

Ankara University  
Faculty of Languages and History-Geography  
Department of Geography

# Glacial Geomorphology

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# READINGS / REFERENCES

1. Erinç, S., 2001, **Jeomorfoloji II**, Der Yayınları, İstanbul.
2. Huggett, R.J., 2015, **Jeomorfolojinin Temelleri** (Çeviri Editörü: Prof. Dr. Uğur Doğan), Nobel Akademik Yayınları, Ankara.
3. Kutup Bilimleri Ansiklopedisi, TÜBİTAK
4. Çalışkan, O., 2014, **Permafrost ve Periglasyal Jeomorfoloji**, Ankara Üniversitesi yayınları No: 437, Ankara.
5. Bilgin, T. 1972. **Munzur Dağları Doğu Kısmının Glasiyal ve Periglasiyal Morfolojisi**. İstanbul Üniversitesi Yayınları, No:1757, Coğrafya Enstitüsü Yayınları, No: 69, İstanbul.
6. Turoğlu, H. 2011. **Buzullar ve Buzul Jeomorfolojisi**. Çantay Yayınları, İstanbul.
7. Yeşilyurt, S. 2023. Buzullarla İlgili Maddeler. Kutup Bilimleri Ansiklopedisi 2: Yer Bilimleri. TÜBİTAK.

