

ANTARCTIC GLACIER AND ICE SHELF FRONT DYNAMICS IN A CHANGING CLIMATE

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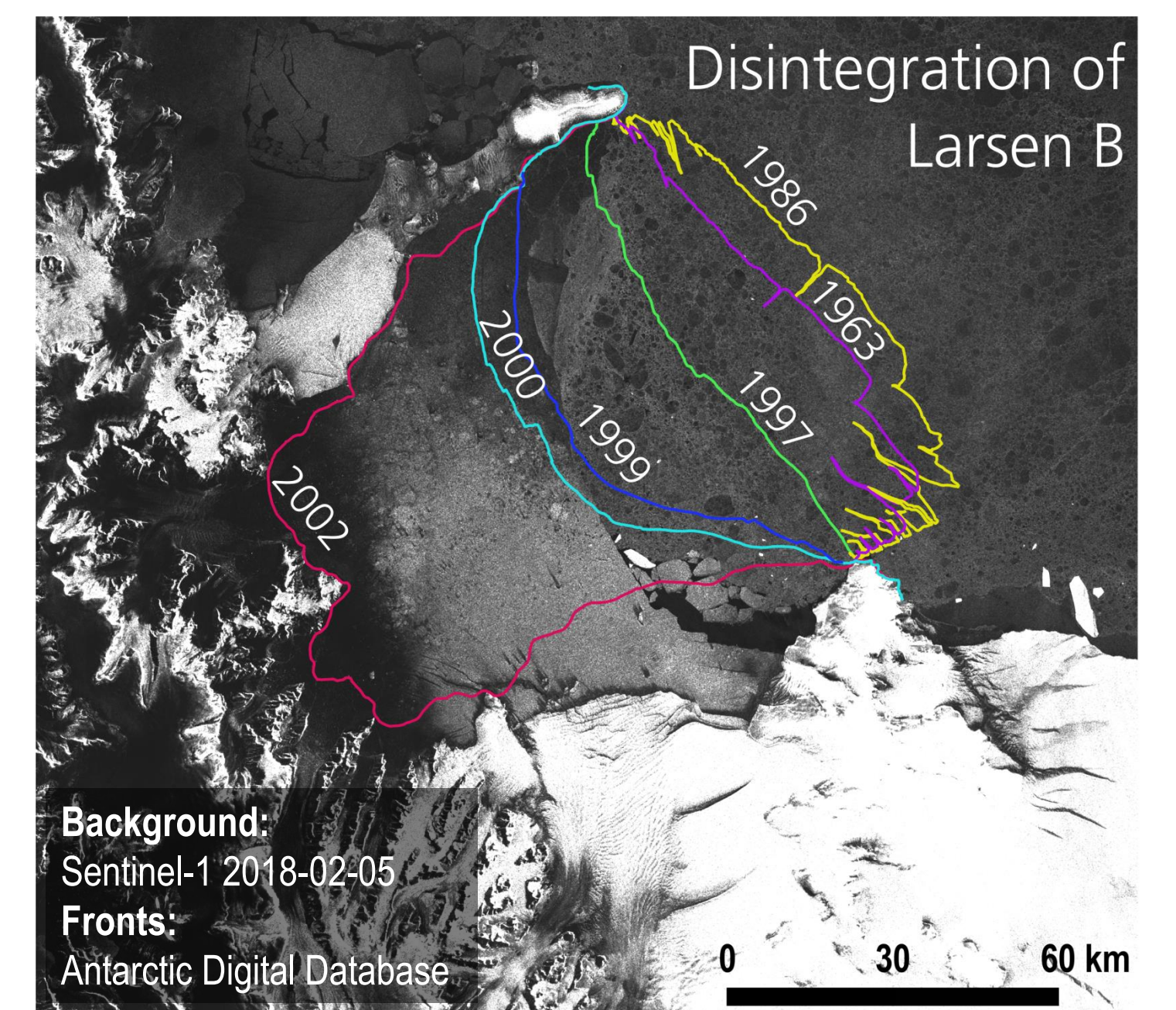
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Introduction

- Along Antarctica's coastline outlet **glacier terminus positions** and **ice shelf extents** are very **dynamic and constantly changing**.
- The extent of ice shelves and glaciers is important as their **floating ice buttresses ice sheet flow**.
- Less buttressing **increases ice sheet discharge**. The consequence is a higher **contribution to sea level rise**.

But where are changes in frontal position most frequent?

