



**University of Manitoba: “What’s the Big Idea?”  
Series 2, Episode 7 Julienne Stroeve**

**TITLE**

**What you need to know about climate change with sea-ice expert, Julienne Stroeve**

**INTRODUCTORY MONTAGE:**

**CNN- AI Gore on what the world needs to do to stop climate change:  
(Dec 2023)**

“We still have the ability to seize control of our destiny... if we reach what they call true net zero... the temperatures will stop going up right away.”

**CBC News on glaciers receding:  
(May 2022)**

“Our glaciers are receding at an alarming rate not only across Canada but around the world..’

**BBC report on 2023 Canadian wildfires:  
(Aug 2023)**

“Wildfires in Canada are threatening tens of thousands of people in British Columbia which is now under a state of emergency. 30,000 have been told to leave their homes, with another 36,000 told they may need to do the same imminently.”

**Dr Stroeve tease clip:**

“We really need the largest and fastest economic changes that the world has ever seen. And it has to be done now. And it has to be done everywhere in the world. We have to completely change our transportation, the way we generate electricity, the way we produce food, the way we manufacture buildings and materials. All of this has to change right now. And I don't see that happening.”

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**MUSIC SWELLS**

**INTRODUCTION:**

Hi, I'm Michael Benarroch, president of the University of Manitoba. Welcome to the season two finale of my podcast, What's the Big Idea? I've had a great time this season speaking with our extraordinary community. We've heard ideas that have inspired us, challenged us, and demonstrated UM's great



impact. To close out this season, we hear ideas that do all three.

In this episode, I sit down with Professor Julienne Stroeve, a renowned climate change researcher. She is a professor in the University of Manitoba's Center for Earth Observation Science and a senior Canada 150 research chair in climate forcing of sea ice. In the past, she has briefed US Vice President Al Gore, US congressional staff, and the World Economic Forum on her research.

Her work shows that climate models have been too conservative. Changes are happening at a much faster rate than we have expected and planned for. And we need to understand the significance of this. I hope you enjoy listening to this conversation, which was recorded live in Winnipeg.

### **MAIN INTERVIEW**

And it's wonderful to have you here tonight. And a real privilege for me to sit down with you this evening. Thanks for being here. I'm excited to learn from you tonight because climate change is one of the most intractable and serious challenges we're facing in the world.

And so there's a question I've started each one of these podcasts with, and that's to ask our guest, what's your big idea?

**JULIENNE STROEVE:** Yeah, when I saw that question, I was like, ooh, that's a big question. But yeah, so I'm a climate scientist. And I would say as a whole, climate scientists tend to be somewhat conservative. And I had a good sense of that when Al Gore visited the National Snow and Ice Data Center in 2007, and I was showing him a graph of how quickly the Arctic sea ice was shrinking and looking at it in comparison to the climate models at the time. And...When we looked at the observations and we compared it to the models, we saw that the pace of ice loss was much faster than even the worst case scenarios could capture. And so, we're looking at that, I could say, well, maybe we're about 30 years ahead of what the model suggests as to when the Arctic Ocean might become ice-free. But, you know, Al Gore was like, no, just give me a number. I need a number as to when the Arctic Ocean will be ice-free. Kind of like me, I'm saying, what's the big idea? Just give me the idea.

Yeah, and that wasn't something I could easily answer because we understand the uncertainties in these simulations. We understand that there's a lot of internal climate variability. And so to try to give an exact number is not possible. But that's what he wanted as a policymaker. And I think maybe one of the reasons that I feel like the world has been so slow to act on climate change maybe is because part of it is a conservatism of climate scientists.

**MICHAEL:** So in 2007, and take you back a bit, you published a paper that said that the International Panel on Climate Change was being too conservative in its estimates. Drawing from your experience and expertise, how would you describe the...situation now 20 years later and what did you mean by that, that they were being too conservative?