# Course Contents

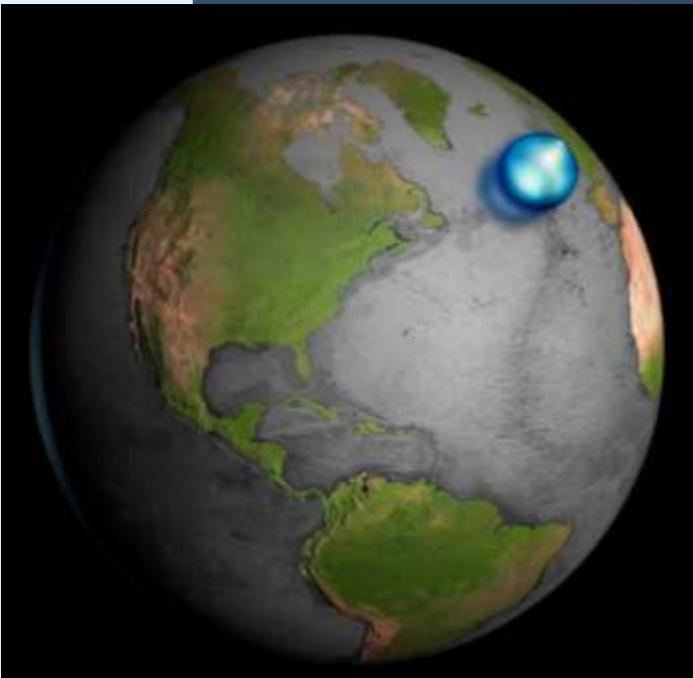
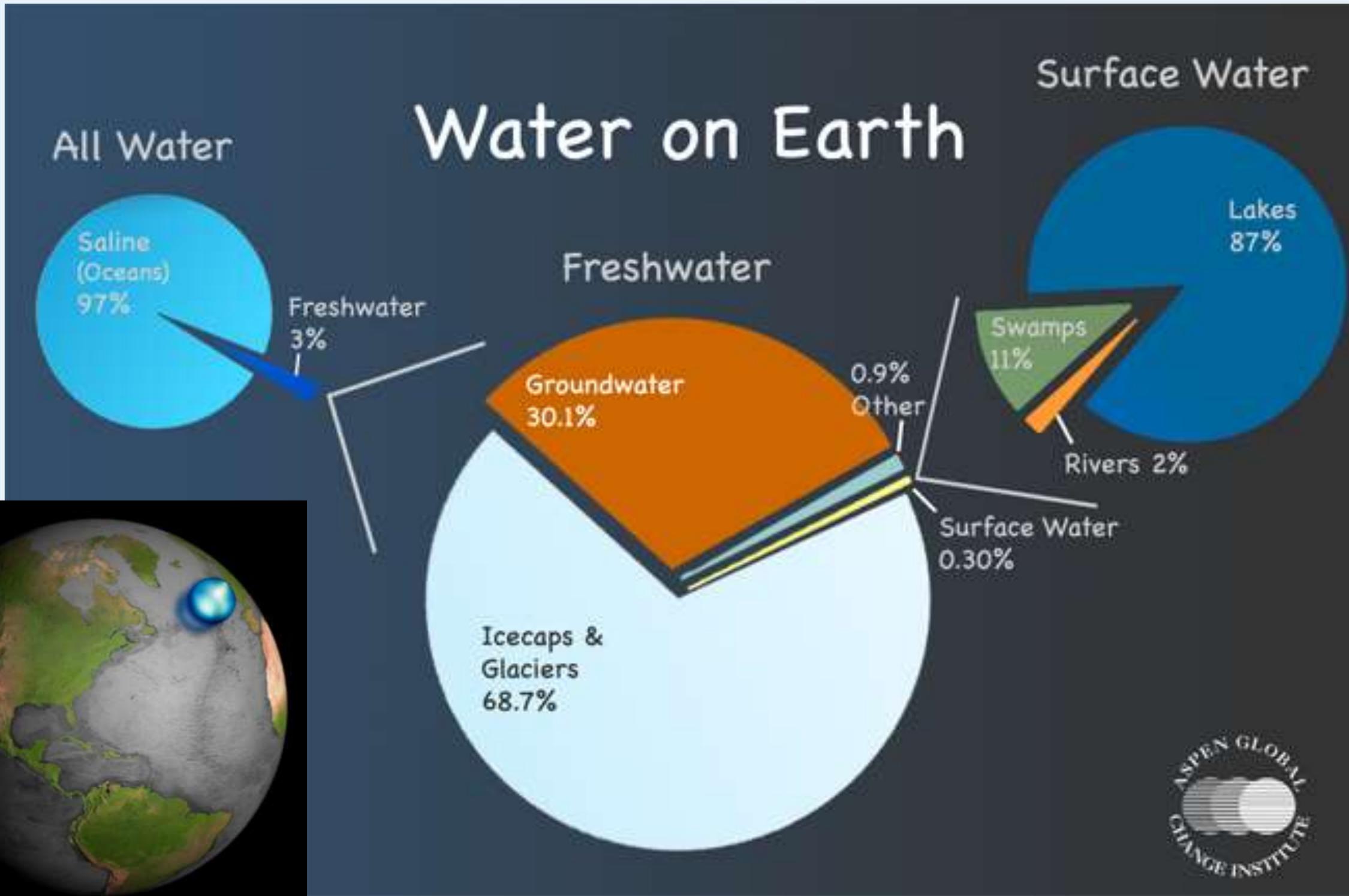
1. The significance and distribution of glaciers
2. How glaciers form, glacier movement, glacier mass balance, and the snowline
3. Glacial erosion and erosional glacial landforms
4. Glacial deposits and depositional landforms
5. The Ice Age, Quaternary climate changes, and types of glaciers
6. Glacio-isostatic uplift and sea level changes
7. Midterm
8. Antarctica
9. Glaciers in Turkey's mountains and their future
10. Glacial traces and geomorphology in Turkey's mountains
11. Glacial chronologies in Turkey's mountains
12. Permafrost, periglacial environments, and processes, global permafrost areas
13. Periglacial landforms
14. Distribution of periglacial landforms in Turkey's mountains

# Why glaciers important?

- Two-thirds of the Earth's freshwater is stored in glaciers.
- Glaciers respond directly to climate changes.
- As a geomorphological process, glacial activities form the topography, creating unique landforms.

