Hypotenthuse Ep 3 - Julienne Stroeve

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SPEAKERS

Sophie Lane, Laura Hewison, Julienne Stroeve

Laura Hewison 00:01

Hello, and welcome to Hypot-enthuse, a podcast all about science, maths and the world around us from Mathematical and H H H H

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data. So I'm trying to understand the changes that are happening in the polar regions, over the sort of the last 40 years of observations that we have from satellites. And the reasons I work with satellite is because it actually allows us to see these really inhospitable regions, every day, pretty much where you can't really do that so easily by working in the field, especially in the polar night. So satellites give us this broader perspective of changes that are happening in these regions that are very difficult to access.

Laura Hewison 01:20

What what are you actually physically seeing from the satellites? Is it kind of a 3d image? Or is it a series of kind of models or data,

Julienne Stroeve 01:29

it really depends on what satellite systems you use. So what might be most familiar to most people would be visible satellite images, so what you can see with your eye, but we also develop satellite systems that monitor energy in different parts of what we call the electromagnetic spectrum. So not just what we see with our eyes, but also what we can sense for example, temperature, or we can also look further out in the spectrum and look at microwave energy, which is very small, but there's still information carried at really long wavelengths.

Sophie Lane Ď Þ

Laura Hewison 02:54

So what have you been finding, especially with som

a strong idea of what's going on? A lot of the time, I think I've my heads in the sand.

Julienne Stroeve 05:03

Well, I think in some ways this study was really helpful because it's a bit, you know, often we get asked these questions of when do we expect the Arctic Ocean to become ice free the for the first time. And it's, it's not really about time the sea ice doesn't care about time. But what it cares about is how much more co2 we put in the atmosphere. So by being able to quantify how the sea ice is changing with co2 amounts, that also then provides a better sort of metric for policymakers to focus on when they're thinking about what do we need to do to limit our co2 emissions to not have the Arctic Ocean become ice free in summer?

Laura Hewison 05:39

So this was going to be one of my questions to you is, how important are policymakers in all of this? And what can we be doing to inform that policy change?

Julienne Stroeve 05:50

Well, it's it's incredibly important, because what we're finding is many aspects of the climate system, especially the Arctic sea ice, are the changes that we're seeing are largely driven by the warming from co2. And so putting concrete limits on the amount of extra co2 we put in the atmosphere can help, you know, slow down the ice loss and can actually not make it so that we have ice reconditions. But the reality is, is our current emission rates are about 40 gigatons of carbon per year, around the world. And this would mean that in the next sort of 20, 25 years, we will start seeing ice free conditions happening in September. And if we keep putting more carbon in the atmosphere, we'll start seeing ice free conditions extending to October and also happening earlier in August. So basically, we're going through this transitional period, and we can do something about it. But that would require very aggressive measures to not only reduce the amount of co2 we keep adding, but also start having negative emissions.

Sophie Lane 06:54

Do you like- do you think it's like possible do you have? Do you have hope? Or do you feel a bit..?

Julienne Stroeve 07:02

I feel a little bit pessimistic, I think the what we've kind of gotten to the point where I

mean, it's it's such drastic measures are needed to reverse the changes that we're seeing that, you know, it's just hard to imagine that all the countries are going to get on board to do this. I mean, I think it's great that with the Paris Agreement, we're trying to limit the warming to 1.5 degrees Celsius. And if we do that, we will likely have sea ice remaining, although there still be instances where it might become ice free, because everything in our climate system is a function of both natural climate variability and the sort of background warming from greenhouse gases. So even if you get to the 1.5 degrees Celsius, we'll have a lot less sea ice. And it could be that we'd even have ice free conditions, if natural climate variability were to be in phase to help remove a bunch of ice in one particular year.

L Laura Hewison 07:57

So what does it actually mean, for us, for animals for kind of, you know, local populations in these areas to have an ice free Arctic?

J Julienne Stroeve 08:11

Well, there's there's many, many implications of this.

L Laura Hewison 08:14

We've got time - over to you Professor Stroeve (laughs)

J Julienne Stroeve 08:18

Well, I mean, one of the issues is that, of course, the sea ice helps to keep the Arctic cool, it reflects most of the sun's energy back out to space. So if you remove that reflective barrier, basically, then the oceans gonna absorb that heat instead. And so what we're already seeing is that the warming that's happening in the Arctic is more than twice what we see in the rest of the planet. And this is because we've been losing the sea ice. So the oceans are absorbing a lot more heat during summer. But before the ice can freeze again, in winter, all that heat that the oceans gained has to get re released back to the atmosphere. And so if you were to look out and and say, Okay, well, at two degrees global warming, what does the Arctic look like? Well, under two degrees of global warming, the Arctic will be an annual mean temperature will be at four degrees, so twice as much. But in autumn and winter, it can reach seven degrees Celsius above of warming, so it's actually so much more amplified up in the Arctic. And this, of course, would have implications on biodiversity ecosystem functions, coastal communities that are normally protected from waves by the sea ice being present, but then it would be gone. So then waves from storms can do a lot more damage on these coastal communities. At the same

time, the warming from the loss of sea ice will enhance permafrost thaw. So you also have a lot of coastal erosion already happening in these areas from a combination of sea ice loss and permafrost temperatures falling. And then of course, is that big feedback that is looming where there's more carbon today stored in the permafrost than what's in our atmosphere. And so by warming up the Arctic even more, you will have this massive release of carbon in the forms of methane and co2 that will further amplify the warming. And a lot of ave t ave3

influence sea level. At the same time, the reason we have a lot of our atmospheric circulation patterns in ocean circulation patterns are because the equator receives more heat, more energy from the sun than the poles. And so the purpose of our large scale atmospheric and ocean circulation patterns is to bring the excess heat from the equator to the poles. And so if you warm up the Arctic, and you change the temperature difference between the equator and the poles, you're changing all of your large scale weather patterns. And so a lot of science has been going into just trying to unravel how changes already happening in the Arctic are influencing, for example, extreme weather events. And these links are becoming increasingly clear that there are links between them. How this will also impact larger scale ocean circulation, I think remains still a bit unclear. But obviously, everything in our climate system is connected. So if we change one part of the system so dramatically, the rest of the climate system is going to respond.

