

Transcript:

AusSMC ONLINE BRIEFING: Ice ain't ice - Antarctic ice in climate change

Friday 12 June 2009

Featuring:

Dr Ian Allison - Leader of the Ice, Ocean, Atmosphere and Climate Program at the Australian Antarctic Division and Antarctic Climate and Ecosystems CRC. He was also Lead Author, IPCC Chapter 4 – Observations – changes in snow, ice and frozen ground.

Dr Tony Worby - Principal Research Scientists Australian Antarctic Division and the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC)

Associate Professor Marcus Haward - Leader of the Policy Program at the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC).

Facilitator

So while we're waiting for journalists to type their questions in my first question is to Tony and is whether we know if there is any impact of sea ice growing and shrinking on rainfall in Australia.

Tony

That's a good question there's been some interesting work done that shows that the rainfall over the south western part of Western Australia, which we know has been receiving significantly less rain over the last several decades is related to the same large scale changes in the atmospheric circulation that are bringing warmer air down over the Antarctic Peninsula region where we're seeing significant increases in temperature.

The Antarctic Peninsula has warmed on average by about half a degree Celsius per decade, which is about twice the rate of the global average, and that's largely because we've seen more warm air coming over the Antarctic Peninsula.

I don't know whether it is possible to scroll through my presentation, I could show the figure. That's great, I'll just go back here, if I've got control, which I think I have, no sorry I need to go forward. Okay, so the right hand figure here shows large scale atmospheric circulation over the Southern Ocean and over Antarctica. So you can see here if I put this arrow here you can see the pressure lines kind of come in towards the Antarctic Peninsula region from the north and so would expect warmer air to be coming in there, which is related to the decrease in sea ice that you can see over on the left hand side here where I'm putting the arrows.

Now at the same time if we go back to the right hand panel you can see that in the western part of the Ross Sea these winds are coming from the south out towards the Southern Ocean. So they're pushing cold air off the Antarctic Continent and if we come back over to the left that's largely what's driving this increase in sea ice in that area.

Now this same large scale circulation is also believed to be bringing this warmer air, as you can see, over south-western Western Australia and has influenced the amount of rain that is falling there. And there's some interesting work that I know is being done by Tas van Ommen here at the Antarctic division in the CRC that's looking at the relationship between those things. So it's

not a direct relationship between sea ice and rainfall, but the same atmospheric pattern seems to be causing a response in both.

Facilitator

Fabulous, we've got a couple of questions on line now. Kathy Alexander wants to know if the ice on land is only declining by $\frac{1}{4}$ of a millimetre in a year, then does that matter, it sounds negligible?

Ian

Yeah I guess that is for me is it?

Facilitator

Yep.

Ian

Sure it is fairly small at the moment. The total sea level rise at the moment is about 3mm a year, which is equivalent if it can use it at the same rate of about 30cm over a century. Now that is significant.

The ice sheets at the moment, the figure you see there of about $\frac{1}{4}$ mm that's the Antarctica alone. Greenland is contributing as much as $\frac{1}{2}$ mm a year on top of that.

But the major concern is will these rates increase?

The changes for the ice sheets are occurring because the big drainage glaciers are speeding up. We've seen evidence during the end of the last ice ages that sea level from the melt and collapse of ice sheets can contribute as much as several metres per century to sea level rise. The situation then was a little bit different from now because we had more ice on land, we had more ice sheets. So there was more ice to melt and go into the ocean.

But our concern is not just what's happening now, but what will happen in the future and there are several mechanisms of instability that could occur within the ice sheets and the ice stream systems.

Facilitator

Okay we've got a couple more questions from Andrew Darby who wants to know if you say the largest unknown in sea level projections is how ice sheets are going to behave, what are the most urgent needs in terms of gaining more research data?

Ian

Okay that's not in climate change, that's in sea level rise. That part of climate change, how sea level is going to respond to climate change.

As I said the unknowns are partly the coupling between the floating ice shelves and the ice streams we've seen around the Antarctic Peninsula several ice shelves break up because of warming from underneath and then other mechanisms cause them to collapse very rapidly. They're like sea ice, they're floating already so they don't affect sea level.

You remove that floating barrier, you get a speed up of the glaciers behind them.

The present models that project how ice sheets will respond in future make a number of simplifications that don't properly account for those mechanisms.