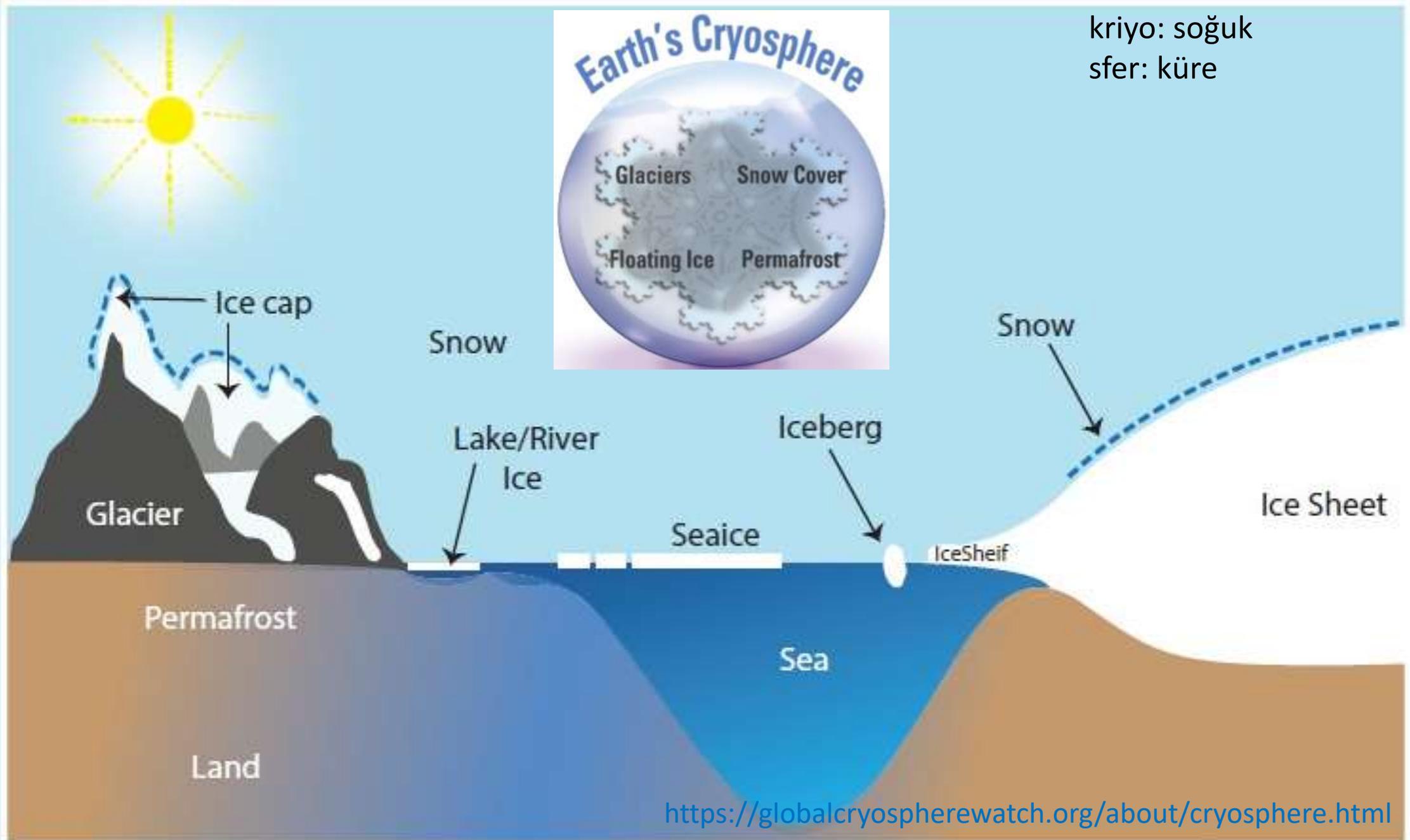


# Dünyanın Su Kaynakları (Buzulların Önemi)