- Many glacial extent studies on single glaciers or coastal sections exist but no **circum-Antarctic record** because **manual delineation** of frontal positions from aerial and satellite imagery is **very time-consuming**.
- To analyze where changes took place, **over 100 existing studies** were reviewed and **compiled to one single data set**



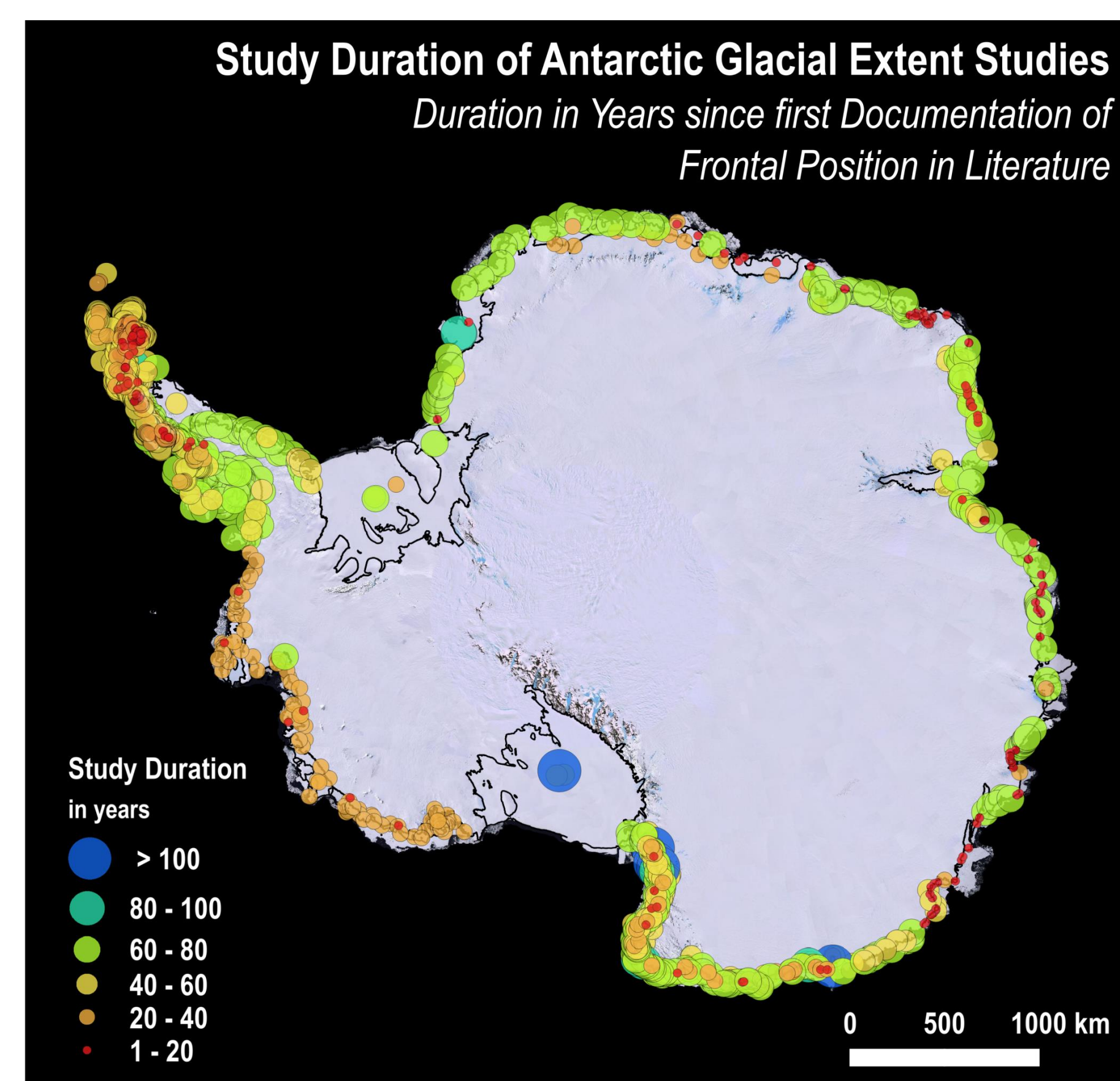
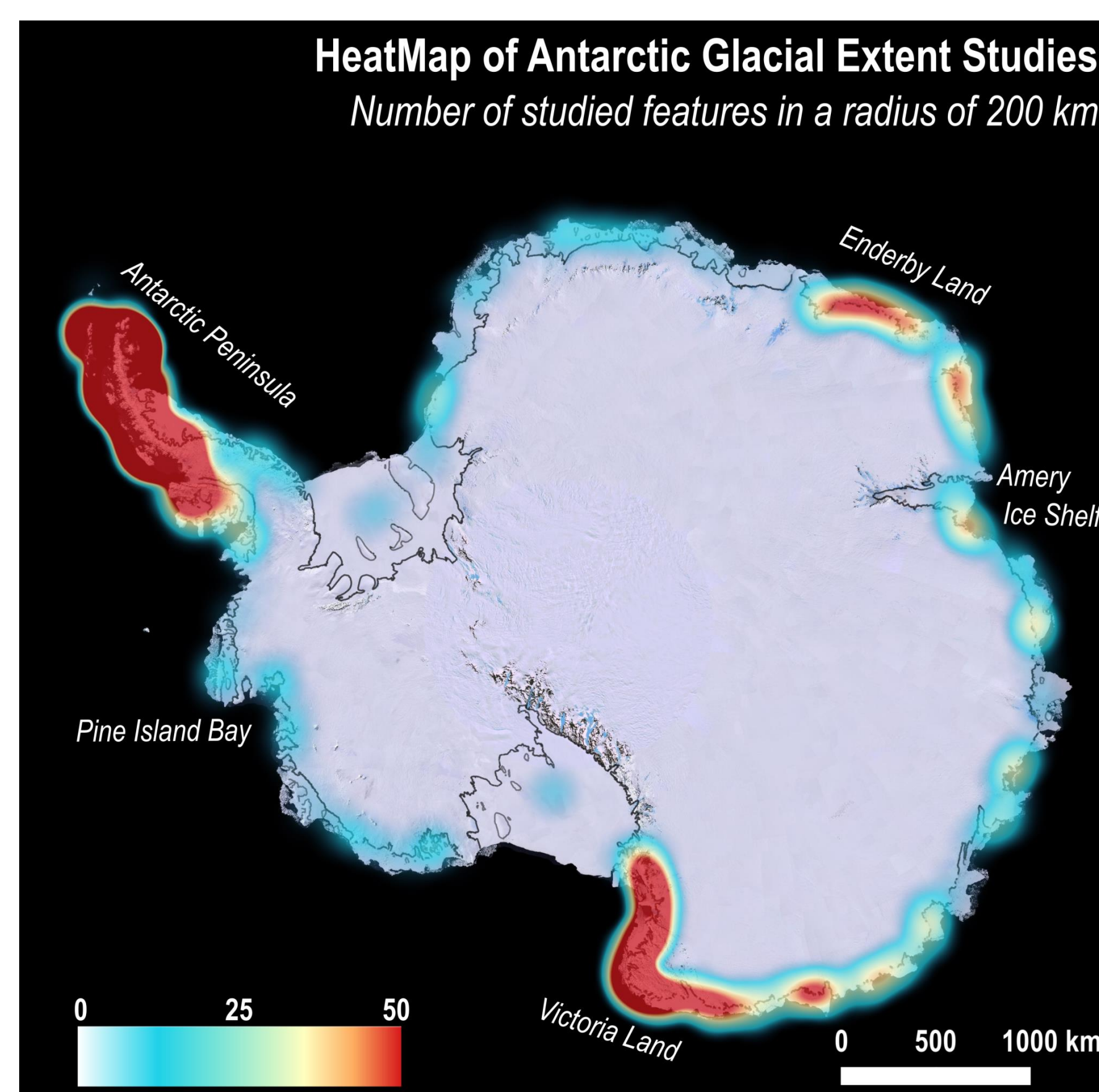
Advancing & Retreating Fronts

