

Climate Update: Warming Temperatures

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17-Minute Listen

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The National Oceanic and Atmospheric Administration released its annual "State of the Climate" assessment. Deke Arndt, an editor of the report, discusses warming temperatures and other climate trends from 2012. Plus, Sol Hsiang, who studies climate and violence, discusses his research connecting rising temperatures to increases in human conflict.

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With Climate Change, No Happy Clams

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Obama: U.S. Should Lead Assault on Climate Change

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With Rising Temperatures, Infrastructure Falters

Transcript

IRA FLATOW, HOST:

Last year was another record-breaking year for the global heat index. 2012 was among the 10th warmest years on record, the hottest on record in the United States according to the State of the Climate report that was just released by the National Oceanic and Atmospheric Administration. Hotter temperatures, melting ice - how is 2013 looking up?

Deke Arndt is one of the editors of this report and chief of the climate monitoring branch at NOAA in Nashville, North Carolina. He joins us from WCQS. Welcome to SCIENCE FRIDAY.

DEKE ARNDT: Thank you. Thank you for having me.

FLATOW: Does one thing stand out? One - is there a blip or that really pops out in 2012 climate?

ARNDT: I think it's a mix of two things. We saw, generally, broadly, across the many indicators that we looked at that the warming and the changing going on with our climate system continues, you know, and that's looking at the oceans or the ice sheets or the glaciers or the snow cover. We saw, you know, broadly, a continuation of recent trends in that regard. And then also the Arctic as a region, not just the Arctic Sea but all around the Arctic - land, air, sea, ecosystem - huge changes, huge - and what we call anomalies in 2012 across the Arctic.

FLATOW: Wow. Will that be Greenland also and melting glaciers there?

ARNDT: Yeah. The Greenland ice sheet saw some record loss at times during the year itself, and then again it tends to - every - almost every year lose more and more ice. So the mass, the actual quantity of ice sitting atop Greenland, down once again this year.

FLATOW: Mm-hmm. And there's sort of a - there's a feedback loop there, isn't there, with the ice and - the melting ice in the Arctic and then the exposure of the sunlight to the ocean?

ARNDT: That's correct. You know, we often don't think about how important the Arctic is as part of our climate system, but it is a region that is covered in white stuff throughout most of the year. And when that white stuff goes away, what it does, the snow and the ice that covers the Arctic tends to reflect the incoming sunlight right back out into space. And as that disappears, as that retreats, as the footprint of the white stuff, the frozen stuff, snow and ice, goes away, more and more sunlight is absorbed in the Arctic. And so that is what we would call a positive feedback or what folks might call a vicious cycle that tends to add to the warming of the planet. So it's an important region even though it's many hundreds and thousands of miles away.

FLATOW: It appears, though, that while the Arctic is melting, there may be something - the opposite actually happening in the Antarctic.

ARNDT: Yes. The Antarctic, in 2012 anyway, saw a growth to record level. So when the Antarctic sea ice reached its maximum in its - at the end of its winter, which is September, that was larger than it had been in the previous 35 years or so. What we saw there - what we do see in the Antarctic is continued growth and retreat. Almost every year, it expands rapidly and contracts almost all the way back to the Antarctic continent. Whereas in the Arctic, we tend to see permanent, multi-year sea ice. So when we lose ice in the Arctic, it tends to be indicative and have longer term consequences than what we see in the Antarctic.

FLATOW: Does that mean that global warming is not happening, seeing the snow or the ice grow - building in the Antarctic?

ARNDT: Well, again, that is more of an annual cycle. And each year, kind of - and the Antarctic is reborn, and so it's a little bit more independent of the years before it. We're actually seeing some thinning of the ice across the land in the Antarctic as well. So, no, really, multiple indicators, when you look worldwide, especially in the Arctic where multi-year ice is important. And multi-year ice, ice that survives this expansion and contraction cycle, is an important element of - and very sensitive to the long-term climate signal. We're seeing multiple indicators that the planet continues to change, and all of these indicators are at least pointed in the direction of a warming world. Most of them are pointed strongly in the direction of a warming world. And those that aren't, are just - were relatively neutral for the last few years.

FLATOW: Let's talk about some of that - those warming events. It's - the summer was really hot, and it's drought-filled in lots of places in the U.S.

ARNDT: So we saw that across the U.S. beginning really in the spring months and extending into summer. And we had our warmest year on record here in the U.S. Even though it's roughly a top-10 year for the globe, the U.S. had its warmest year. So we were part of the driving of that warmth. And we saw a large drought kind of manifest during the summer months across the plains, and that has since migrated into the western half of the country. But yes, so we, in many ways, led the world in a very warm year for the United States.

FLATOW: Well, the Russians weren't far behind. They had a big drought, too, did they not?

ARNDT: Yeah. That's one thing, you know, that it's nice to look at these broad indicators, and it's great that these indicators and data sets and editors even come from all over the world to help put this together. So it's a real privilege to work with all of those folks. And one of the things that we really had noticed emerging as a theme was drought in the Northern Hemisphere, particularly in agricultural areas of the northern hemisphere. So 2012, by itself, will be known as a year of drought, not just in the U.S. grain-producing areas, but we saw that in much of Asia and Eastern Europe as well.

