Two Antarctic Ice Shelves Almost Gone

May 5, 1999 Boulder, Colorado - Tonight, more tornado weather is threatening Moore and Norman, Oklahoma. And so far this week, those vicious half mile wide tornadoes with winds approaching 300 miles an hour in Kansas and Oklahoma this week have killed at least 44 people and wiped out more than two thousand homes and businesses. Earlier this year in January, another series of unusually violent tornadoes tore through the Tennessee region. Are these freak storms? Or will atmospheric turbulence get worse and worse as global warming continues to take hold of the earth?

Few scientists any longer argue that global warming is real. And most agree that contributing factors are greenhouse gasses from human industries and cars. In the year 2050 -- only 5 decades from now -- the concentration of carbon dioxide in the earth's atmosphere is expected to be at least TWICE what it was in the 1700s. And the planet will be somewhere between two and seven degrees Fahrenheit warmer.

Last week in Philadelphia at a National Oceanographic and Atmospheric Administration Lab, powerful computers were used to project current global warming trends 500 years into the future. Not because continued global warming is a guaranteed future. The computer modeling was done, explained Jerry Mahlman -- an expert in climate modeling -- because: "It is almost impossible for people to think beyond 50 years."

Scientists estimate that 90% of the warming from greenhouse gasses will occur in this next century. What happens if you look further into the future with the world maintaining carbon dioxide levels (of about 560 parts per million) as they are today? In the computer projection, Philadelphia turns into a hot, steamy city like Bangkok. The oceans and seas rise and all the coastlines will be under water. New Jersey, for example, would have ocean all the way to the Garden State Parkway. And Florida would be under water from Key Largo to Ft. Lauderdale.

It could get worse if energy consumption continues at present rates. If greenhouse emissions aren't cut back now, levels of carbon dioxide could *quadruple* instead of double in the coming century. If that happened, oceans would rise more than six feet and water would advance inland for at least a quarter mile. "Exactly where the Earth will end up," Mahlman said, "will depend upon the choices society makes during the next 100 years. What is certain is that climate change is coming. There is no question about that. We are only arguing about when and how much."

The earth's climate is already changing -- and one place that had a radical change in 1998 was the West Peninsula of Antarctica. Satellite images showed that huge portions of the Larsen B and Wilkins ice shelves broke up more quickly than anyone had predicted. Geologist Ted Scambos at the National Snow and Ice Data Center at the University of Colorado in Boulder has been monitoring the South Polar region for several years. He talked to me recently about his surprise that the big glaciers broke up as fast as they did.

Interview:

Ted Scambos, Ph.D., Geologist, National Snow and Ice Data Center, University of Colorado, Boulder, Colorado: "We've been monitoring the Antarctic Peninsula for quite awhile because there has been indications of a strong regional climate warming in the area. In the last year, we saw that two of the large ice shelves in the area retreated very rapidly. By retreating, they calved off thousands of small icebergs and they (ice shelves) are now quite a bit smaller than they've ever been in the past and are probably on the way out.

THESE ARE THE LARSEN B AND WILKINS ICE SHELVES?
That's correct.

ACCORDING TO A RELEASE I HAVE THAT NEARLY 1100 SQUARE MILES OF THEIR TOTAL AREA DISAPPEARED IN 1998 ALONE.
That's right. It's a significant event. I think what makes it important and the reason that people call up and ask about what is going on is that it's such an incontrovertible bit of evidence that something significant is going on -- at least regionally. And others who study other regions have their own set of observations of things that haven't occurred in the past, but are happening now.

WHAT HAS ACCELERATED THIS MELTING AND RETREAT?
What's happening is that these ice shelves are seeing a longer melt season every summer -- particularly in the 1990s they have seen lots of melt on their surface through January and February which is summer in the Southern Hemisphere. And as we get water pooling on the surface, the water acts to enhance the fracturing that occurs naturally within the ice shelves. Ordinarily, these fractures have a tendency to heal themselves and if there isn't a lot of melt water around, then the ice shelves just goes merrily along, cracks form and then seal back up again. With water and fairly warm temperatures, the cracks penetrate all the way through the ice shelf and essentially over a few years it's a mass of fractures and essentially separate icebergs that are all drifting next to one another tightly packed until a storm or tidal surge comes along and sweeps the bergs out to sea. In other words, it appears that these things (ice shelves) have been shattered for awhile now by these warm summertime temperatures, by the melt water acting on the fractures. And in 1998, we saw large areas getting swept out.

1998 WAS THE FASTEST RETREAT OF THESE TWO GLACIERS ON RECORD?
Oh, yes. For these two ice shelves, definitely.

WHEN WAS THE LAST TIME IN HISTORY THAT THE WILKINS ICE SHELF WAS ACTUALLY GONE?
Well, that's the key. Also within the last year, we've been able to get a better handle on just how old these ice shelves are and the answer we're coming up with is centuries old -- possibly they've been there since the end of the last Ice Age. Particularly in the Larsen B, we can track back surface features that formed when the ice was still up in the mountains still grounded on the continent. And then as it flowed out over the ice shelves, those surface features remained. So, by knowing the speed of ice flows on the ice shelves we can determine that that shelf must be old enough to have it flow from the mountains out to the front of the ice shelf. And that takes it about four or five centuries at least.