**JULIENNE STROEVE:**



Well when we first looked at the models and that went into the IPCC 3 report, we found that none of the models were able to capture how quickly the sea ice had been declining over the last four decades. So certainly the pace of ice loss was quite alarming compared to the models and so when we're making these sort of assessments as to what the future will look like and we're basing it on these models, it probably led to the idea that the sea ice, the Arctic Ocean, might become ice -free sooner than expected. Now, in subsequent modeling efforts, in the last two IPCC reports, the models are doing a bit better in the overall, in terms of capturing the pace of ice loss. They're still, as a whole, I would say, a bit conservative.

I don't think we've communicated very well to the world leaders what the real risks are and what is really at stake by not doing anything and not acting quickly. You know, too often we're focused on these arbitrary temperature targets of like the Paris Agreement. So I think we've been somewhat, in some ways, asking the wrong questions. At the moment, the World Meteorological Organization said 2023 hit 1.45 degrees plus or minus 0.12. So we're really close to that 1.5 at the moment.

And we really would basically have to cut our emissions in half within the next six years to hit that target and keep the warming below 1.5. I think perhaps we need to reframe things as to what is the worst case scenario? And if we can look at it that way, then we can say, well, do we care about that? Do we wanna act on that?

**MICHAEL:** Right, right. So let's talk a little bit about thickness of sea ice. Most people, I mean here in Winnipeg, we know about ice, but we wouldn't necessarily appreciate how much sea ice and the thickness of sea ice matters from day to day. Talk a little bit about the significance of that thickness and why it's so important.

**JULIENNE STROEVE:** Wow, it has a whole host of importance. So for one, I feel like thickness is a more important metric for us to measure because it tells us overall volume of the amount of ice that's covering the oceans. So if we know how thick it is, I think you can kind of look at it as in the old days when you had really thick ice, you could have had a huge melt year. So maybe you had an Arctic Ocean covered by like three to five meters thick ice. Maybe you had a lot of melt that summer, but the ice was still so thick that it would survive because you had enough ice. Now because the ice is getting thinner, you've lost a lot of the old thick ice. Now you have 70 % of the Arctic Ocean is covered by thinner first -year ice, which is about 1 and a half to 2 meters thick. That means if you have an unusual melt year, you can remove a lot of ice. And of course, that has a whole host of biological and ecological implications. And also, I think our predictions on how quickly the ice is going to disappear, it's better to know how thick that ice is, because I think that's really key.

Of course we want to monitor thickness as well. If you think about all the coastal communities that rely on sea ice for travel and hunting, as well as the species that rely on the sea ice as a platform for hunting and seals for burling on the ice, then you need to know that thickness information.

**MICHAEL:** And so what are some of the significant ways that the world or maybe even Canada is going



to change because of the melting sea ice?

**JULIENNE STROEVE:** Well, I mean, definitely all of the coastal communities that depend on the ice, their ways of life are already changing. And you know, you think about too, ice is kind of a buffer that protects these coastal communities from waves when a large storm happens. So now you have more risks of coastal erosion together with permafrost thaw. But I think one of the key things is that, of course, having an ocean covered by snow and ice, it has a very high reflectivity, reflects most of the sun's energy back out to space.

If you start removing that reflective ice cover, that heat is being absorbed by the ocean. And it's one of the reasons why the Arctic is currently warming nearly four times faster than the rest of the planet. It's because we've lost that reflective cover. And then by warming up the Arctic more, you start impacting on melting of the Greenland ice sheet, because now you've got more heat in the Arctic, so you can start melting more land ice. You can also start causing more permafrost thaw.

The other thing that we talk about a lot in climate science, of course, is by changing the energy balance and having the Arctic warmer now than it used to be, that changes the temperature difference between the equator and the pole. And that's what drives our really large scale atmospheric and oceanic circulation patterns. And so you start to impact on the large scale weather systems by changing the Arctic by having it warm up so much faster.

And I would say too, so I have consulted for oil and gas companies before because they want to know like, when are these regions that they're interested in extracting oil from going to become ice free. So they understand as well that greenhouse gases are contributing to the loss of Arctic sea ice. So they know this is going to happen, but of course they want to take advantage and extract more oil and gas when they can.

