American Chemical Society AMA: I'm Andy Jorgensen, Associate Professor of Chemistry and Environmental Sciences at the University of Toledo. Ask me anything about communicating climate change to non-scientists.

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

[1]Affiliation not available

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How do you respond to climate change deniers who will argue that you are biased because your career path is directly tied to claiming that climate change is a reality?

parkerLS

I give several answers to this very common comment. Scientists are generally honest, but if there are problem or flaws, other scientists provide corrections or context. This is a field where good or bad news, supported by facts, can be convincing. Some reply that there is more money in other fields, like drilling for oil, but that might not be convincing. I use the analogous situation - why do you believe that the antibiotic given for your infection will likely work even though there is much more money for scientists in that field for being influenced by financial matters. We are constantly checked by other professionals. We are not part of a giant conspiracy.

Have you ever been asked a question that left you stumped? Follow-up - what's the most frequently asked "gotcha" question that ends up falling flat after you can show some contradictory evidence?

Silverback_6

Good question. Early in my time in giving presentations I could not definitely answer the question of why the earth was warmer eons ago. I subsequently studied the issued and learned that the position of the earth with respect to the sun - our orbit - has changed over time, which caused a different amount of the sun's energy to hit the earth. That is not the situation at present. The sun's radiance to us has changed little in decades.

I have seen some research that suggests one of the biggest reasons for climate change denial by the general public is that it makes people feel scared and powerless; it's more comfortable to believe that something that threatens our entire planet is a myth or a lie. Is that consistent with your experience? What is the best way to make people more emotionally ready to understand the science of climate change, while staying accurate?

neurobeegirl

You have a valuable prospective and I see that you are in that field. I believe that there are several reasons why we don't want to believe - and, more importantly, act. First and foremost, we do not like to be told that we need to change, particularly for something as broad as climate change. We don't even like to exercise when we are told we should! Second, the changes are hard to detect, though that is getting easier. Third, there are those who believe, sometimes for religious or other social reasons, that humans are not possible to change the earth. Looking at photos from Asian cities - or US cities before the EPA - will tell you that we can. I do include a significant discussion of what we can do to reduce the problem - and note the values - saving money, creating green jobs, using FREE energy from the sun and wind. But the points you raise are value and should be considered.

Have you ever considered collaborating with people in the field of psychiatrics? From where I sit, climate change denial has more to do with fear of uncertainty, chaos and death than it does with anything remotely pertaining to climatology. People are terrified of the notion that nobody is in control, and climate change speaks volumes about the human condition.

Seems to me that we're going about this all wrong.

matthias7600

I do some reading in the area of social responses to this issue. I recommend the work of Anthony Leiserowitz and Edward Maibach et al at Yale. There are a group of individuals, several percent of the US population, who will not be convinced, so it is not reasonable to be reasonable with them. But I have found from the data I collect at my talks that there are 20% or so of individuals who will change their mind if shown compelling data - and given hope for how to deal with the problem. Yes, there are human nature aspects to this, so one must put the points in perspective - see my other comments on analogies. Control is an interesting issue. I frequently get the comment that even if we do all we can, China is the big culprit and they are doing nothing. This is wrong for two reasons. Our emissions of greenhouse gases per person in the US are more than twice that of those in China, and almost 4 times the world average. We have lead the world in emissions per person for decades. In fact, 26% of GHG emissions since 1870 have come form the US while we are less than 5% of the world. The other statement is about China doing something. China has made commitments related and separate from the Paris accords and, for example, decided not to open more coal mines. But their emissions do present a challenge, so international cooperation is critical. Their social changes that accompany climate changes may well be a major driver for them.

What is the most compelling evidence to suggest we've broken away from the predictable climate cycles we've observed for the last 100,000 years or more?

SetPhazersToStun

There are many indications: temperature changes in just the last few decades, including successive records for the world average temperature in 2014, 2015 and 2016. Three years in a row is compelling. Others include loss of Arctic ice, which reflects warmer oceans. Increasing acidity of oceans due to absorption of carbon dioxide. Increased sea levels, due to both thermal expansion of water and melting land ice. Also, compelling evidence comes from biology - early budding of plants, shifts in zones were plants and animals are migrating to.