So, for Wilkins, it's a little bit fuzzier, but the thickness of the Wilkins and some other features in the area imply that it, too, is at least several centuries old. Now, since we know that a ten year period of particularly warm temperatures causes these things to disintegrate, then we can say that the climate in the 1990s apparently is unique relatively to the last 400 or 500 years in the Antarctic Peninsula.

IF THIS ACCELERATION OF MELT CONTINUES INTO 1999 AND

2000, WHAT IS NOW THE PROJECTED TIME FOR WHEN THE WILKINS AND LARSEN B WILL BE GONE?
I think the best way to answer that is that in the next one or two warm summer seasons, you'll see both these ice shelves disappear. Or there might be small remnants remaining, but essentially disintegrate and there will be open ocean bays in areas that used to be covered by ice shelves.

THEN YOU MEAN IT COULD HAPPEN THIS SUMMER OR NEXT SUMMER OF 2000?
Yeah. It's -- we've seen how fast these things can happen. We have a pretty good idea of the mechanism. It's not a question of actually having the entire thickness of the ice shelf melt due to warmer temperatures. The action of a relatively small amount of melt water can destroy the entire ice shelf even though it's 600 to 900 feet thick.

WITH THESE LITERALLY MELTING AWAY AND BREAKING OFF INTO THE SEA -- WHAT ABOUT SEA LEVEL RISE?
The problem is, or the question is, will the glaciers that fed these ice shelves -- sort of behind the ice shelves on the continent, begin to speed up because there is no longer a large mass of ice obstructing their flow? Again the Larsen B and Wilkins -- their break ups don't effect sea level directly. But if the glaciers that feed them were to speed up, then that would have potentially an effect on sea level. I think the key is that this trend is started at the northern tip of the Antarctic Peninsula and over the last 20 years or so, we've seen several ice shelves show melt ponds, show lots of calving events, begin to retreat and eventually disappear. The next several ice shelves to the south are larger and have larger glaciers feeding them. So, the question becomes: When we see speed ups in the glaciers where the Larsen B and the Wilkins used to be and will the trend continue to the larger ice shelves to the south?

IF THEY DO, IF THE LARGER ICE SHELVES TO THE SOUTH CONTINUE TO MELT AT THE RATE OF LARSEN B AND OF WILKINS -- WHAT DO YOU EXPECT WILL HAPPEN?
First, if the ice shelves would disappear -- then if the glaciers were to speed up behind it, there would be a potential to unload some of the ice in the Antarctic Peninsula and the rest of the Antarctic continent into the ocean. The process would be slow. But it's conceivable that it would have an upward effect on sea level. That's the only way a regional warming could significantly effect sea level. Direct melting of the ice sheet is not an effective way to try to raise sea level. There is just not that much energy imparted to the ice sheet every year. But by causing glaciers to flow more rapidly through some feedback mechanism, like removing ice shelves or like having water penetrate to the base of the ice sheet and begin to cause things to speed up -- that's how it's possible to cause large changes in what we call the mass balance of the ice sheet. And by mass balance, we mean mass leaving the continent of Antarctica and flowing towards the ocean. And that could raise sea level.

HOW MUCH?
In the West Antarctic ice sheet which is the area I'm speaking of where there are these more dynamic glaciers, the potential is about 15 feet of sea level rise. However, the time scale over which that could possibly occur is slow. Even the most radical runaway kind of models would call for a few centuries, a century or two before you could really get most of the mass of the west end of Antarctica into the ocean.

BUT WOULD IT BE FAIR TO SAY THAT THE MELT OF LARSEN B AND WILKINS IN 1998 SURPRISED YOU AND OTHER SCIENTISTS?
The rate of change in the Antarctic Peninsula is fairly surprising. And what's more is the realization that the ice shelves were fairly durable until the decade of the 1980s and 1990s also gives one pause in terms of understanding what's going on there and how it compares to recent climate history.

WHAT IT MIGHT MEANS FOR OUR FUTURE AS A SPECIES IN WHICH SO MUCH OF THE POPULATION OF THE WORLD ARE AT COASTAL CITIES.

Yes, it's going to be costly to deal with the many effects that regional warmings and the overall trends towards a warming climate on earth has. In terms of catastrophes, I think sea level rise is going to be a background issue with barrier islands and break waters around the world. The Antarctic may begin to have a more significant contribution in the future, 50 to 100 years from now. Right now, the best thing to do is to understand how the system works, to take note of events that are occurring that appear to demonstrate rather vividly that things are changing in the Antarctic ice and climate system.

IN A DRAMATIC WAY.
Yeah.

