

RUSSIAN sea captain Dimitri Zinchenko has been steering ships through the pack ice of Antarctica for three decades and is waiting to see evidence of the global warming about which he has heard so much.

Zinchenko's vessel, the Spirit of Enderby, was commissioned in January last year to retrace the steps of the great Antarctic explorer Ernest Shackleton, marking the century of his Nimrod expedition of 1907-09.

Spirit of Enderby was blocked by a wall of pack ice at the entrance to the Ross Sea, about 400km short of Shackleton's base hut at Cape Royds. Zinchenko says it was the first time in 15 years that vessels were unable to penetrate the Ross Sea in January. The experience was consistent with his impression that pack ice is expanding, not contracting, as would be expected in a rapidly warming world. "I see just more and more ice, not less ice."

Rodney Russ, whose New Zealand company Heritage Expeditions has operated tourist expeditions to Antarctica for 20 years, agrees. He says ships regularly used to be able to reach the US base of McMurdo in summer, but ice has prevented them from doing so for several years.

"Vessels are usually stopped 8km to 14km short of the base. A few years ago, that was often open water," Russ says.

"We have experienced quite severe ice conditions over the past decade. I have seen nothing in this region to suggest global warming is having an effect."

Such observations are not in step with the popular perception of what global warming is doing to the polar icecaps. Reports last week that an ice bridge had snapped in west Antarctica, threatening the disintegration of the Wilkins Ice Shelf, generated international headlines. Environment Minister Peter Garrett insisted that although he had not received any scientific advice about the Wilkins break-up, he was in no doubt about the implications.

"It's a big event. There are many others that have been identified in and around the Antarctic, which I think tells us unequivocally that we're seeing climate change impacts," Garrett said.

The real story about ice and Antarctica, however, is more complicated.

With Antarctica holding 80 per cent of the world's fresh water and 90 per cent of its ice, a meltdown of the icecap would raise sea levels worldwide by a catastrophic 70m. With the depth of the icecap averaging 4km, nothing like that is on the horizon. But is there cause for concern about what is happening with the weather in Antarctica?

Climatologists say if temperatures rise by 4C to 6C by the end of the century — the upper limit predicted by the UN Intergovernmental Panel on Climate Change — the melting of ice sheets in west Antarctica and Greenland would raise sea levels by up to 1.5m, enough to create problems in coastal areas.

What is less certain is whether ice shelf losses in west Antarctica, such as Wilkins, are being offset by cooling conditions and ice expansion in east Antarctica, which is four times the size of west Antarctica.

Unlike the Arctic, there has been no certainty that global warming is having an effect across Antarctica, although temperatures have risen in parts of west Antarctica, especially on the Antarctic Peninsula. The peninsula is geologically more an extension of the Andes of South America than part of the Antarctic continent. The crucial distinction between west Antarctica and the much larger east Antarctica is rarely mentioned in media reports of ice shelf break-ups.