**MICHAEL:** Now shifting focus a little, just to some of the work here at the University of Manitoba. So you hold the Canada 150 research chair. And you have a number of colleagues here at U of M who also hold research chairs in this field. And we're known as one of the leaders in sea ice and the teams that we've put together. And it's also home to the Churchill Marine Observer.

With this much talent and kind of the work that we're doing, how is University of Manitoba shaping global conversations?

**JULIENNE STROEVE:** I'm actually very excited to use the CMO facility. I've been wanting to use it because I want to do some more experiments with my radar system where I can do more controlled experiments, right? So I can control the ice growth formation process. I can control the amount of snow accumulating on it. I can control looking at the influence of salt and its migration from the ice into the snow and how that influences our remote sensing capabilities. So that is quite exciting to me. I think the amount of research that we can do with this system is fantastic. I know there's colleagues of mine that are really focused on oil spills and how we would deal with that in ice-infested waters.



And of course, as the Arctic Ocean starts to open up more, the pressure to use the Arctic and to do more transportation with shipping is increasing. And so we need to start looking at these sort of impacts of what would happen if you have an oil spill. I mean, it's difficult enough to clean up an oil spill when you don't have ice. And then can you imagine with the ice? And so I think a lot of these experiments are now being done thanks to facilities like CMO, so we can do more responsive. Hopefully we can learn better and be more responsive when these sorts of catastrophic events happen.

Half of my work, I would say, is really focused on doing a better job with the satellites to get the most accurate geophysical variable that we're trying to retrieve. And the other part of my science is really focused on, you know, why does all of this matter, and whether it's in a local context or in a global context. So, for example, we have a paper with some of my colleagues here at U of M where we're looking at the future projections of the ice-free period in Hudson Bay and the changes in the snow cover in that region and how that would then, in turn, influence the polar bear fasting period and also the seals if they have enough snow to put their dens on the sea ice. And yeah, of course the future doesn't look great. The lengthening of the ice-free period is going to become too long, especially if we don't keep our warming to at least two degrees.

**MICHAEL:** So maybe we can shift there. There seems to be some consensus is that if we can limit the average temperature to increase to well below two degrees compared with pre-industrial times, we can keep global warming on a safe trajectory. So first question, and you talked a little bit, but let's focus on it. Can we do this? And if so, how?

**JULIENNE STROEVE:** Well, I guess this is where my pessimism will probably come in.

I think we're quickly running out of time. I mean, we're definitely quickly running out of time to keep the warming to 1.5 degrees. I don't think we're going to achieve that target. And if I think about, for example, the Arctic sea ice, the work that we've done, and now colleagues, there's a new paper that just came out again. Basically, the Arctic sea ice, at 1.7 degrees, we find that you lose the summer ice already. So that's before you hit 2 degrees. So that's not far off. But the uncertainties with this, though, are still, you know, plus or minus 20 years. So the latest paper said that it could be anywhere from 2035 to 2060 because you do have, again, we can't control natural climate variability. We can't control weather. But in terms of what can we do, I guess I feel I've, because I have spoke to policymakers for quite some time and I've,

I feel that we just still lack strong global leadership to really do something about it. I don't see that we're gonna act quick enough. And so what I am a bit concerned about, because I'm seeing this now with more and more funding agencies requesting proposals on geoengineering, because I think people are starting to think we're not gonna achieve these targets, so what else can we do?

So I actually had a reporter ask me today from the BBC if it was realistic to thicken the sea ice by bringing water from below and putting it on top of the ice to thicken it. And this is a concept that's similar to what's already being done in the Himalayas where they're building these ice stupas in order to provide some fresh water that melt into the summer so that communities have water because of the receding



glaciers in the Himalayas as well. But to do this on the scale of the Arctic Ocean, which is, you know, 15 million square kilometers, that's just absolutely not possible, right? I think the more realistic thing that's probably going to happen is solar geoengineering where you're putting aerosols in the stratosphere. And there's a lot of research. I have a PhD student doing that at the moment, actually.