How do you communicate the scale of the emergency while mitigating panic and hopelessness?

merikariu

I use the analogy of a fever. The earth's temperature has changed about 1.8 degrees F in recent decades. This is rather comparable to a child with a fever of this level. It is a serious situation which describe as the need to "pay attention." It is not life-threatening. The same with the temperature increase of the earth at this level. But, in both cases, it is not to be ignored. By 2050 middle estimates of temperature increase are almost 4 degrees F, which would be very serious for a child and about the point of what climate scientists say are irreversible changes in the earth's climate. By 2100 this could be 6 degrees F - and remember that this is an average, with the Arctic seeing about twice this. So like the child's fever, we must act - quickly and decisively.

What is the strangest reaction or comment you've witnessed from a climate change denier?

Indioduke

I was once heckled by someone who yelled out at a honors banquet that water is a greenhouse gas so are we going to get rid of it. Of course water is a greenhouse gas. Fortunately water, carbon dioxide and other gases makes the earth warmer than we would be if there were not atmospheric gases around the earth. On average we would be freezing if it were not for these gases instead of an average of about 60 degrees F worldwide. So we like the Greenhouse Effect, but we don't like the present Enhanced Greenhouse Effect. Regarding water, the concentration of water in the air is increasing and it affects rainfall, including more instances of intense rainfall. But the increase has not been comparable to the 40% increase in carbon dioxide since the Industrial Revolution.

Hi. What has been the fact you have used in your teachings that usually works to convince those who don't believe that climate change is real?

mistymountainz

Both in my regular teaching and in speaking about climate change I use personal response devices, called "clickers" to gauge the response of members of the audience. In speaking with many groups on climate I have found that a single hour of showing document facts - temperature records from NASA, gas emissions from the D of Energy - and one fifth of the group has become convinced of the reality of climate change.

Thank you for doing this AMA. As a PhD student working in a related field, I have fielded questions like those below from friends and relatives and am interested in your responses.

How do you respond to people that believe, as Matt Ridley presented to the Royal Society last year (link below), that science has not provided sufficient evidence to suggest that global climate change is inherently dangerous? On a related point, what is your opinion on openness in scientific discourse to allow those that might not disagree with the science but instead disagree with the extent of the forecasted danger? I say that with the fact in mind that there have been calls by some to not allow "climate denier scientists" to speak at scientific conferences. Lastly, how do you respond to those that believe that money has tainted scientific objectivity by linking the livelihoods of researchers to their field, creating an incentive for dramatized predictions. If the future of a PI's research didn't rely on continuously obtaining grants, would the same dire pictures of the future still be forecasted?

http://www.thegwpf.org/matt-ridley-global-warming-versus-global-greening/

diceroseros

I replied to the financial issue above. Deniers to have avenues - that is why we read about them all of the time in the popular press. They make an impact well beyond what their science indicates. Yes, there is little patience with those deniers who keep making false statements - like the so-called pause in temperature increases. The last 3 years of record increases should close down that argument. To quote the idea of Richard Alley and others - if a scientist found a truly compelling argument that the present understanding was so far wrong such that the 40% increase in carbon dioxide in the air in a few lifetimes was not the problem, that person would make their reputation on that science. Everyone in climate science would like to be shown that the problem is not as bad as the present evidence indicates, but it has not happened as yet. It would have to be something fundamental in the science, which as been around for over 100 years and no one has found a flaw.

How do you react to "alternate facts" - people who cite debunked or cherry-picked data or studies? (Often a dimly-remembered version as presented by Breitbart or whatnot)

gnurdette

Simply - with facts and give the sources, such as NASA, NOAA, D of Energy. I sometimes make a facetious comment that I believe NASA - including watching the landing of Neil Armstrong on the moon in person that Saturday night in July of 1969!