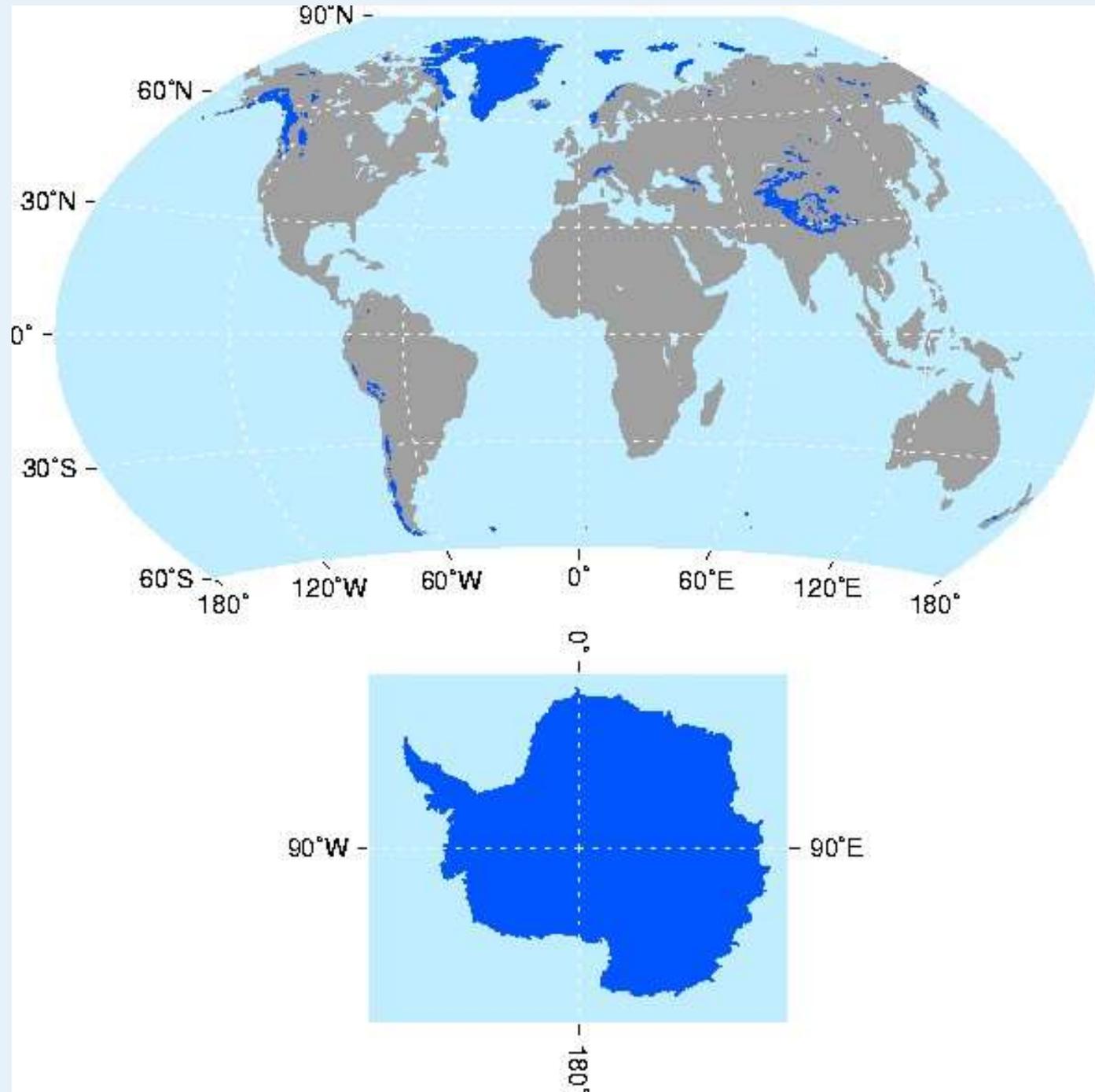
# Cryosphere (Kriyosfer (Soğukküre / Buzküre))

