

Following the Pine Island Cracks, Antarctica

The Ladies' College

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Aims: To investigate how the width of the cracks in Pine Island Glacier have changed over time

Introduction: History and Geography of Pine Island Glacier

Pine Island Glacier is "one of the largest ice streams in Antarctica" and flows into the Amundsen Sea in the West of Antarctica. The glacier sits atop a "large, floating ice shelf" and this helps to stabilise the glacier (Bethan Davies, 2014). It is 175,000km2 and the average thickness of the ice is approximately 2km (D.G. Vaughan, H.F.J. Corr, F. Ferraccioli et al, 2007).

Pine Island Glacier is the fastest melting glacier in Antarctica and is responsible for 25% of Antarctica's ice loss. Calving events used to happen around every 6 years before 2013, but now they occur almost annually. Pine Island has shed glaciers in 2013, 2015 (these icebergs were calved amid the austral winter), 2017, and 2018.

Satellite images using the Sentinel satellites are important as they enable yearround observation. The data is collected using microwave signals are transmitted at an angle. Smooth surfaces will reflect signal away from the detector so will appear dark in images; rough surfaces will back-scatter signal



The next iceberg to carve from Pine Island Glacier is likely to be 5-6 times as big as the Island of Guernsey

Method of Collecting Data

Starting in July, we downloaded the photos of the Pine Island Glacier from the Centre for Polar Observation and Monitoring website, taken by the sentinel 5 satellite. We started our observations by following the appearance of a crack in July 2019.

For each photo taken, we measured: The length of the two cracks The width of the two cracks across 7 locations and found the mean The total length surveyed

The biggest gap between 2 width readings The percentage wide part

We then made several graphs to visually display how the length and widths of the cracks changed over time. The general trend of the graphs showed that as time went on the cracks got wider and longer. However, there were slight fluctuations in the graph as there were 4 of us measuring the cracks, so we started at different places, hence causing small errors.

and so will appear brighter.







Reasons Why the Cracks are Expanding:

- Antarctica is in the summer period, so the weather is a lot warmer. As a result of this, the ice is melting at a much faster rate.
- The pressure exerted on the glacier is concentrated in the cracks, which causes them to widen and this will induce a calving.



18th January 2020 Notice there are now 3 cracks and the shape of the indent on the RHS is larger. **SUMMER**

Glacier

7th July 2019 Notice the beginning of cracks and the shape of the indent on the RHS WINTER (note absence of sea ice)

Conclusion:

5 600

Overall, we conclude that since July and due to starting the Antarctic summer with thinner and less ice from winter, the cracks in the Pine Island Glacier have both increased in length and width. Looking at the pattern, it appears that the cracks are widening in spurts, slowly widening then a sudden large movement. We predict that a calving will occur in the next few months as the widening of the cracks has started to accelerate.

The Problem- Rising Sea Levels

Additionally to the sea ice, melting glaciers are the third-largest contributor to eustatic sea-level rise and therefore the melting of pine island can have dramatic effects on global sea levels, posing the risk of inundation to low lying areas. Guernsey has reclaimed land from the sea in the past and this land is vulnerable to sea level rises.



The Problem- Extreme Climate

We were interested in how this can affect us in Guernsey and found that a similar event is happening in the Northern Hemisphere. The increased freshwater from the Arctic is reducing the net flow of the arctic chimney waterfalls which is, in turn, slowing the rate of the North Atlantic Drift. This together with the reduced flow from the south can have extreme effects on our climate in Western Europe. If it wasn't for the gulf stream, we would have a similar climate to Canada and it has been predicted that the slowing of the gulf stream could lead to cooling of up to 5-10 degrees!

These effects highlight the importance of monitoring and measuring glacial melts in major ice stores such as Antarctica.

We are already experiencing severe storms more frequently on the island in winter which is disrupting our supply of food and damaging sea walls. In the past decade drought is also becoming more common.

The Problem- Gulf Stream

Pine Island is the greatest contributor of sea ice into the ocean of any ice drainage basin system in the world. This is having adverse effects on the global climate as well as the ocean current systems. As the fresh meltwater is flowing on top of the dense seawater, it is causing haline stratification. This is an issue as it prevents the cold water from sinking and therefore slows the thermohaline circulatory system which is important in regulating the world's climate, which, in the southern hemisphere, are ultimately







Evaluation:

It was very difficult to accurately measure the distances as we had to magnify the image and it was quite pixilated. The crack also varied in length and width so we took many readings to find an accurate average. The satellite photos were not uploaded regularly so we often had a lot of data to process all in one go.

If we had had satellite photos taken more regularly, the pattern in the graphs could been clearer due to the closer intervals. However we feel that despite the difficulties, we have produced data that shows what is happening to the crack.

driven by water sinking in Antarctica.

The Grey Wolf:

In December, we visited the "Grey Wolf", which is a boat that explored an area of Antarctica close to the Pine Island Glacier. It was amazing to be on board a boat that had been to Antarctica! It was interesting to hear the stories and meet people who have experienced seeing the glaciers melting first-hand. We also saw some amazing video footage and photos of the geographical landscapes of Antarctica.