Obviously animal agriculture isn't the end all for environmentalism. But it still is a big contributor. How do you respond to people passionate about slowing climate change, but also say "you won't take away my steak" (looking at you Neil Degrasse Tyson)

SilentmanGaming

I respond partly by example - eating almost no beef, the production of which puts over 7 times as much carbon dioxide in the air as a like amount of chicken - living close to my workplace, when replacing appliances or cars getting ones that are much more efficient - and monitoring my home's temperature and using an electric blanket while letting my house drop in temperature overnight. As I said, it is like exercise and eating, many small steps add up. We got to this point by an almost continual changes in lifestyle which put us in the US at the head of major countries in terms of emissions per person - twice that of China and Europe. We can get better, but it takes the will and money and frankly laws - just like it did to improve the air in our large cities which many of us remember from 50 years ago.

While your background in Chemistry makes for an excellent foundation on which to understand and perhaps teach climate change, isn't the question of communicating this information to non-scientists more a psychological or educational question? Wouldn't someone with expertise in those disciplines be more successful in this endeavor?

Bman409

As you may have seen above, although my degrees are in chemistry, my post-doctoral position was in science education, which has been an emphasis for my entire career. I chaired the American Chemical Society's Committee on Education and have published in science education. Yes, getting the point across takes more than facts, it takes presenting the facts in a comprehensible way. As I stated, I use "clickers" to monitor the effect of what I am saying - in my chemistry classes as well as in my climate talks.

Currently, CO2 is being captured from flue gas in fossil fuel power plant; however, other sources for CO2 will still being generated. Will CO2 capture and sequestration relevant in mitigating global warming in the long run?

munbulan

There are only a very few plants that capture CO2 before it gets in the air - only a handful. It is incredibly difficult, far harder than the success we have seen in reducing SO2 emissions by scrubbing, but very worthwhile. It is very energy intensive, so you lose energy in the process, so must burn more fuel. It is worth significant research, but it will be limited. There is very little hope of actually removing CO2 from the air since the concentration, though high by historical standards, is not high enough to do efficiently. So one of the answers is to let nature do the sequestration! That is photosynthesis. There is work done on nudging roots to store more carbon dioxide. This is also worth pursuing since we would be partnering with nature, not fighting it.

Is climate change caused by humans/human activity or is it occurring naturally? If possible could you link key evidence to support your answer? Many thanks

crunchy_sunscreen

See the information by the poster below. But, an important point that many miss is that even if the 40% increase in carbon dioxide in the past hundred years were not caused by humans - though we know it is by the isotopic signature of the carbon which indicates it was underground as coal and oil for millions of years - we would still need to deal with the consequences - such as rising sea levels, increased temperatures which effect crops and the prevalence of insects and other health-related issues. If you natural, non-human effect environment is unhealthy, you need to deal with it, not say it is just "natural." Many things are natural and harmful and must be dealt with.

It seems to me that science communicators are at a distinct disadvantage because the proponents of anti-science are free from the onus to ensure their materials are well-composed and well-supported. Do you find this to be an issue in practice or do you find, for instance, that the opposition puts as much effort into the *appearance* of legitimacy as you and yours put into actual legitimacy?

halborn

You point to a constant frustration. When talking about climate I make sure that I am reporting data that is confirmed and reliable. A denier can say about anything. This makes for a challenging discussion. So I need to stress the source of my information and how reasonable it is given what is known and perceived. But this imbalance will not go away, even as the ocean's waters rise up through the drains of the streets of Miami.

When will we hit a point in climate change were there will be no going back? How would you go about reducing causes climate change if given the power to do so? What will be the first "side effects" of climate change and when will they happen? What has to happen for climate change to be reduced on a macro scale? Thanks for this AMA!

