerARipEh

Interesting question. It is important and diagnostic that there is no coherent theme among the reasoning of the other 3%. Some say 'there is no warming', others blame the sun or cosmic rays or the oceans. Those opinions typically mutually contradictory or incoherent: i wrote a piece about that here that illustrates a few of the contradictions: https://www.opendemocracy.net/conspiracy/suspect-science/stephan-lewandowsky/alice-through-looking-glass-mechanics-rejection-of-climate-science -- Stephan Lewandowsky

I feel really helpless as an individual in making any difference in the direction we're heading. Is there anything we can do that would actually be helpful to stop or reverse global warming?

toastandpeanutbutter

Solving this problem requires enormous changes in how society acquires and uses energy. Your biggest impact as an individual is to influence the people in power to make this transition. Or, better, run for office and become one of those people in power!

Your impact is greatest when you join with like-minded people locally, nationally, or internationally to demand action.

Individual actions as listed below are useful (and I do many of them). But we really need bold creative people to redesign our world on a grand scale.

-Sarah G.

Thanks for doing this AMA! I have a few questions:

What do you believe is the difference, if there is one, between studies like Verheggen 2014, which reports 91% , and Oreskes 2004, which reports 100%?

Do you believe that the lack of support of climate policy in Congress is due to a fear of economic fallback, a disregard of evidence, or a combination of the two?

What do you use to measure expertise (education level, job experience, how close the field is to climate science)?

How significant is the recent Paris Agreement, and what do you believe is the logical next step?

And finally, what do you think should be done to educate the public about this threat?

lastcommenter

The main differences between the different consensus studies are: - survey of literature vs survey of scientists' opinions - how is consensus position defined - how is the sample of who/what to survey determined

Verheggen (that's me) is an opinion survey; Oreskes (and Cook 2013) literature survey

Verheggen's definition of what entails the consensus position was rather strict: man-made greenhouses gases having caused more than half of recent global warming. Oreskes' operational definition was, judged from the abstract whether the article agreed with the general thesis of anthropogenic global warming.

Both survey's included the wider scientific field, so not just phsyical climatologists, but also scientists/papers who study climate impacts and mitigation.

So for this specific comparison, the first tow aspect probably explain a large fraction of the difference in consensus.

--Bart

I feel like no one actually read this study.

97% of scientists agree that humans have an effect. I'd wager 97% or higher of non-scientists would agree as well from what I've seen. I've actually never met anyone in real life or the internet that said humans have absolutely 0% impact on their environment. This is just a strawman that gets repeated and attributed to people.

The relevant questions are exactly how much are humans contributing and can we do anything about it that will stop or reverse the parts that humans have caused? And there is no 97% consensus on that answer.

hillman7

Actually, there are a number of different definitions of consensus used throughout the studies - some look at humans causing *most* of global warming, others look at humans *causing* global warming (which implies a large or dominant portion), others look at humans contributing without specifying the percentage. Regardless of the definition used, there is overwhelming consensus among climate scientists.

To give a precise example, in our 2013 paper, we asked scientists to rate their own climate papers. Among papers that were self-rated as stating a position on whether humans were causing *most* of global warming, around 96% endorsed the consensus position.

So I'm afraid its your characterisation of our research that is the straw man.

-- John Cook

What would you say to climate change deniers who also claim that the 97% statistic is fabricated?

oftheunusual

Hello there!

I would encourage them to read this meta-analysis of the existing research on the subject and revisit their opinion.

But of course there will always be people who can't be convinced of a fact no matter how much evidence you present.

-- Peter Jacobs

Given 99% of nutrition scientists got fat/sugar wrong for the last 40 years, why should we believe you guys?

denverfan79

https://www.reddit.com/r/science/comments/4ekfo7/cause_of_global_warming_consensus_on_consensus_a/d21ngbq