L Laura Hewison 12:42

Equally terrifying. So two, ocean circulation patterns. Is that kind of to do with say, cyclones, hurricanes, or even? I know, there's huge droughts at the moment in Australia, the is that all going to become more prevalent?

J Julienne Stroeve 13:00

Well, I would say that's, I would frame that more in terms of changes in the atmospheric circulation patterns. So one of the things that we have been able to see is that because the the difference in temperatures between the pole and the equator are weakening, so it's not such a great difference, that has been slowing down the zonal wind speeds. And where there's a bit of debate still is how that then influences the jet stream. So there are some studies that have suggested that the jet stream is going to become a bit wavier and moving more slowly. So then whatever weather systems are on the other sides of the these waves, so either high pressure or low pressure, or really hot dry conditions, or really wet, cold conditions, those are persist for longer at a time. And there was a new study that came out this year that was showing just in the United States that the frequency or duration of extreme weather events is directly tied to this amplified warming that we're seeing in the Arctic.

L Laura Hewison 14:00

Wow. People are suffering incredibly tragic fires at the moment in California, which have been attributed by some camps to some kind of climate change. Is that a direct correlation or is?

these experiments with climate models. We try to model all the processes in the climate system. And then you can try to do these sort of sensitivity studies to look at, well, what would be the response if I take away the ice? Or what would be the response? if, you know, we adjust temperatures globally by this amount, so you can kind of look at these things in a modeling framework. But of course, that depends on the complexity of your models and the resolution of your models, especially if you want to get to the regional scale. If you want to see Well, what's it going to do to weather in my neck of the woods? Well, the the resolution of a lot of these models isn't sufficient for you to be able to answer those kinds of questions. But it's getting better. I mean, it's just that there's so many complexities that you can add, I mean, even just human population growth, and how we're changing the land cover of this planet, and how we're going to change our consumptions, all of these sort of projections, you know, trying to model all of that as well, because we, we run our models, and we make these assumptions about what we think the emissions will do out in the future. But all of that depends on humans, which is very unpredictable.

Laura Hewison 17:33

there are people out there in this world that say that climate change isn't really a thing. Let's call them skeptical. What do you say to people who might think along those lines? Or say, Oh, well, you know, it doesn't really affect me?

Julienne Stroeve 17:52

Well, I guess I would say that they have their head stuck in the sand a little bit still, it's really hard. I think now, to deny that human impacts are affecting climate, I mean, we, we can see the clear increases in co2. And this is due to anthropogenic activities. We know that from physics, if we get b

definitely due to natural climate variability. It's a long term trends that are clearly being defined by co2.

Laura Hewison 19:30

I grew up hearing a lot abouebo

to human activity. But that's not the same thing as necessarily extreme event. If the extreme events are happening more frequently, related to a warmer planet, then we can link them more directly with climate change. But I think that's really difficult with individual storms. And obviously, I mean, media wants to have kind of sensationalist stories that get, you know, people excited, but yet, it doesn't necessarily help with climate change sort of dialogues, I think we just need to frame it better about it's these long term changes. And the reality is, I mean, the public should be very worried that if we get to two degrees Celsius, I mean, you can look at forecasts foroorooroy lic ty o asndi" en

really growing. And part of that is because it's becoming economically viable. But sadly, that is what drives most governments and most places in the world is all about money. So yeah,

Laura Hewison 24:04

Yeah, you'd think that, you know7 Ď ŋ

like change your own personal co2 emissions is not eating meat.

Julienne Stroeve 25: think from personal es, probabne t η

awareness of something that needs to be done within communities that are centrally, kind of around the Arctic and areas where they kind of see, well, being on a regular basis

Julienne Stroeve 27 nd area

Yeah, I will be going during the polar darkness. So it'll be very interesting, because I haven't been to the Arctic during winter like that before.

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Laura Hewison 31:32

And how many kind of people will be on the ship with you? I'm just interested now.

J

Julienne Stroeve 31:37

I don't know. Like, I don't know how many people actually it holds. But there'll be lots of scientists from from all different countries. And they, you know, everybody will have different projects, whether it's trying to understand, for example, how much light gets through the ice and how does that impact under ice algae growth of phytoplankton blooms, people that are sampling the water column to look at nutrient supplies, people that are measuring what's going on in the atmosphere. There'll be people from all disciplines coming together to study the Arctic Ocean and its Yeah, and its impacts.

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Sophie Lane 32:09

What's it like when you go on like those kinds of field trips Is it like, must be like a really intense community bond of people that

J

Julienne Stroeve 32:18

it is you get to know people really well, because you're kind of stuck in this confined space and especially in winter isn't really not anywhere. You can go too much anyways, and it'll be dark. So it'd be very cold outside. So I think you're trying to get your research done quickly so that you don't have to freeze too much. But yeah, you it throws you into relationships with people really quickly that you get to know everybody really well. And those friendships can last for a long time, which is really nice.

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Laura Hewison 32:48

Well, I hope it is a community of people who are out there and can tell us how we can change the impending doom

Sophie Lane 32:58

Or to work out how to fix it. And just relay that and get back to us.

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Laura Hewison 33:02

Make sure the message gets disseminated. Thank you so much Professor Stroeve for joining us today. That's all we have time for on Hypot-enthuse please join us next for some more maths and physics chat