Paulcashcarter

One estimate of the point of irreversible changes is 2 degrees C, so 3.6 degrees F. We have presently reached half of that. At present in the world we emit 36 billion tons of greenhouse gases annually. The good news is that this amount has not increased for about 2 years whereas it was increasing about 3%

per year. The less good news is that this must decrease to about 5 tons to stop the temperature increase. That is a major challenge. We are seeing the first side effects - less ice in the Arctic, remember that ice reflects sunlight so less ice means less reflection and more absorption of heat and therefore less ice, so a snowball effect - changes in food production, which can be critical. California produces one-third of our vegetables and two-thirds of our fruits and nuts. They have been experiencing a drought, which has been reduced this year, but their changes in precipitation, which are affected by climate change, can mean major changes in food productivity - which will have consequences in the US and other parts of the world who we feed with our excess. In the Midwest if there are extremely high temperature for only a few days in a certain time in the crop development cycle there can be drastic reductions of crops. But some of the key effects will be storms, ocean level increases and ocean increased acidity. There are places in the world an even the US that will need to build barriers to the ocean. This will be very, very expensive and disruptive.

What methods can you use to preach to the non-choir? As far as I understand attitude change is easier to achieve from early age education and loads of science communication materials will focus on children. But how can you approach adults with set and less flexible views, even previously mentioned deniers maybe? Without them perceiving these attempts as being offensive or dismissive of their opinion?

normabatty

Early education is valuable for any type of learning, including science. I teach a course that includes elementary education majors and last week I gave my presentation to a group of such teachers. So educating the educators has been an emphasis of mine. Such teachers are often drawn to the early years for reasons other than an interest in science, so it is important to give a context for the science - and not just climate change. Science is not magic or not unintelligible - but challenging to teach accurately and in a comprehensible way. There are several good texts about this, including the American Chemical Society's Chemistry in Context for college students who are not science majors but who may become teachers.

Thanks for the AMA!

Here's my question:

What would be your suggestion to increase scientific literacy, despite strong political resistance?

winz3r

Science matters! Whether it is for health reasons, such as nutrition or medicines, for economic reasons - more efficient autos and appliances safe you money - career opportunities - there are more jobs in renewal energy than fossil fuel production so the prospects are better. One must ask those who promote such matters as fossil fuel use what do they have to gain. The answer is far more than any grants awarded to educate about climate change or any science. On our specific point, governmental agencies have put together very good brochures on Energy Literacy and Climate Literacy which anyone can understand and learn from, though climate is changing faster than the latter document so it is a bit out of date.

Despite a near-unified front amongst academia, entertainment/culture figures, and (until recently perhaps) government officials that urgent action on climate change is needed, the issue never appears high on polling of what issues matter most to voters

Are voter priorities wrong?

Is it simply a matter of waiting for the negative effects of climate change to manifest themselves to an even greater degree before voter attitudes change?

ningrim

Very good question. It does poll low, though the Yale group cited above indicates that 70% of those in the US believe that climate change is happening - and this was polled after the elections. Even about half of the supporters of the president believe that climate change is really happening. It polls low because so many other issues which poll higher are closer to home - jobs, crime - and some think terrorism, but it is quite clear that climate change will affect your life more than terrorism for the vast majority of people - just more slowly. So, yes, the priorities are wrong, hence my reason for speaking to so many audiences or so many forums like this one. But, as you say, it may well take significant negative consequences to sway that needle. Recently I have taken to adding a slide to may talk that urges listeners to speak to others - this is real and there is a price to be paid, especially for the younger generation. I got into this area just a few years ago when my first grandchild was born. In 2100, when major negative impacts which may be almost impossible be avoid, she will be younger than my mother is now, so very possibly alive at that time. She and her generation will be paying a price - but perhaps we can put a down payment down right now, just like a like to do for her college expenses.

How important do you think reforestation is compared to cutting carbon emissions? Could one balance out the other significantly? What historical levels of carbon emissions and plant life correspond to what we need for a stable temperature?

obfuscationeschewer

I am not an expert on reforestation - but it can help. However, some trees are far better than others. And, more importantly, when those tress die or are burned, the carbon dioxide and maybe methane enter the air. Trees are only temporary repositories of carbon dioxide, though they can help bridge us to broader use of renewal fuels.

How do you think communication about climate change has changed since the "Climate Gate" fiasco between scientists and the public?

AdamBermingham2916

Regarding the so-called "Climategate" situation I cite the NSF and the British Parliament who found nothing outside ordinary scientific analysis by the individuals involved. It is a false "scandal."