-- Peter Jacobs

/u/SkepticScience You've still not defended yourself against those who's papers you classified as endorsing AWG when in fact they were not... You've still not defended yourself against the fact that Cook et al. (2013) packages 'Explicit endorsement without quantification' & ' Implicit endorsement' with "Human beings are the cause of Global Warming" when those concepts are NOT the same. Cook et al. (2013) did not find that "over 97% endorsed the view that the Earth is warming up and human emissions of greenhouse gases are the main cause." Quoting from the Abstract, "Among abstracts expressing a position on AGW, 97.1% endorsed the consensus position that humans are causing global warming. " http://iopscience.iop.org/article/10.1088/1748-9326/8/2/024024;jsessionid=F2C83245B7696D5641B1436BFD695012.c1.iopscience.cld.iop.org#erl460291t4fn3 The first issue with “Cook et al. (2013) is “explicit endorsement with quantification” vs “explicit endorsement without quantification” Within the Abstract section 2. Methodology, of “Cook et al. (2013), we can observe the paper broken down as follows: (1) Explicit endorsement with quantification. (2) Explicit endorsement without quantification (3) Implicit endorsement (4a) No position (4b) Uncertain (5) Implicit rejection (6) Explicit rejection without quantification (7) Explicit rejection with quantification “explicit endorsement with quantification” is representative of a paper that states that: "Explicitly states that humans are the primary cause of recent global warming"—primary cause in usage meaning more than 50 percent. This is the only category anyone claiming "X number of papers endorse Man Made Climate Change." should reference, because this is the only category where that statement is true. “explicit endorsement without quantification” are papers in which the author, by Cook’s admission, did not say whether .001 percent or 1 percent or 50 percent or 100 percent of the warming was caused by man. The crux of "explicit endorsement without quantification" is that man has contributed SOME amount. Then there is "Implicit endorsement", which "Implies humans are causing global warming. E.g., research assumes greenhouse gas emissions cause warming without explicitly stating humans are the cause". The important distinction here is that neither the “explicit endorsement without quantification” or the "Implicit endorsement" make the claim that Human beings are the primary cause. However the theory of AGW([Anthropogenic, or human-cause, Global Warming) is that human being ARE the PRIMARY cause. However within his results he breaks down the summery of abstracts with AGW([Anthropogenic, or human-cause, Global Warming) position (%) as follows: Endorse AGW 97.1% Reject AGW 1.9% Uncertain on AGW 1.0% In formulating his result of "Endorse AGW", Cook lumps together "Implicit endorsement" & “explicit endorsement without quantification” with “explicit endorsement with quantification”. Thus lumping together papers which suggest that human contribute some portion, with those stating that we are the primary cause. Further examination of Cooks data http://iopscience.iop.org/1748-9326/8/2/024024/media/erl460291datafile.txt shows the truth of the matter: By his count, the number of articles classified into each category was: Level 1 = 64 Level 2 = 922 Level 3 = 2910 Level 4 = 7970 Level 5 = 54 Level 6 = 15 Level 7 = 9 The 97% figure was the sum

of levels 1-3. Assuming the count is correct—that 97% breaks down as: Level 1: 1.6% Level 2: 23% Level 3: 72% This shows only 1.6 percent explicitly stated that man-made greenhouse gases caused at least 50 percent of global warming. Only Level 1 corresponds to "the Earth is warming up and human emissions of greenhouse gases are the main cause." Hence when John Cook attributed that view to 97% on the basis of his Cook et. al. (2013) he was misrepresenting 1.6% as 97%. So no, Cook et. al. did not find that "over 97% endorsed the view that the Earth is warming up and human emissions of greenhouse gases are the main cause." A study that is no more than a collection of ill-categorized data intertwined with word manipulation. If this is what is considered to be 'scientific', then i'm sure I will enjoy these other 'studies'.

dillyyoung

Thanks for this (lengthy) comment. It neatly encapsulates the key flaw of criticisms of Cook et al. (2013) - the unwillingness of critics to consider the self-rating survey that replicated the 97% consensus. To my knowledge, every criticism of our research has studiously avoided the self-rating replication.

To give a quick overview of Cook et al. (2013) (freely available athttp://sks.to/tcppaper), we first estimated the scientific consensus by categorising the abstracts of scientific papers about global warming. We identified ~4000 abstracts stating a position on human-caused global warming - amongst those abstracts, 97.1% endorsed the consensus.