So the first thing we need to do, and there are a number of groups around the world that are starting to work on this, is to improve our models of ice sheets. And we understand most of the things we need to do to that, so that's a matter of just getting down and doing the work. But we also know that now, and this is fairly recent work, that there is a lot of liquid water at the base of ice sheets, that they're not frozen on the bed but over, there are many lakes and many drainage systems underneath kilometres of ice in Antarctica. We don't know how they affect the sliding of the ice over the bed and how they might change in the future.

So they're two of the mechanisms improving the models, and accounting for some of the things like the basal water that we don't properly account for at the moment.

Facilitator

Okay we've got a couple of other questions. So Kathy Alexander wants to know - climate change is supposed to be heating up the planet but it seems that Antarctica isn't really melting. Sceptics would say that indicates climate change is not happening, if it was wouldn't we already notice Antarctica melting?

Ian

Well first of all we're not going to see Antarctica melt but surface temperatures on average around the coast are about minus 20. So even if we warm it up 10 degrees it's still not going to melt.

I think though the question really is, we're not seeing strong evidence of warming around Antarctica.

Global warming is not something that happens uniformly over the planet. Certainly because there's a drought in Southern Australia and a flood in Queensland doesn't mean that change is not occurring. But in Antarctica one mechanism that has been hypothesised and actually I think basically verified is that the ozone hole is insulating Antarctica from more general warming. That the ozone hole is changing the circulation in the stratosphere, the polar vortex that's changing the lower atmospheric circulation, the flow of air around the continent and that's helping to protect against warming we're seeing elsewhere.

Along the Antarctic Peninsula we're seeing very rapid warming. That's one area of the globe that's warming at rates faster than almost anywhere else. And as Tony mentioned before the change in atmospheric circulation due to the ozone hole may be affecting sea ice distribution also.

Facilitator

Okay we've got another question from Andrew Darby, he says: can you explain some of the key reasons behind the belief that sea ice volume will decrease by one third?

Tony

Yeah I can. That is an ensemble mean of the current climate models that are being used by IPCC. So it in many respects doesn't capture a lot of the variability that different models predict. So the number has to be treated with a little bit of caution. However, I think the important point to make is that the models have improved significantly over time and almost without exception they do predict that there will be a decrease in both the extent and thickness of sea ice over the next hundred years in response to a warmer atmosphere and a warmer ocean.

I think the important thing to point out is sea ice can be expected to respond very, very sensitively to any changes in climate because it sits right at the interface between the ocean and the atmosphere. So small changes in the temperature of either could have a pretty significant impact on Antarctic sea ice, most of which is at significantly warmer temperatures than the continental ice. So it's likely to be more responsive to changes in temperature. And I think the fact that we've seen a slight increase in Antarctic sea ice, actually really demonstrates how sensitive it is because as climate scientists we had anticipated a reduction in Antarctic sea ice in much the same way that we've seen in the Arctic, so it's been necessary for us to explore the mechanisms to try and explain why that reduction hasn't increased. There is strong evidence now to suggest that it is linked to larger scale changes in atmospheric circulation and the fact that despite the warming that we've seen around the Antarctic Peninsula and the net warming that we've seen around parts of the globe, we've seen this slight increase in Antarctic sea ice - which shows that it responds very quickly and sometimes in unexpected ways to different forcing.

But over time, as ozone recovers, we believe that it almost could be understood as a bit of a masking effect of the ozone, that we would see the impact of the warming more significantly than we currently do.

Facilitator

Thanks Tony, we might just mute the calling users now so if you are joining us over the phone and you have a question please go ahead.

All right, we have another question on line from David Fogarty who wants to know is it safe to say the IPCC are for maximum of a 79 cm rise is likely to be the new minimum in terms of sea level rise and are we likely to see a clearer or more definite estimate by the release of the fifth assessment report?

Ian

For the first part of the question no, it's not. We still don't know the upper bound. I think it is fair to say that we expect the sea level rise over the century to be greater than the minimum suggested by the IPCC but we still don't have a clear indication of what the maximum is.

Will we be able to refine this further by the next IPCC? I would hope we can. I would hope the next generation of ice sheet models is able to account for the removal of the buttressing from the ice streams by then and that will help define the upper limit more accurately. It will still have unknowns and uncertainties.

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