

# What cools the world

As the world warms, the earth faces the risk of losing its ice. This could have many implications for Singapore. **The Straits Times** speaks to Ms Margaret Lindeman, a doctoral candidate studying glacier-ocean interactions at the Scripps Institution of Oceanography, to learn more about the cryosphere, and the role of ice in the climate system.

## MAIN TYPES OF ICE

### Sea ice

#### What it is

- Formed when air cools the ocean below its freezing point.
- Just as how the water level in a glass of frozen water does not change when the water melts, melting sea ice does not have an impact on sea-level rise.
- But it still plays a crucial role in the climate system due to its reflective capabilities. Called the

ice-albedo feedback, sea ice can reflect incoming solar radiation back into space, preventing the earth's surface from warming.

- Melting sea ice could reduce the amount of heat being reflected back into space, exacerbating warming.

#### Where it can be found

In places such as the Arctic Ocean.



Arctic sea ice as seen from a South Korean icebreaker in August last year.

### Glaciers

#### What they are

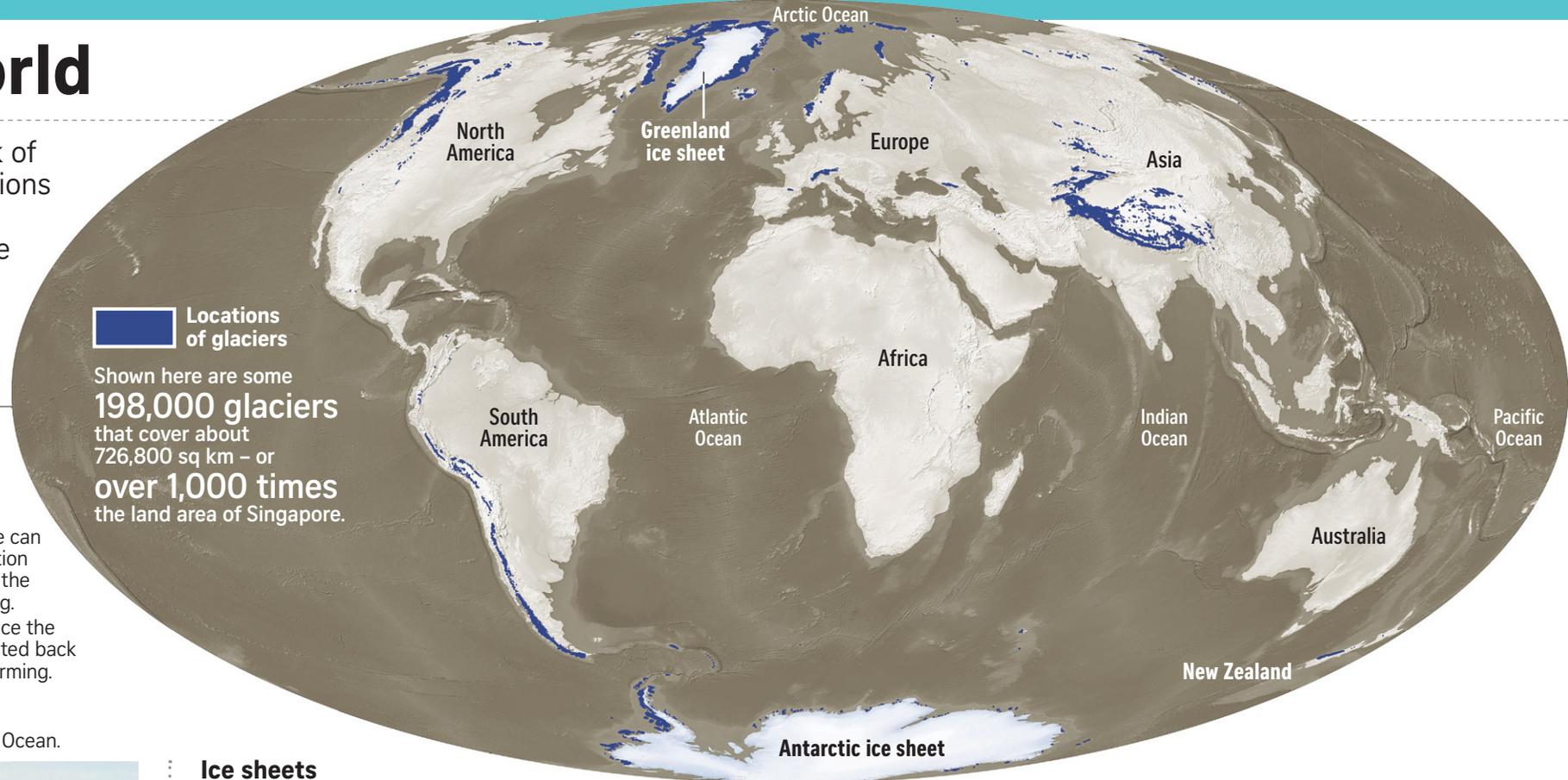
Glaciers are also land ice that, like ice sheets, are formed through the compaction of snow.