Research Hotspots

The number of glacial extent studies is distributed unevenly along Antarctica's coastline.

Information on front fluctuations is agglomerated in coastal sections with small glacier catchments.

The Antarctic Peninsula is by far the most studied area. Furthermore, the coast along Victoria Land, Enderby Land and specific ice shelves such as Amery, Ronne-Filchner and Ross are hotspots of research.



Study Duration

The study of glacial extents started with first expeditions to Antarctica in the early 1900s.

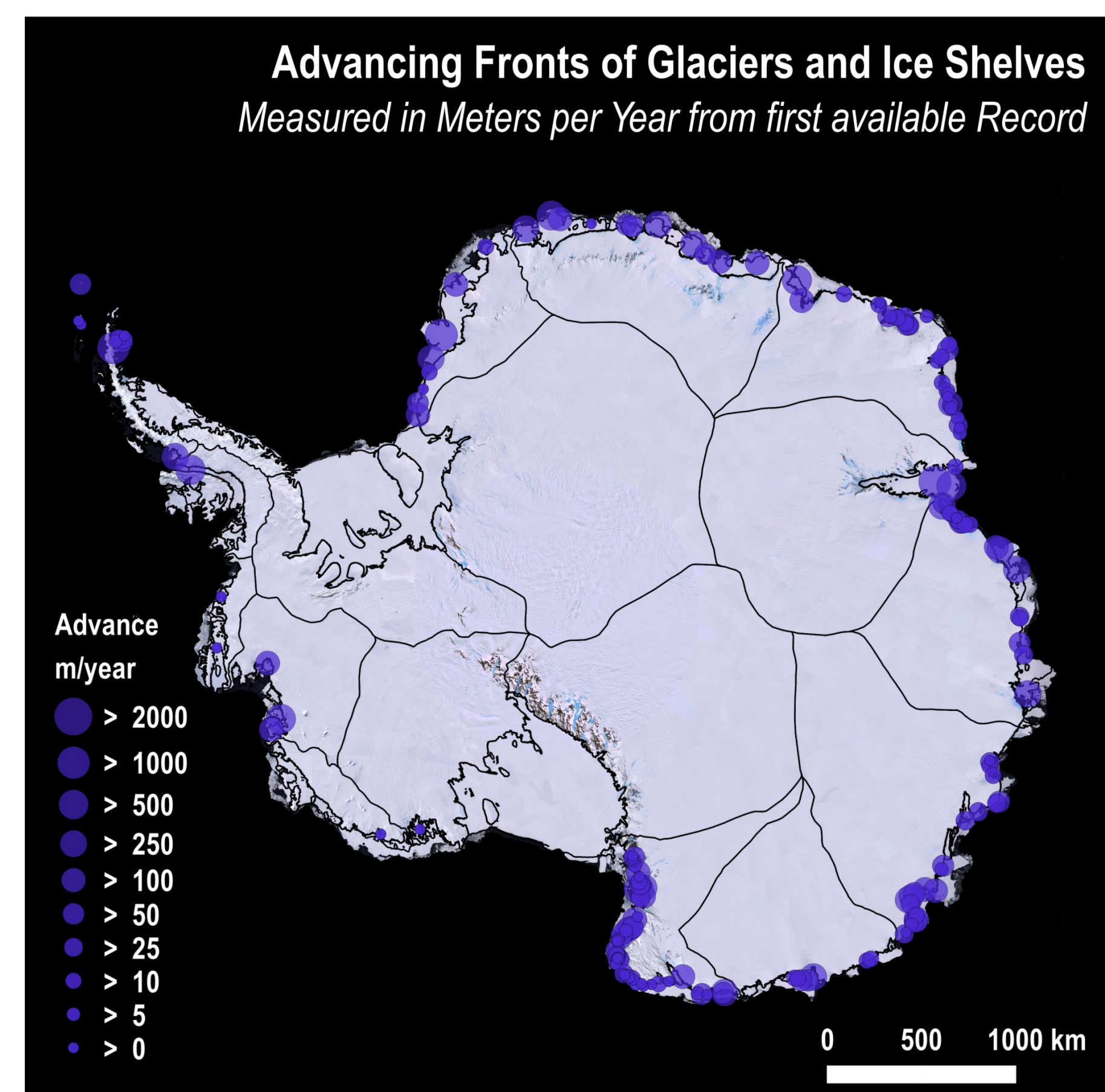
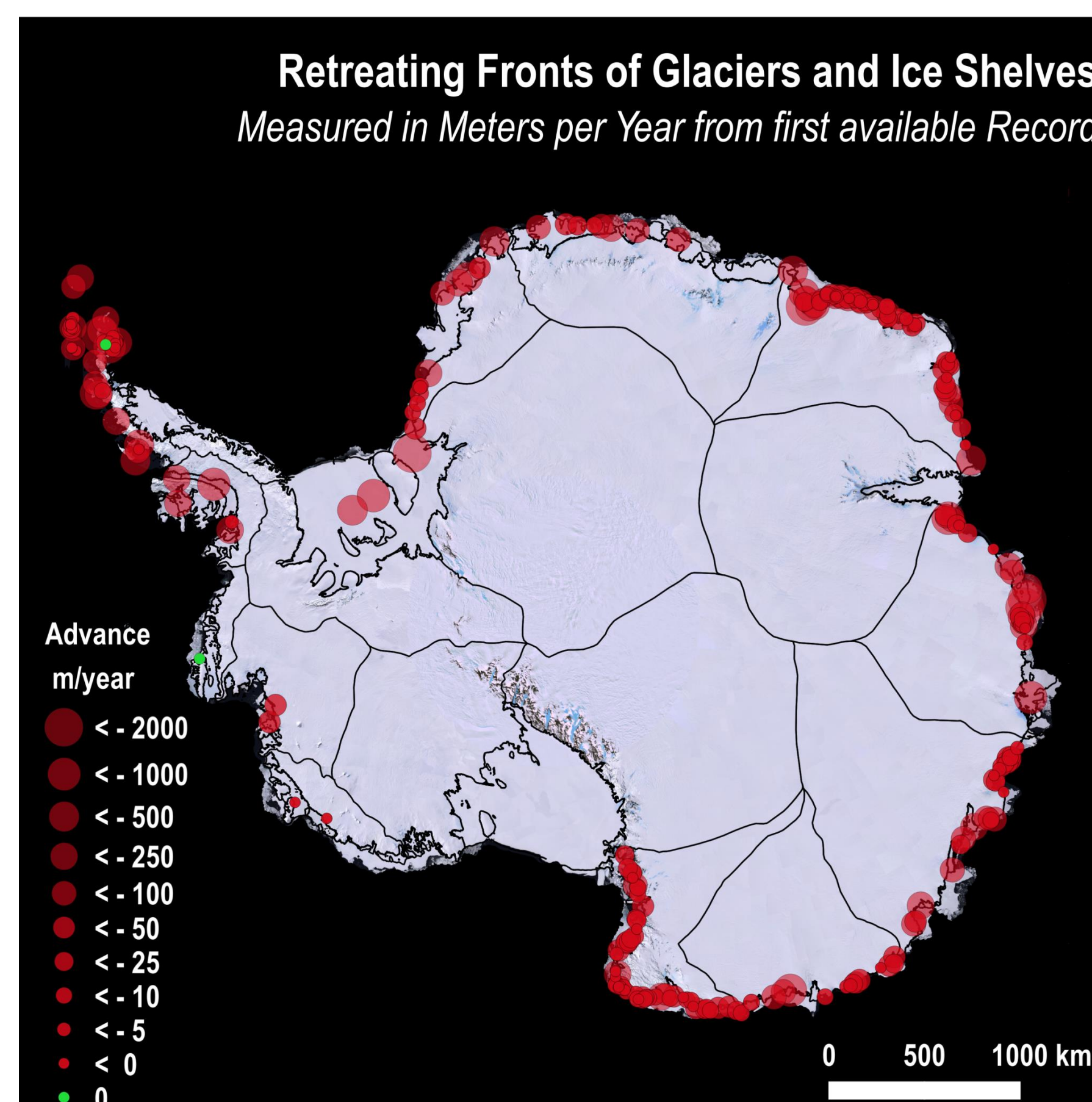
In the last years, data availability dramatically increased thanks to numerous earth observation missions such as Landsat and Sentinel.