FLATOW: Were there any areas where things actually improved, anything that's going on with the climate?

ARNDT: Well, one way, you know, as part of the atmospheric system, we do continue to see reductions in ozone-depleting gases. So if you remember all the way back to the '80s when chlorofluorocarbons were an issue, we do see, if not major improvement, at least, the stabilization of those gases as well. And then in general, this isn't necessarily indicative of an improving climate, but when you bring all of these indicators together, one real positive that you get out of it is by having multiple authors looking at multiple data sets, looking at multiple parts of the climate system, it really helps us refine our precision. So we're able to be more confident that we are precisely measuring what we think we're measuring. And that's one of the purposes of this report.

FLATOW: Yeah. I'd like to bring on another guest who says increases in temperature may also lead to increases in violence and human conflict. You know, we all know that feeling when you're sweating in a hot, crowded place, you get a little antsy. Can a warming climate affect our social behavior? Sol Hsiang is assistant professor at the University of California, Berkeley. He's here in our New York studios. Welcome to SCIENCE FRIDAY.

SOL HSIANG: Thanks for having me.

FLATOW: How - tell us about your study. Isn't it - it seems like its common sense. Things get hotter. People get hot under the collar. What does your study show?

HSIANG: So what we did is we actually looked at 60 previous studies conducted by over 190 authors around the world. We try to understand were there any common

patterns in the results that these researchers were finding, and what we found is that whether you look around - wherever you look around the world, whenever you look at human history, the changes in the climate have been associated with changes in human conflict, from sort of the interpersonal level - conflicts between individuals, things like domestic violence or road rage on the ground; to the group level, things like inter-ethnic riots and civil conflicts.

FLATOW: And you can actually put numbers and figures on the increases in these things?

HSIANG: Yes. So that was the central contribution of the study, was to try and - it was actually a meta-analysis, where we took a lot of previous statistical results and we tried to combine them to get sort of more solid numbers that we could really get behind. And so what we found was that for a one standard deviation change in the climate, and that's just sort of a yardstick that we use, we observe a four percent increase in interpersonal conflict and a 14 percent increase in intergroup conflict, sort of as median estimates from around the world.

FLATOW: Fourteen percent. Wow.

HSIANG: Yes. So that's one reason...

FLATOW: Was that as surprising to you as it is sounding to me?

HSIANG: Yes. We were struck by both the level of consistency...

FLATOW: Yeah.

HSIANG: ...across different studies as well as the overall magnitude of these results. So the central contribution of the paper is to point out that the overall sensitivity of human societies is substantially larger than I think most people would intuitively think.

FLATOW: Just for the geeks in the room, how many degrees is one standard deviation here?

HSIANG: So the reason we used standard deviations is because different studies look at different locations. And changes in the climate, historically, look very different depending on where you are. If you're in a United States county, then a one standard deviation change in temperature is roughly five degrees increase in Fahrenheit. So it's a relatively small change, but it still leads to a pretty substantial change in human behavior.

FLATOW: Has anybody really studied, you know, what happens under a laboratory controlled condition, you get people hot?

HSIANG: Yes.

FLATOW: Yeah?

HSIANG: So two of the studies we looked at were actual experiments. I can tell you about them if you're interested.

FLATOW: Yeah. Please.

HSIANG: So one was actually kind of a famous study where they actually looked at - they messed with drivers on the ground to see basically how angry they could get them. And they basically applied the same treatment to all the different drivers. They put a car in front of a green stoplight and let a car come up behind them, and then they just didn't budge during the green light. And a guy - one of the researchers in the bushes basically timed how much time they spent on the horn during the 12-second green light cycle.

And what you saw was that on hotter days, there was a dramatically higher level of aggression towards the driver in front of you. There is a different study that was actually conducted in a laboratory, as you suggest...

FLATOW: Right.

HSIANG: ...where they actually did police training exercises in front of basically a monitor, and changed the temperature in the room and observed that when faced with an assailant, police officers were more likely to use an aggressive stance or to draw or fire their weapon when they're under hotter conditions. But that's a scenario where

both the police officers in the hot room and the cold room were faced with exactly the same stimulus in terms of what the assailant looked like and what their actions were.

FLATOW: Yeah. Well, you know, if the climate is warming and people are going to be exposed to hotter situations and there is going to be more people sweating and hot under the collar, doesn't this mean we need more training or need to realize the potential for violence here?

HSIANG: Absolutely. We think that by, sort of, studying these issues and highlighting where they emerge, we can sort of develop either policies or institutions or way to adapt to these types of environmental fluctuations so that this doesn't happen as frequently in the future, especially as the - and this only becomes increasingly important as the world seems to be getting warmer.

FLATOW: Mm-hmm. And I guess if the climate is shifting and jobs may be shifting with the movement of the climate, people are getting angrier.

HSIANG: Exactly.

FLATOW: Yeah.