**MICHAEL:** And that's been, well, that's received a bit of strange attention recently.

**JULIENNE STROEVE:** Yeah, but I think governments are starting to speak about this more. And that's, I think that worries me. So instead of actually trying to do things and rapidly change our economy, I mean, **we** really need the largest and fastest economic changes that the world has ever seen. And it has to be done now. And it has to be done everywhere in the world. We have to completely change our transportation, the way we generate electricity, the way we produce food, the way we manufacture buildings and materials. All of this has to change right now. And I don't see that happening.

**MICHAEL:** We need the equivalent of an industrial revolution again, but now to save the planet in some ways.

**JULIENNE STROEVE:** In some ways, yeah. But I think, so then the question shouldn't be about time or a date. It should be, OK, how much additional warming? How much more CO<sub>2</sub> do we add before this happens? Because the climate system doesn't care about a date. It cares about how much more warming we're going to go through before you have some of these transitions. I think the sea ice is a bit easier. I would say like the ice sheets, that's a much harder thing. Because some of these thresholds of where the ice we're thinking of irreversible loss. I mean, for Greenland, it's been estimated between one and three degrees Celsius. For the West Antarctic ice sheet, it's between one and six degrees Celsius. There's a lot of uncertainty. But if those things tip, I mean, then those changes that you set in motion will be there for millennia to come. So in terms of our human lifespan, then you might as well think that it's irreversible.

**MICHAEL:** Right. So in the face of the daunting reality, what's next for you in terms of where research is taking you? Or what questions are you trying to tackle now?

**JULIENNE STROEVE:** At the moment, I think I'm shifting my focus a bit to the Antarctic. I had two post-docs that just overwintered. Monitoring sea ice in the Antarctic is actually even more challenging than in the Arctic.

in part because it's a more complicated snow system because you have a lot more snowfall on top of the ice and it pushes the ice below sea level and so that causes a lot of flooding of the snowpack and you get a lot of slush and snow ice formation so that really confuses the satellites even more than we have in the Arctic. So it's a new challenge. I think in the Antarctic because you had such dramatic changes these last three years there's a lot of scientists now suggesting that the Antarctic sea ice is finally responding to anthropogenic warming and that maybe this is a new sign of things to come in the Antarctica, that you're finally going to lose the ice there as well. Because it had actually been slightly expanding over the satellite data record, and now it's not.



**MICHAEL:** And you've seen these changes over the period of your career, right?

**JULIENNE STROEVE:** Yeah. You know, I mean, it's funny because when I started my career, which was a long time ago, I went to Greenland, I was doing my PhD on the Greenland ice sheet and trying to measure from satellites the temperature of the ice sheet and also the reflectivity of the ice sheet, because both of those go into the energy balance of the ice sheet. And back then, I didn't really think that climate change was an issue. It seemed like there was still enough snow and ice, and I certainly wasn't concerned, although I did understand, of course, the importance of these regions in climate change. Because if you do start to melt the snow and ice, it's sort of this vicious positive feedback cycles. So then you'll melt more and it warms up and it melts more. And so, of course, trying to detect small changes in things like the surface albedo is really important to understand the overall energy balance and how much ice will melt. So I wasn't really concerned, and it wasn't until the mid -2000s when we just kept having one record low sea ice year after another. And our conventional wisdom on how we explain that in terms of the weather patterns wasn't holding.

So you could have a stormy summer and you still melted a lot of ice. You could have a sunny summer and you still melted a lot of ice. Like nothing was really explaining it anymore so neatly. And then we kept seeing these really large changes and you're like, okay, what's going on? And really I think what we lacked, we didn't appreciate at that time was that the ice was thinning quite a bit.