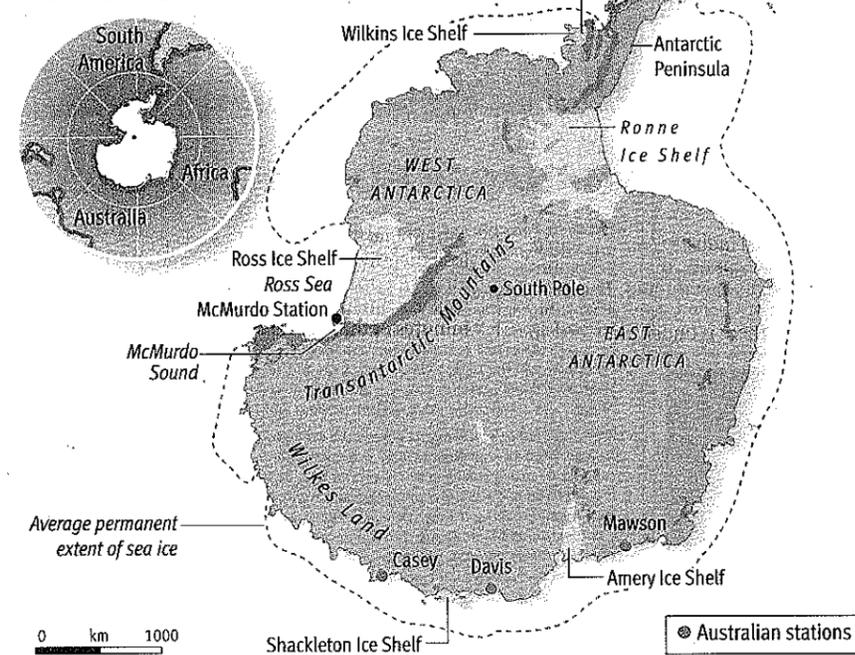
Last week, ABC's *LateLine* claimed that a new report by the Scientific Committee on Antarctic Research predicted sea level rises of up to 6m by 2100 because of Antarctic melting, but the upper level predicted by the report was just over 1m in a worst-case scenario.

A letter published in January in the journal *Nature* by University of Washington climatologist Eric Steig and colleagues argues that the



Dropping off: While ice shelves in west Antarctica are crumbling, those in east Antarctica are growing, thus balancing the potential for higher sea levels

SEA OF ICE



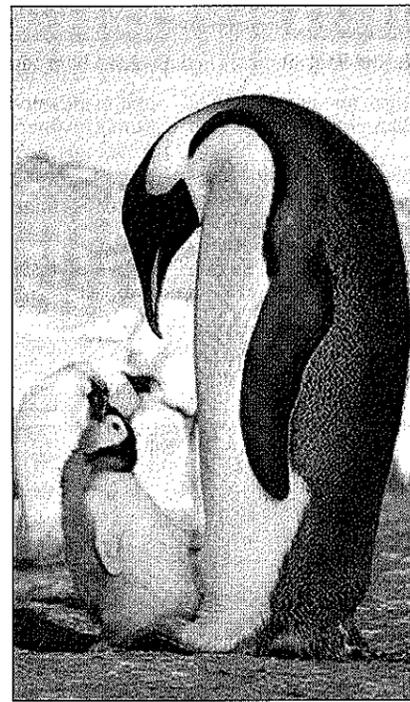
continent generally is feeling the global heatwave. Steig concludes that the area of west Antarctica affected by warming is larger than was thought previously, with temperatures having risen by about 1C during the past 50 years.

Last week's SCAR report points to substantial ice losses in and around west Antarctica: for instance, 28 of 36 surveyed glaciers on South Georgia Island are retreating.

However, the picture in east Antarctica, which includes the South Pole and the territory claimed by Australia, is different.

Steig tells *Inquirer* that his study found some cooling in east Antarctica in the 1980s and '90s. He adds, however, that the evidence indicates the continent is warming overall.

"West Antarctica is warming significantly and has been for the entire 50-year period of our study. West Antarctica has been warming



On the way out? Emperor penguins

so much that the average over the entire continent, including east Antarctica, is significant warming."

Nonetheless, evidence supports anecdotal observations that over much of east Antarctica, the sea ice that fringes the continent, a key indicator of climate change, is becoming more extensive.

According to Antarctic Climate and Ecosystems Co-Operative Research Centre research

fellow Ian Allison, satellite data since the mid-'70s suggests that across the whole of the continent there has been a slight increase in sea ice.

Although sea ice had contracted in west Antarctica, the decline was more than offset by increases in the Ross Sea in east Antarctica, which has an ice shelf bigger than France.

"We have not seen any evidence over that period of a statistically significant change in sea ice for the continent generally," Allison says. He points out that the satellite data does not give an indication of how thick the ice is.

He says anecdotal evidence provided by whalers indicates their operations moved southwards towards the Antarctic coast during the '60s, suggesting a reduction in sea ice mass of about 20 per cent.