HSIANG: And so when we look at these sorts of larger-scale conflicts, things like civil conflict, which is a very complicated event, obviously, it's not only dependent on the climate. It's dependent on many factors. One of the important factors is the state of the economy and what people are doing on a day-to-day basis.

And what we're learning is that as climatic changes occur, they are having important impacts on various economic sectors. And so in places where employment might go up, people have fewer things to do, it's easier to get them irritated, get them involved in a riot or in organized violence.

FLATOW: Deke, you folks at NOAA, do you realize this connection?

ARNDT: Well, it's great to listen in because one of the things that we do here in Asheville at the National Climatic Data Center is preserve all of the data that is used in studies to help define what is one standard deviation from place to place. So we see - we do get the privilege of seeing many, many uses of long-term climate data and

weather data. And it's fascinating. And it's really needed to help support in a small way this great research that's helping make the country smarter.

FLATOW: Mm-hmm. This is SCIENCE FRIDAY from NPR.

I'm Ira Flatow, talking with Deke Arndt and Sol Hsiang, talking about changes in the climate from 2012. One of the things, Deke, that were - that has been predicted from the loss of the glaciers and the fact that the glaciers are melting and spilling huge amounts of ice cold water into the oceans, is that they may change the patterns of ocean circulation. Has there been any evidence of that yet?

ARNDT: Well, currents in the ocean - the oceans generally, as you mentioned, are dynamic things. And so they're sensitive to changes in their overall environment. Much like the weather that we experience here on land is sensitive to changes in the overall climate. So there's been a great deal of research into, if we do lay a lot of this cold fresh water on top of certain parts of the - particularly the North Atlantic, how will that change the Gulf Stream and the larger global ocean circulation pattern that delivers much of the climate that we know and especially that Northern Europe knows?

And while, you know, the results aren't totally conclusive, it's an active area of research. I think it's safe to say we will see changes. And it's quantifying those changes and the timescales and the magnitude of those changes that a lot of really smart folks are looking at.

FLATOW: Mm-hmm. And where do you go from here in terms of climate and violence research? What - yeah, what more stuff can you, Sol, look into? What do you want to look at next?

HSIANG: What we try to communicate is that we can observe a really strong association between climatic conditions and how different populations behave. But in many cases, it's extremely difficult to understand exactly why. What is the mechanism that translates changes in the climate into changes in human behavior?

And so in that sort of sense, we're kind of like we're epidemiological researchers who, in the 1930s, looked at smoking, and could find there was a clear association between

smoking tobacco and lung cancer, but they couldn't explain why.

So moving forward, a lot of the research community is going to try to understand what are the different mechanisms. Is it something economic, as you suggested? Is it something psychological, as the psychologists have been suggesting? And in reality, it's probably a combination of many factors, and those factors might be different. So trying to understand when one thing is important, and a different mechanism is important in a different context, is going to be the other key to designing interventions that are effective.

FLATOW: Yeah. So that implies that there may be certain parts of the world that are more dangerous or more threatened by the climate change, the heat from - for civil conflict, than other parts.

HSIANG: Absolutely. So we think that sort of your geography might be important, things like international trade tend to be important, whether or not you can effectively move food in and out of your country. And then, you know, and Deke will know this better than I do, but there's many parts of the world that are expected to warm much more substantially than others. And so there we should expect to see a larger impact.

FLATOW: Deke, it's - we're now past half the year in 2013. Any predictions on how we're doing this year?

ARNDT: Well, globally, we expect 2013 to not be too different from 2012. Many of the large-scale factors that tend to push the global temperature up and down from year to year, like the presence of El Nino or La Nina, look a lot like 2012. So while it's not a sure thing, we're looking at something close to a top 10 finish for global temperatures. We have seen the drought in the United States migrate westward.

So - and Western water issues are a lot different in the U.S. than Eastern water issues. So they're worried about snow and reservoirs, where in the plains where I'm from, you worry about tomorrow's thunderstorm. So that is an important factor that we're keeping track of, we're monitoring, you know, here, NCDC and in many places around the country.

As far as the temperature, I don't know when the next time will see a year in the United States as warm as 2012. It not only broke the record, it just obliterated it. So it set a new bar, very high, temperature wise.

FLATOW: Do you have to add another color like the Australians had to?

(LAUGHTER)

ARNDT: We actually did have to adjust our national temperature graph that we had been displaying.

FLATOW: What color is that?

(LAUGHTER)

ARNDT: Well, we just added a new number to the top. So where there was a 54, we added a 55.

FLATOW: Wow.

ARNDT: We broke the old record by about a whole degree, which in the long-term look at the national temperature, that's a big number. It may not sound like much to you and me, but you smear one degree Fahrenheit across the whole country, and it's a big deal.

FLATOW: There is the point today. Thank you very much, gentlemen, for taking time to talk with us today. Deke Arndt is editor of this report and chief of the Climate Monitoring Branch at the National Oceanic and Atmospheric Administration in Asheville, North Carolina. Sol Hsiang, assistant professor, University of California, Berkeley, thanks for dropping in today.

HSIANG: Thanks for having us.

ARNDT: Thank you.

FLATOW: That's about all the time we have for this hour.

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