**MICHAEL:** So one final question. Is there anything giving you hope?

**JULIENNE STROEVE:** There was one thing this year that gave me hope, and that was a report that Portugal, for I think it was 11 days in November, ran their entire country on renewable energy. I thought that was quite fantastic, that they were actually to demonstrate that you can run an entire country on renewable energy for 11 consecutive days. So I mean, I think we have the technology, we know what needs to be done, it's just we don't seem to have the motivation.

**MICHAEL:** Right. You know, in change management theory, we always say you have to create a bit of a crisis, right? So within an organization, but we seem to have that crisis, but unwilling to change. I mean, it's hard. This kind of change is really hard, right? It's really hard. And it doesn't seem to be the will on the part of all governments to move in a positive direction together.

**JULIENNE STROEVE:** And I would say the Western world, I think our lives are still relatively comfortable and okay, we might have some extreme weather events, but you know, usually we have enough money we can deal with it and handle it. I think it is going to start to change though because there's places even my house, I have a house in Colorado. It's so hard to find insurance on it now because of the fire dangers. And so insurance companies are dropping us right and left or you have to pay outrageous fees to have your home insured. So then it starts to really affect people's pocketbooks because of climate change.

**MICHAEL:** You know, I think we're seeing that in Canada, in places where insurance is starting to be a



problem because of the fires.

**MICHAEL:** So, Julianne, thank you so much for that. We're gonna have a little bit of time now to open it up for questions. We're doing this with Menti. Okay, so we are doing it with a Menti software.

**QUESTION:** Yeah, we've got our first question here. What can I do to make a difference?

**JULIENNE STROEVE:** You know, that's a really good question and it's something, so I'm a bit frustrated by what I see as individuals having so much concern and stress. I mean, I have colleagues that won't fly anymore to go to meetings, so of course they won't cross the ocean then to go to meetings. There's so much individual guilt rather than having,

I feel like good government leadership to help with the climate problem. I find that, yeah, as individuals, of course, we can do all these different things and we can think about, you know, where our food's coming from, buying local. We can think about, you know, our consuming, of course, because the more we consume, the larger our carbon footprint is. We can think about our transportation, but I feel like there's so much individual guilt now being put on people when I feel like we really need the strong government leadership to make a difference.

**QUESTIONS:** OK, our next question is, do you know of any promising ways to make switching to renewable energy profitable? Or is it impossible to make these changes if profit is the only incentive?

**JULIENNE STROEVE:** Well, I don't know that it's not profitable. I'll just give a good example. So my mom and her husband, they're very staunch Republicans. Well, I don't even know if my stepdad believes in climate change. But when they were living in Maui, they put solar panels on their house because they had such high AC, do you know, their energy? Because a lot of the energy in Maui was actually oil being shipped from the mainland to the island, so the cost was outrageous. But now they've moved to Grand Junction on the western slope in Colorado, they've installed solar panels there too. So it must have been economical from a cost perspective for them to do that because I wouldn't have done it anyway. So I don't know if I believe that renewables are not cost effective. And I think in some cases, and I'm not up to date on the latest numbers, so I apologize for that. But I do believe solar, and I'm not sure about wind, but I think solar is already out competing like coal for electricity.

**MICHAEL:** And the economist in me would say, we need to factor in the cost of the environment, which we don't usually. We take a personal cost, but there's a cost to the environment. If you include that in, it's going to be financially economical.

**QUESTION:** OK, our next question is, do you have anything to say to younger generations about future developments in environmental technology, or is it up in the air?

**JULIENNE STROEVE:** Well, I think there's a lot of opportunity for young people to get involved in new technologies. I think that's what's going to revolutionize things. And it's in all aspects of our lives and how we construct everything. And especially, I think the food production is a really big thing now that we





really have to become more... clever, I think, in how we do our food production. And I think there's going to be so many opportunities for new jobs and new technologies. So I think the young people have a really good... Well, there's some really interesting careers I think they could follow on.

**QUESTION:** Okay, the next question we talked about solar energy before. So what are your personal and ethical opinions surrounding solar engineering and its potential role in combating climate change?

**JULIENNE STROEVE:** I'm not in favor, of course. I would rather deal with the problem than try to put a band-aid on it, which is, I think, what that is trying to achieve.