The Cryosphere refers to any place on Earth where water exists in a solid state



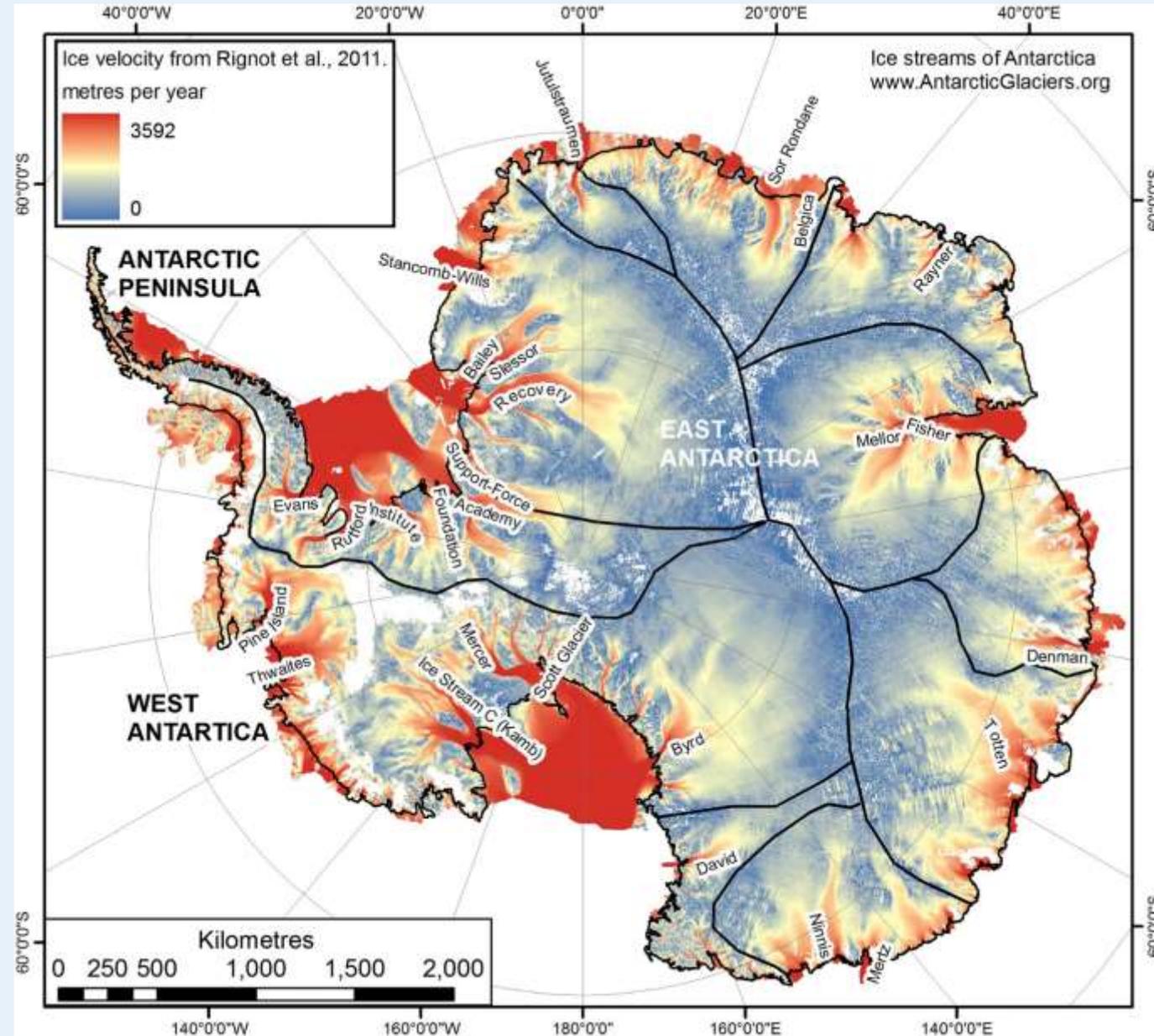
# Distribution of Glaciers

1. Glaciers exist on every continent except Australia.
2. 10% of the Earth's land surface (15 million km<sup>2</sup>) is covered by glaciers, whereas during the Last Ice Age, this was 32%.
3. 91% of the world's glaciers are found in Antarctica, and 8% in Greenland.
4. Half of the remaining 1% is located in North America, with the rest spread across Asia, South America, Europe, Africa, and New Zealand.
5. Outside the polar regions, Pakistan holds the largest amount of glacial ice.
6. If all glaciers were to melt, global sea levels would rise by 70 meters.