A shrinkage of about 15 per cent in sea ice in that time was reflected in core sampling in Australia's Antarctic territory, but this may not be exceptional.

"You get 10-year cycles with the level of ice going up and down, but in east Antarctica there's no indication of a long-term increase or decrease beyond the levels of natural variability," Allison says.

Glaciologists point out that the Arctic, where substantial ice losses are well documented, is fundamentally different from the Antarctic. The Arctic is essentially landlocked. The Antarctic is a continent surrounded by the Southern Ocean, which may be absorbing global heat.

The Antarctic also has an ozone hole above it, which could be acting as a pressure valve, allowing heat to escape the icecap. "It could be that when the ozone hole is fixed, there will be more warming," Allison says.

In the Arctic, polar bears are declining as ice melts, and Greenlanders farm once desolate icy wastelands, but nothing of the sort is happening in Antarctica. Data compiled by Australian Antarctic Division ice modeller

either direction," Heil says.

Scientists note that stable or increased sea ice does not necessarily mean temperatures are not rising. Australian Bureau of Meteorology senior climatologist Andrew Watkins says monitoring at three sites in Australia's Antarctic territory and at Macquarie Island, Australia's sub-Antarctic territory, indicate minor warming since the mid-'50s.

Watkins points out that snowfall could be increasing in Antarctica even as temperatures rise, adding to the ice mass, and there is much uncertainty about the total volume of ice.

"My view is that there is nowhere in the world that is not being affected by climate change," Watkins says.

University of Adelaide director of climate science Barry Brook says climate modelling indicates increased precipitation over the continent, especially in east Antarctica, possibly indicating a cooling effect associated with a build-up of snow and a thickening of the ice in some areas.

Nonetheless, Brook believes the deterioration of ice conditions in west Antarctica, where calvings from Wilkins and other ice shelves are becoming more frequent, is cause for concern. In February, an iceberg 41km long and 2.5km wide broke from the Wilkins shelf.

"If the sea ice is looser because of warming, the ice shelf is destabilised and that allows the continental glaciers to push down from behind. The result is a bit like pulling the plug out of the bath. That's when sea levels can start to be affected," Brook says.

There are more localised consequences. A study published in January by the Woods Hole Oceanographic Institution warned that breeding colonies of emperor penguins, a species that breeds only on ice on the continent, could be doomed by global warming in west Antarctica. In Terre Adelie, the penguin colony is set to shrink from 3000 to 400 pairs by the end of the century. However, there are no indications that colonies of emperor penguins in east Antarctica are threatened.

Brook says temperatures on the Antarctic Peninsula have been rising at a rate much higher than the world average, about 2.5C during the past 50 years. "The evidence is strong that we are seeing large regional shifts of ice in that part of Antarctica and that is worrying," he says.

SCAR uses modelling to predict a warming over Antarctica of up to 3C during the next century. SCAR warns that melting on the Antarctic Peninsula may be of sufficient magnitude to make a substantial contribution to global sea levels. The committee says it cannot predict how the continent's ice sheets will respond to warming but says "observed recent rapid changes give cause for concern".

Glaciologists point out that the world has seen shrinking icecaps in the past. Ice is a dynamic environment and it is not necessarily abnormal or catastrophic when ice sheets periodically lose the quantities of ice that generated last week's headlines.

On a grander scale, the globe has experienced numerous ice-sheet meltdowns prehistorically. Melting in the northern hemisphere about 18,000 years ago raised sea levels by 130m.

Ice-core drilling has suggested 40,000-year cycles of ice melting and refreezing.

The Wilkins Ice Shelf is just several hundred years old, a speck of time in the evolution of the Earth. SCAR notes in its report that predicted temperature rises in Antarctica are comparable to or slower than increases during past weather events.

For his part, pack-ice veteran Zinchenko is relaxed. "One year there is more ice than the year before and the next year there is less. The amount of ice goes up and down, up and down. That's just the way it is."