#### Where they can be found

- In many places around the world, including in northern Asia.
- Surprisingly, the key season that determines the formation of glaciers is summer, not winter. If the rate of ice melt in summer is lower than snow fall in winter, glaciers are likely to form.
- This condition means glaciers usually form in the polar regions or in mountainous areas.



Franz Josef Glacier on New Zealand's South Island dwarfs visitors.



Locations of glaciers

Shown here are some **198,000 glaciers** that cover about **726,800 sq km** – or **over 1,000 times** the land area of Singapore.

### Ice sheets

#### What they are

Ice sheets, according to the National Snow and Ice Data Centre, are land ice that are at least 50,000 sq km.

#### Where they can be found

- There are only two ice sheets in the world – the Greenland ice sheet, formed about three million years ago, and the Antarctica ice sheet at about 34 million years old.
- Scientists estimate that if both ice sheets were to melt completely, global sea levels will go up by about 65m.

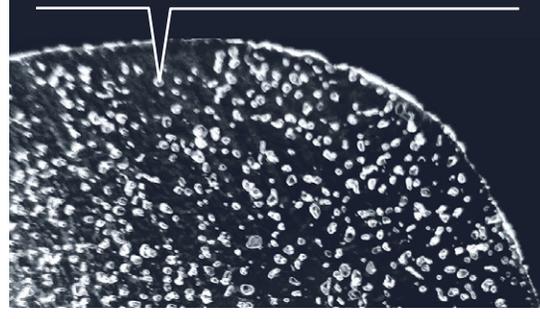


Hiawatha impact crater covered by the Greenland ice sheet.

### Ice cores

As snow accumulates on land and gets compacted into ice, it holds within its layers clues to earth's climate in the past.

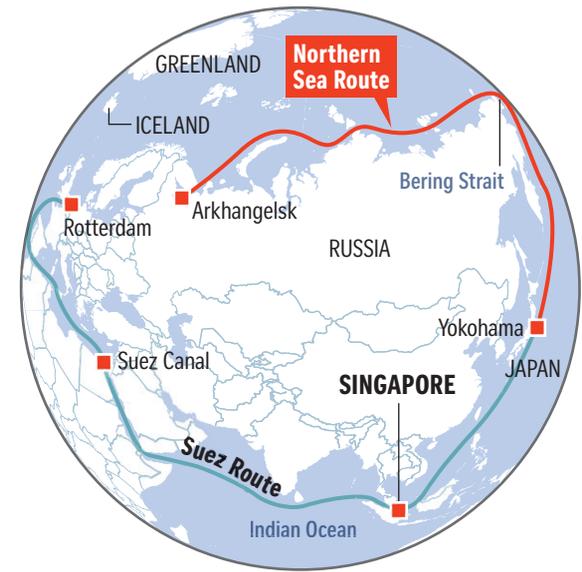
Ancient air, trapped in bubbles in the ice, allows scientists to measure how carbon dioxide concentrations in the atmosphere have changed over the past 800,000 years.



## IMPLICATIONS FOR SINGAPORE

### Shipping hub status

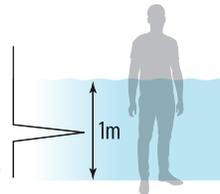
Melting sea ice in the Arctic could threaten Singapore's position as a global shipping hub if the Northern Sea Route is opened all year round, shaving 30 per cent off travel time via the conventional Suez Canal-Malacca Strait route.



### Sea-level rise

- The melting of glaciers and ice sheets has the potential to cause sea-level rise.

- Singapore's Second National Climate Change Study has projected mean sea level in the Republic to go up by about 1m by 2100.



Antarctic ice loss has raised global sea levels **1.4cm** since 1979



### Antarctic ice loss per year (billion tonnes)