WHEN WAS THE VERY LAST TIME THAT SCIENTISTS ESTIMATE THAT THE ANTARCTIC LAND ITSELF WAS FREE OF ICE?
That's an interesting question. Basically, there are several epochs in geology. They have names that are associated with either the climate or the geologic events that were occurring in them. The Pleistocene has been the most recent epoch just prior to the current one and that has been characterized by ice ages. Now, particularly in the East Antarctic -- which is quite cold -- this is where the South Pole is located and where some of the Russian bases that have the coldest recorded temperatures ever are located. The East Antarctic -- chances are it has been covered by ice for the last few million years, with some retreats in the past but never completely ice free in the last 2 or 3 million years.

In the Pliocene which is the epoch before that when the earth was quite a bit warmer, apparently there have been beech tree forests in the Antarctic Continent along the area around McMurdo which is the main base in the Antarctic, a little south of McMurdo.

MEANING PALM TREES?
No, I mean beech -- southern beech which is a type of deciduous tree.

THEY'VE ACTUALLY FOUND EVIDENCE OF BEECH TREES IN THE ANTARCTIC?
Yes, we have found fossilized leaves in recent sediments in the Antarctic indicating that a few million years ago there were actually forests along these hillsides on a relatively ice free Antarctic continent - which is quite remarkable. It implies a whole world of different climate.

ONLY THREE OR FOUR MILLION YEARS AGO?
Yeah. That's true.

IF YOU GO BACK 65 MILLION TO THE EXTINCTION OF THE DINOSAURS -- WAS THE ENTIRE PLANET A TROPICAL SPHERE?
That's the general model that is painted for the late Cretaceous period -- for the end of the dinosaur era. And a globe that was largely flooded by higher sea levels. For example, here in Colorado, there was a tongue of the Gulf of Mexico extending up along what's now the Rocky Mountains all the way as what is now Denver and Boulder.

WATER.
And into Wyoming. Yes, sea water.

HOW DEEP IS THE ICE AT THE ANTARCTIC?
It varies of course -- between a good round number for the central part of the continent would be between 1,000 and 3,000 meters.

WHICH IS ABOUT 3,000 AND 9,000 FEET WHICH IS NEARLY TWO MILES DEEP AT ITS DEEPEST.
That's right.

HOW DID THAT EVER OCCUR? HOW DO YOU GET 2 MILES OF ICE?
Lots and lots of cold, snowy winters. Actually, the cold. The amount of

snowfall in the Antarctic is remarkably low, but of course, it accumulates year after year with almost no melting in the interior of the continent. Only the perimeter of the Antarctic ever experiences melting and then, in general, only for a few days in mid summer. In the interior (of the continent), even though the accumulation (of snow) may be only a few centimeters of water every year in the form of snow -- it's been accumulating for 100,000 years and you get thousands of meters of ice built up.

WHAT ARE YOUR PLANS FOR 1998 AND 1999 TO MONITOR THE LARSEN B AND WILKINS ICE SHELVES AND THE GLACIERS BEHIND THEM?
We're going to continue to collect the daily satellite data we get over the area, plus some additional radar images which are higher resolution that help us see these events in more detail. There is a plan to use new Landsat 7 image data to look at these areas and re-map the speed of the glaciers flowing into the area that are no longer occupied by ice shelves and see if there is a speed up. Monitoring the climate at various stations in Antarctica will continue in the British Antarctic Survey, and also with some groups in Austria and Argentina will probably be down in the field again in the spring and summer seasons in 1999 and 2000. They will take a look at these areas and to see how they are responding. The main thing I'll be interested in seeing is whether or not the trend of break ups and the pattern we think we have identified for how break ups occur if that continues to push southward into the other ice shelves.

BECAUSE IF IT DOES PUSH SOUTHWARD, IT MEANS THAT THERE COULD BE ACCELERATED MELTING COMING OFF OF THOSE GLACIERS BEHIND THE SHELVES?
More that new areas will be opened up -- yeah -- those are separate evaluations -- Will ice shelves continue to break up further south? Will glaciers begin to speed up as a result of the removal of the ice shelves? Those are two separate questions that I will try to address over the next couple of years."

More Information:

The hard reality in all this climate change is that greenhouse gasses aren't going to leave the earth's atmosphere quickly. That's why global warming is expected to keep increasing over the next century, even if we cut back on industrial and auto emissions.
Last weekend President Clinton endorsed proposed EPA standards aimed at making sport utility vehicles and cars run 80% cleaner. To date, sport utility vehicles have not been required to meet the same tailpipe emission standards as cars. The EPA also called for the sale of only low-sulfur gasoline so emission-control equipment can work more efficiently.

Already this EPA effort to make a bigger dent in auto emissions has been attacked by Republicans defending the automobile culture. And the American Petroleum Institute says it will try to change EPA's proposal. Such political short term thinking is why the computer projection into the future is a sobering reality check that should make equal headlines with political and economic news.

Websites:

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