Longest studies exist for Ross Ice Shelf and Mertz Glacier. In the 1970s, the launch of Landsat also allowed studies on a larger scale even for smaller and unnamed glaciers.

Retreating Fronts

In the very North of the Antarctic Peninsula in the Region of Trinity Peninsula and James Ross Island strong retreat rates can be observed.

An accumulation of glacier retreat at East Antarctica can be seen at Victoria Land and Enderby Land.



Advancing Fronts

Most advancing tendencies can be observed along the east Antarctic coast.

Only isolated glaciers along the Antarctic Peninsula advance slightly.

A very strong advancing front of the Amery ice shelf is obvious.

Conclusion

- Hotspots of Antarctic glacial extent studies exist. Especially **sensitive regions** with very dynamic front fluctuations are studied more frequently. Besides, **data availability** influences the choice of study regions.
- The **duration of studies is still very short** as good data coverage only exists since the launch of Landsat. Short time-series make it **difficult to link retreating fronts to climate change**.

- **Strong retreat rates** are observed along the **Antarctic Peninsula** with almost no advancing glaciers.
- **East Antarctica** was always thought to be **more stable** but besides many advancing fronts glacier **retreat can be observed**. As measurements are short and inhomogeneous in duration the results only reflect **short-term tendencies**.

- To better assess the influence of a warming climate on the calving cycle of glaciers and ice shelves, **longer and more homogeneous data sets are necessary**.