And I also wonder, I mean, it's so hard to get global nations to agree to targets to reduce their greenhouse gas emissions. I don't know how you're going to get the global planet or all the nations to agree to allowing to put a bunch of stratospheric aerosols into the atmosphere. I feel that there are obvious consequences. So it's not just that you put a bunch of aerosols in the stratosphere. I mean, we have analogs, of course, with volcanoes but it's actually gonna change the polar vortex. It's gonna change the distribution of precipitation. The hydrology is a big thing that gets impacted. So there's actually a decrease, for example, in the Indian monsoon when you do these sort of aerosol injections. So I don't know if this is really going to be something that nations are gonna be able to come to an agreement on. Maybe a better solution is to do more carbon capture. I don't think it's currently at a scale that's affordable that could actually really achieve a big change in the carbon footprint. But maybe that's a better solution if we're not going to reduce our emissions.

**QUESTION:** The next question is regarding the effect on smaller countries. So do small island countries, in your opinion, face more or similar challenges due to climate change or compared to the big countries? What can be done to save such small countries that are more vulnerable?

**JULIENNE STROEVE:** Oh, they're definitely the most vulnerable. I had a talk once in Bonn in Germany, and it was a prime minister from Palau came to talk to me because, of course, his nation is under threat from rising sea levels and a lot of the small Pacific nations are under threat of disappearing and they're having to relocate entire communities to other places because of the threat of sea level rise so the threat is real for the small island nations and they unfortunately they're always at like the cop and and they're trying to get their voices heard But I don't think they're really being listened to and I think for me it's a whole social injustice issue because a lot of the climate change and the people responsible are in the global north and it's the global south that's disproportionately affected and they don't have the financial resources to deal with it like the global north does.

**QUESTION:** In change management, part of the process is the motivation to change. What do you think would move leaders in society to create the changes that we need?

**JULIENNE STROEVE:** So it's sort of what I was saying in my opening. I think we haven't really focused on the worst case scenario. I don't think we're giving people the real ideas of the risk that we're facing. Because I think if you understand the worst that could happen, then you have a chance to figure out how you're going to deal with it and maybe this is something that climate science should try focusing on, is



coming from the community level, so what is the worst thing that can happen for you guys and how do we then assess what is the probability of that happening? Because then you can start planning and then you can start figuring out what to do.

**QUESTION:** Yeah, I think we're down to our last question here. You mentioned good government leadership will shift us collectively. How do you see this looking in Canada? What does it look like in Canada? And what does it look like globally?

**JULIENNE STROEVE:** Well, that's a hard question for me. Yeah. Glad I'm not a politician. I don't know if I believe in like carbon tax. I don't think that that's necessarily going to help. But I think there has to be real incentives and real investments in infrastructure. I mean, I have a plug-in hybrid car, which is great. I haven't gone full electric because I don't think the infrastructure is there yet for me to be able to really reliably use a full electric car.

So, you know, there has to be this push for the infrastructure. There has to be pushes and incentives financially to renovate your building, to make things more efficient. You know, that's, I think, where we've got to go. I don't know that a carbon tax credit is going to make a lot of people very happy and it's probably going to have a lot of backlash. Instead, I think we need financial incentives to change our energy usage and to renovate our homes or renovate our buildings. We have to rethink food production especially, I think. So that's where the investment should go.

Thank you. I want to thank Dr. Stroeve for, I think, a fascinating conversation. So I think you've given us really a lot to think about.

#### [OUTRO MUSIC FADES IN](#)

Thanks for listening. That's it for season two. I've had so much fun this year speaking with UM's wonderful faculty and alumni. I hope you have enjoyed it as much as I have. If you're new to the show, be sure to check out our other episodes available wherever you get your podcasts. We'll be back with season three this fall. Until then, think big and have a great summer.

For more information about the University of Manitoba and our global impact, visit [umanitoba.ca](http://umanitoba.ca).

See you next time.