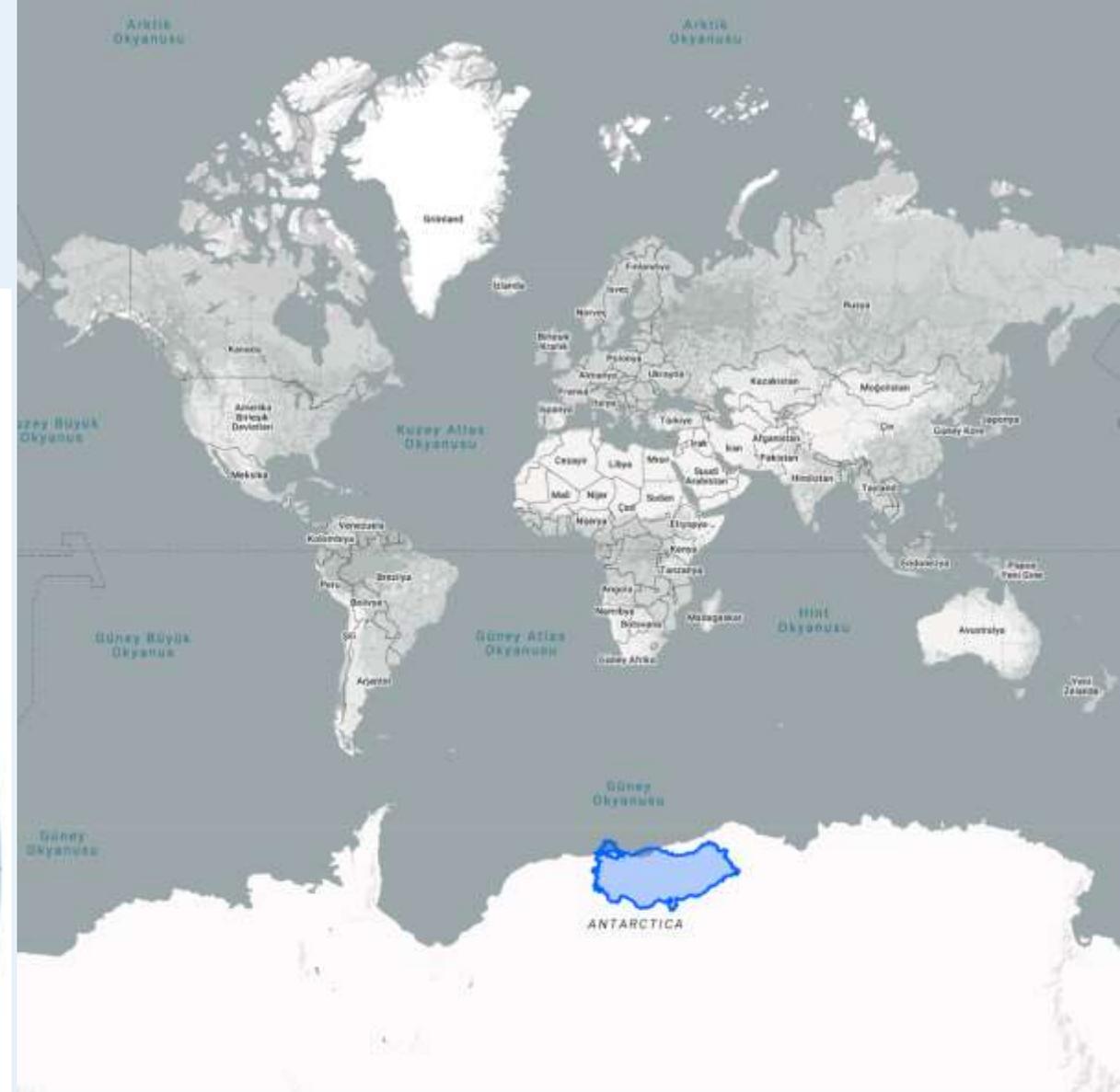