Next, and here is the crucial part that every critic of our paper has conveniently ignored or avoided, we *replicated* our result by inviting the authors of the scientific papers to rate their own research. If we had mis-characterised a significant number of papers (e.g., rated them as endorsing AGW when they didn't), then there would've been a significant discrepancy between our abstract rating and the self-rating. 1200 scientists responded to our invitation, resulting in over 2000 papers receiving a self-rating. Amongst papers that were self-rated as stating a position on human-caused global warming, 97.2% endorsed the consensus.

However, when you dug deeper into the data, there was one significant discrepancy between self-ratings and our abstract ratings. More than half of the abstracts that we rated as "no position" were subsequently rated as "endorsing AGW" by the paper's own authors. So in contrast to this commenter's characterisation that we characterised papers as endorsing when they were not, quantitative analysis reveals we were actually much more likely to go the other way - characterising papers that *did* endorse AGW as expressing "no position" on AGW. However, the reason for this was relatively straightforward. Abstract ratings were based solely on the abstract text while self-ratings were based on the full paper, which were more likely to include an endorsement of AGW simply for space reasons.

The self-ratings also present another key statistic that I don't recall ever being mentioned by a critic of our study. Amongst papers that were self-rated as stating a position on whether humans were causing *most* of global warming, around 96% endorsed the consensus. So Cook et al. (2013) found that regardless of the definition used, there was overwhelming scientific agreement with the consensus position.

It's significant that critics of our study refuse to take a step back and look at the full study, with independent methods replicating the finding of an overwhelming consensus on climate change. Further, they refuse to take that extra step back and see how our finding of overwhelming consensus is replicated by a range of independent studies. That is the key result of the new "consensus on consensus" study - that the scientific consensus is robust and replicated across many studies. This new study is freely available at http://sks.to/coc

-- John Cook

Hopefully I'm not too late. I'm not even sure this question makes any sense. I got it from a Doctor who would probably put herself in the 3%. The rest is a quote from her.

"Ask them for a definition of AGW which can be measured. Then ask them for the measurements, and their accuracy, both now, and over the millennia.

Here's something I posted earlier about this:

I have never said that human activity has no impact on weather/climate, although I have never seen it definitively proven, or even defined. The problem, for me, is that we are talking about solutions to a nonlinear PDE in 3 dimensions plus time. Integrating a much-simplified version of these equations led to the discovery of chaos theory, which adds a whole other level of doubt on the efficacy of these models.

Next, there is the problem of the data. No one ever, as far as I can see, has tried to estimate the margin of error of the input data. Sensitivity experiments, where (for example) the resolution of the models is changed and then they are run again to compare to the results of the higher-resolution models has not been done. No-one seems to consider Chaos Theory in all of this.

Furthermore, as posts to this site have shown, the equations themselves are being altered to take into account new factors.

Given all these unanswered questions, I simply cannot see how anyone can think that the AGW believers have proven their supposition."

jesusporkchop

Hello there!

Ask them for a definition of AGW which can be measured

Anthropogenic global warming is the increase in the mean temperature of the planet due to human activity. Warming can be measured by measuring changes in the globally-averaged temperature. Attributing the warming to human activity requires understanding how different drivers of climate differently impact the climate system and being able to measure relevant variables. We can measure the concentration of greenhouse gases in the atmosphere. We can measure their isotopic ratios and show that they're from fossil fuels rather than say volcanism. We can measure the heat imbalance accruing in the ocean. We can measure the temperature profile of the atmosphere with altitude and show the expected upper atmospheric cooling that enhanced greenhouse warming produces but other kinds of warming do not. And so forth.

The problem, for me, is that we are talking about solutions to a nonlinear PDE in 3 dimensions plus time. Integrating a much-simplified version of these equations led to the discovery of chaos theory, which adds a whole other level of doubt on the efficacy of these models.

She is talking about weather forecasting, which is fundamentally different than climate change. Weather is an initial value problem, climate is a boundary value problem.

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This is just simply false. It's like she's never read a single scientific paper on the subject.

Furthermore, as posts to this site have shown, the equations themselves are being altered to take into account new factors.

I don't really understand what this is supposed to mean. That models are refined as we learn more about various processes? And this is supposed to be a bad thing?

