Transcript:

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

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Okay thanks Lyndal and welcome everyone.

I want to talk first a little bit about what sorts of ice there are in Antarctica and the opening slide shows and iceberg, which is originated from the continent.

The reason I want to talk about this is there is often confusion. There's been a lot of discussion and a lot of media coverage recently about changes in Antarctica and changes to the ice in particular and sometimes in my reading of them there's confusion about what people are talking about.

This cartoon now shows the sort of ice you'll find in Antarctica. When we're talking about sea level rise issues we're concerned about the ice that is on the land. Just find my pointer here somewhere. Okay, so that's shown in the diagram here.

This is an immense mass of ice. It is resting on the continent and covers an area that's about twice the size of Australia. The ice is up to nearly 5 kilometres thick at its deepest and on average it is over 2 kilometres. It depresses the land underneath it and it is a dynamic system. It is like a river basin. You can see there arrows that show snow falling so it is built up by snow over hundreds of thousands of years. The ice deforms and flows slowly to the coast where it is lost. It is either lost in Greenland in particular by surface melt and run off into the ocean and in Antarctica where it is colder it is not so much surface melt but instead the ice pushes out over the ocean to form what is called ice shelves. And from the front of the ice shelves large icebergs break off and float further north where they melt.

It is this ice that's on the land that can effect sea level. It is presently stored there in a solid mass if that melts it ends up in the ocean and sea level rises. Surrounding the continent and the Arctic Ocean there is also what is called sea ice and that's ice that is formed directly by the freezing of seawater. In Antarctica in particular it is highly seasonal and it is a thin veneer on the ocean, no more than a metre or two thick.

So when we're talking about changes in ice we've got to distinguish what's happening to the sea ice which is moved by wind and ocean currents and what is happening to the ice that is resting on the land which will effect sea level.

It has been along challenge for many years to discover how Antarctica and Greenland are behaving. Are they growing or shrinking? And only in the last few years with new satellite technology have we been able to get an answer to that.

We move onto the next slide and these are some of the ways we can now measure ice sheets. We can measure the change in elevation of an ice sheet by altimeters, things that measure the height of a surface from space. This is an altimeter on the right of the diagram, my pointer won't work. There are two sorts of altimeters, radar ones and laser ones. Laser is flying in space is directly measuring the height of the ice sheet and any changes to it.

We can also effectively weigh the ice sheets by measuring the gravitational field. And there is another satellite system that does that called GRASE, gravity recovery satellite mission and that detects changes in the gravitational field beneath the satellite which is caused by changes in the mass of the ice sheet.

We also have ways of measuring the surface velocity on the ice sheet with synthetic aperture radars. There should be one in this diagram, it's disappeared somewhere, apologies about that.

What sort of results do we see? What is happening to the ice sheets? This rather messy diagram shows what we've been able to discover in the last 15 years or so. The last IPCC statement, which was released in 2007 built on work from about 2005, was for the first time able to state positively that both ice sheets together in Antarctica and Greenland were losing mass and contributing to sea level rise. Since then, and that's only about 3 or 4 years ago there have been a number of new studies using newer satellites and newer data from existing satellites that have confirmed this. This blue line is a plot of those diagrams, the dash line, there are still large errors in this but there's an indication of a slope there, that's not really correct, well it's not significant I should say, because the spread of errors is such that there's no significant indication of an increase at the rate in which Antarctica is losing mass. But it is now quite clear that it is losing mass. And it is losing mass at a rate equivalent to about quarter of a millimetre per year. So that's a value of somewhere around about here.

On average as I said, there are large error bars but it is quite clear now that Antarctica is losing mass.

In Greenland the concern is even greater. Greenland is smaller, the error limits are less and there is some concern in fact that Greenland may even be increasing.

The ice that's being lost in Antarctica is being lost not by surface melt, the continent is very, very cold but it's being lost by discharge from glaciers, increasing discharge. That some of the large glaciers, in what's called West Antarctica, the part that at the Pacific Ocean has sped up and they're pushing more ice out into the ocean.

In Greenland the loss is from increased discharge from a number of large outlet glaciers and also from increased surface melt.

So in both ice sheets we see loss of ice contributing to sea level, in Greenland we see a worrying indication that this may be increasing. I would point out however the time over which the measurements are made are still quite short in terms of the time scale. We may just be seeing things inter-annual fluctuations.

So just to summarise some of those points as I said, the fourth assessment report of the IPCC indicated that those ice sheets are losing mass. We have evidence that this is happening and may be increasing. The IPCC also tried to give a projection of what will happen over the next century, and their figure was that sea level would rise somewhere between 18 centimetres and 79 centimetres, and there's a wide range there because it also needs some estimate of what greenhouse gas emissions are going to do over the century. The largest unknown, though, in the physical response, is how the ice sheets are going to behave. Is there a possibility they can speed up and dump more ice into the oceans? The IPCC gave that upper limit of 79 centimetres, but in fact said that that was not a true upper bound but they couldn't estimate that at this stage.

The recent observations of sea level rise have shown that now we're tracking near the upper bound of IPCC projections along that line that leads to 79 centimetres rather than 18 centimetres, and we firmly believe by the end of the century, sea level rise will be well above the lowest end of the IPCC range. We've seen accelerated discharge of the big glaciers in Greenland and Antarctica contributing to sea level rise and there have been some projections that sea level rise

by the end of the century could be five or six metres. Glaciologically, that's highly unlikely. We don't think the glaciers can speed up fast enough to dump that much ice into the ocean, however the probable upper limit of the contribution from the ice sheets is still uncertain.

So that's the ice sheets, and I'll let my colleague, Tony Worby, talk about something completely different: the ice on the ocean.

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