-- Peter Jacobs

I'm a science student, and most of my professors will even tell me that there are anthropogenic contributions to the concentration of greenhouse gasses, which undoubtedly lead to some degree of climate change. They also usually tell us that quantifying any amount of climate change is difficult, let alone man's total contribution to the change in climate as a result of increased carbon emissions. Does your study address any of those concerns?

BarrettBuckeye

No our study doesn't, directly. Our study assesses the consensus on climate change amongst scientists. Quantifying global climate change is indeed difficult and takes thousands of dedicated professionals. Even though difficult, it is being done at a very advanced level, and done well. The human contribution is clear and is what our study addresses. A strong consensus exists amongst the climate scientific community in this regard. -Peter Doran

I feel like this is a whole lot of effort for nothing. Most people know the majority of scientists agree, and you're just splitting hairs over the number. The bottom line is, all other evidence aside, this piece is completely meaningless. So 97% think global warming is caused by man, at one point that many or more thought the Big Bang never happened, at one point that many or more thought physics wasn't real, at one point that many or more thought the world was flat.

Don't misunderstand, I am not arguing against global warming. My point is that the more you try to hammer on this meaningless point the more you will lose the audience you are trying to convince. Take it from someone who grew up with em. And you can't even argue it based on this *because they're right*. 97% of scientists can be and are wrong about nearly every single thing before they are right about it.

In short, it is very unscientific to use this as standalone evidence.

TelFiRE

We are certainly not claiming that the existence of a strong consensus is "standalone evidence", so you're setting up a strawman argument.

Repeating myself:

Whereas the presence of widespread agreement is obviously not proof of a theory being correct, it can't be dismissed as irrelevant either: As the evidence accumulates and keeps pointing in the same general direction, the experts' opinion will logically converge to reflect that, i.e. a consensus emerges. Typically, a theory either rises to the level of consensus or it is abandoned, though it may take considerable time for the scientific community to accept a theory, and even longer for the public at large.

--Bart

There have been quite a few similar studies and surveys done in the past. How many of these studies do you think you'll have to do in the future? How annoying is it to have to keep repeating yourself?

Deezl-Vegas

I'm hoping that this is the last one that I'm involved with, but I'm not laying odds...

-- Stuart Carlton

Hi, thanks for doing this. I find a counter argument to climate change at this time is that past models have been inaccurate in projections up to this point in time. Why do you think this was the case? Also what model do you think is the most accurate going forward?

Beagleoverlord33

Hello there!

Anyone who works with models is aware of their strengths and limitations. George Box is often paraphrased with the saying "All models are wrong. Some are useful."

Climate models can always be improved and will never be perfect representations of the climate system. However they are undeniably useful.

In terms of how well they have done in modelling what has already occurred, they have shown "skill", i.e. superiority to alternative assumptions like no change or a continuation of observed trends (here and here).

Claims that they haven't done well in recent years are more than a little overblown. When you properly account for the phasing of natural variability and trends in radiative forcings, and do a proper apples to apples comparison of spatial extents, etc., the models and observations are in good agreement.

That's a long-winded way of saying that when people claim the models don't do well they're usually doing an inappropriate comparison.

For further reading, see:

- Schmidt et al., 2014
- Huber and Knutti, 2014
- Cowtan et al., 2015

-- Peter Jacobs

Can you tell us what differs between this consensus and the one in the seventies confirming the beginning of a ice age? Is the "mass hysteria" right this time. How do you see us reversing the change and how long is our timescale.

ThinSTAR

This explains your first question well I believe. The notion that there was a concensus of the beginning of an ice age is false. http://www.realclimate.org/index.php/archives/2005/01/the-global-cooling-myth/

-Peter Doran

Are humans causing global warming or contributing to it? I have been under the impression the globe would warm regardless, just at a slower pace.

Dejimon

Pretty much all of the recent warming is most likely caused by human activity (see e.g. http://www.climatechange2013.org/images/figures/WGI_AR5_FigTS-10.jpg). Over the long run (milennia), the earth actually cooled down very gradually, on its way to another ice age thousands of years from now. The good news is that the accumulated greenhouse gases will very likely prevent that ice age from happening.

--Bart

Hi there thanks for the AMA. I'm currently in a global environmental change studies class at my university and my professor Robert Deconte has a published a couple papers, conducted field research all over the globe, for example ice core in Antarctica, as well as speak at conferences in London and other places as well. My question is, have you guys has ever crossed paths in your studies or worked on a project together? This will probably get buried but I'm just curious

SOMEguysFRIEND

I think you are talking about Rob DeConto at UMass Amherst? He is a very well known and respected modeler of past climates and ice sheets. I've crossed paths with him several times. -Peter Doran

Hi there thanks for the AMA. I'm currently in a global environmental change studies class at my university and my professor Robert Deconte has a published a couple papers, conducted field research all over the globe, for example ice core in Antarctica, as well as speak at conferences in London and other places as well. My question is, have you guys has ever crossed paths in your studies or worked

on a project together? This will probably get buried but I'm just curious

SOMEguysFRIEND

I haven't met him, but I follow his work, especially the stuff he does on ice sheet stability and sea levels with David Pollard.

-- Peter Jacobs

Just a note for you authors as I might have your attention....

Maybe scientists should not be the communicators of this important science! I know that this is anathema to every grad-school teaching, but hear me out.

We teach marketing and psychology in our universities, have experts in these fields who are trained to disseminate information and persuade people to act. We would not let these people conduct climate change science as they do not have the expertise. So why are we stepping on their toes, trying and mostly failing to get our points across?

I argue that scientists should work hand in hand with professional communicators not try to do it themselves - instead we are causing much harm to our own cause.

Perzival-X

Hello there!

I do think there is more than a grain of truth in what you're saying. One of the coauthors of this paper is Ed Maibach, who is a communications expert actively involved in communicating climate science to the general public.

I think it's a bit of an overreach to say that communicating science should only be left to comm people (the general public actually wants to hear from and trusts the scientists themselves), but I absolutely think that climate scientists should learn best practices in comm from experts if they are going to engage with the public.

-- Peter Jacobs

THANK YOU FOR HOSTING THIS AMA!

Question 1)

HOW LONG HAVE WE BEEN RECORDING GLOBAL TEMPERATURES ACCURATELY TO BASE EMPIRICAL EVIDENCE OFF OF?

Question 2)

WHAT HAPPENED TO THE ICE AGE GLACIERS THAT ARE NOW GONE; DID ALL THE FOSSIL FUEL EMISSIONS FROM ANCIENT TIMES CAUSE THE WARMING THAT CAUSED THE GLACIERS TO DISAPPEAR?

Question 3)

THE SUN IS ABLE TO SPONTANEOUSLY GENERATE ENERGY THROUGH NUCLEAR CHAIN REACTIONS, CAUSING MORE OR LESS ENERGY TO BE RELEASED AND ABSORBED BY THE EARTH AND OTHER PLANETS IN OUR LOCAL REGION OF THE MILKY WAY, SO WHAT INFLUENCE DO HUMANS HAVE ON THE SUN TO STOP THE HEATING TREND AS THE SUN AGES?

Question 4)

FROM MY UNDERSTANDING OF STAR PATHOLOGY THROUGHOUT A LIFE CYCLE, STARS HEAT UP AS THEY AGE, HOW DO HUMANS IMPACT THE STAR THAT PLANET EARTH GETS 99.99% OF ITS EXTERNAL ENERGY FROM?

Question 5)

HOW DO YOU EXPLAIN THE LAWS OF THERMODYNAMICS, WHICH SAY THAT EVERYTHING TENDS TO CHAOS -- FIERY DEATH, ARE NOT CONTRIBUTING IN ANYWAY TO A WARMING TREND?

Thank you for taking time to answer my questions!

-ML

iCEOTheDonald

1) Since the late 19th century. 2) Previous climate change episodes are largely due to changes in the Earth's orbit and consequent changes in the amount of solar energy received by the plante 3) & 4) The solar time scales need not concern us, we are talking bazillions of years. 5) Not sure what that means. --Stephan Lewandowsky

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I can't speak to the ban itself, but it looks like a bunch of people spammed the same copypasta they stole from a two year old blog post.

John Cook answered it here:
https://www.reddit.com/r/science/comments/4f6f6g/science_ama_series_we_just_published_a_study/d26wd1e

-- Peter Jacobs