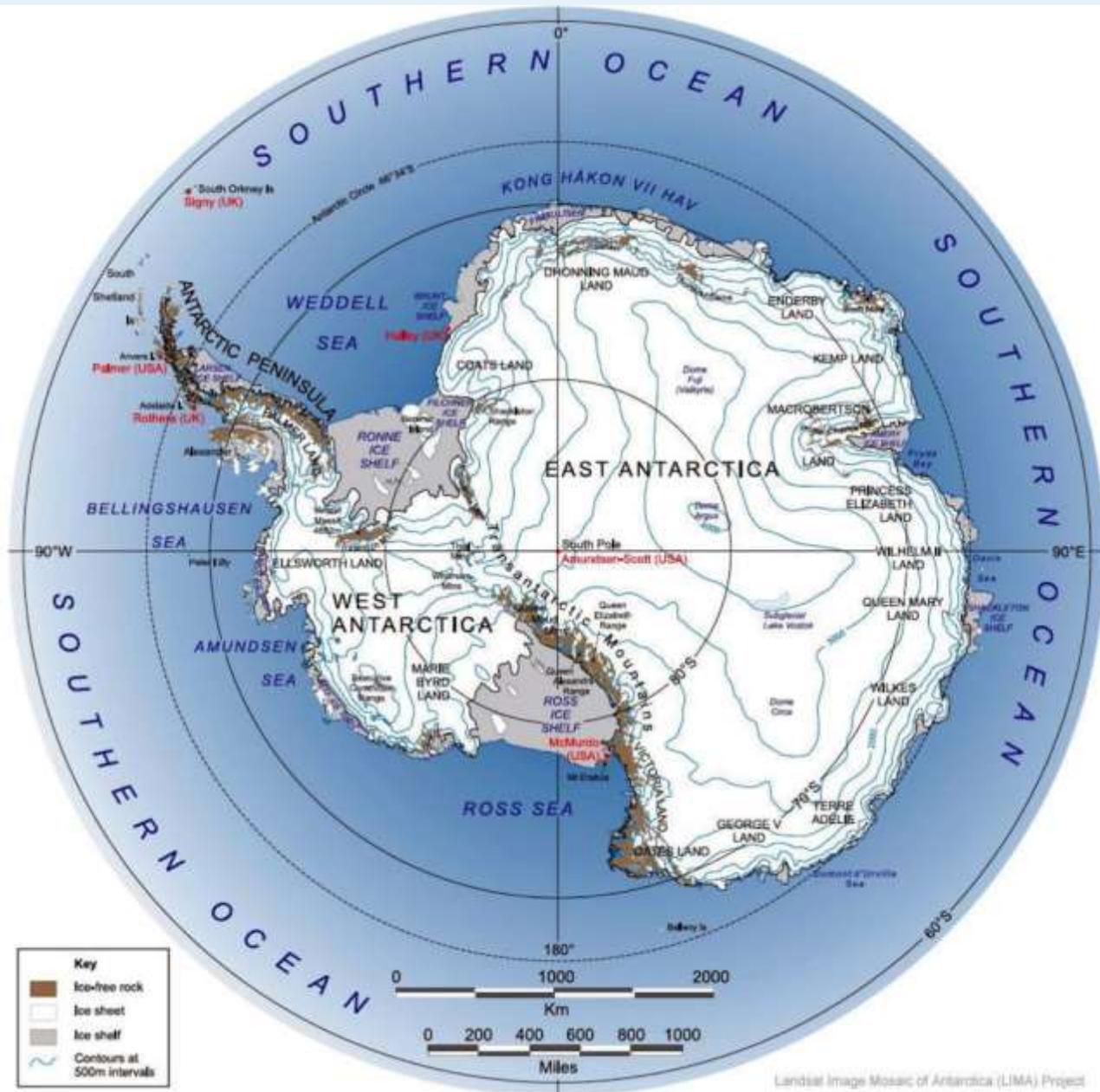


# Antarctic Ice Sheet

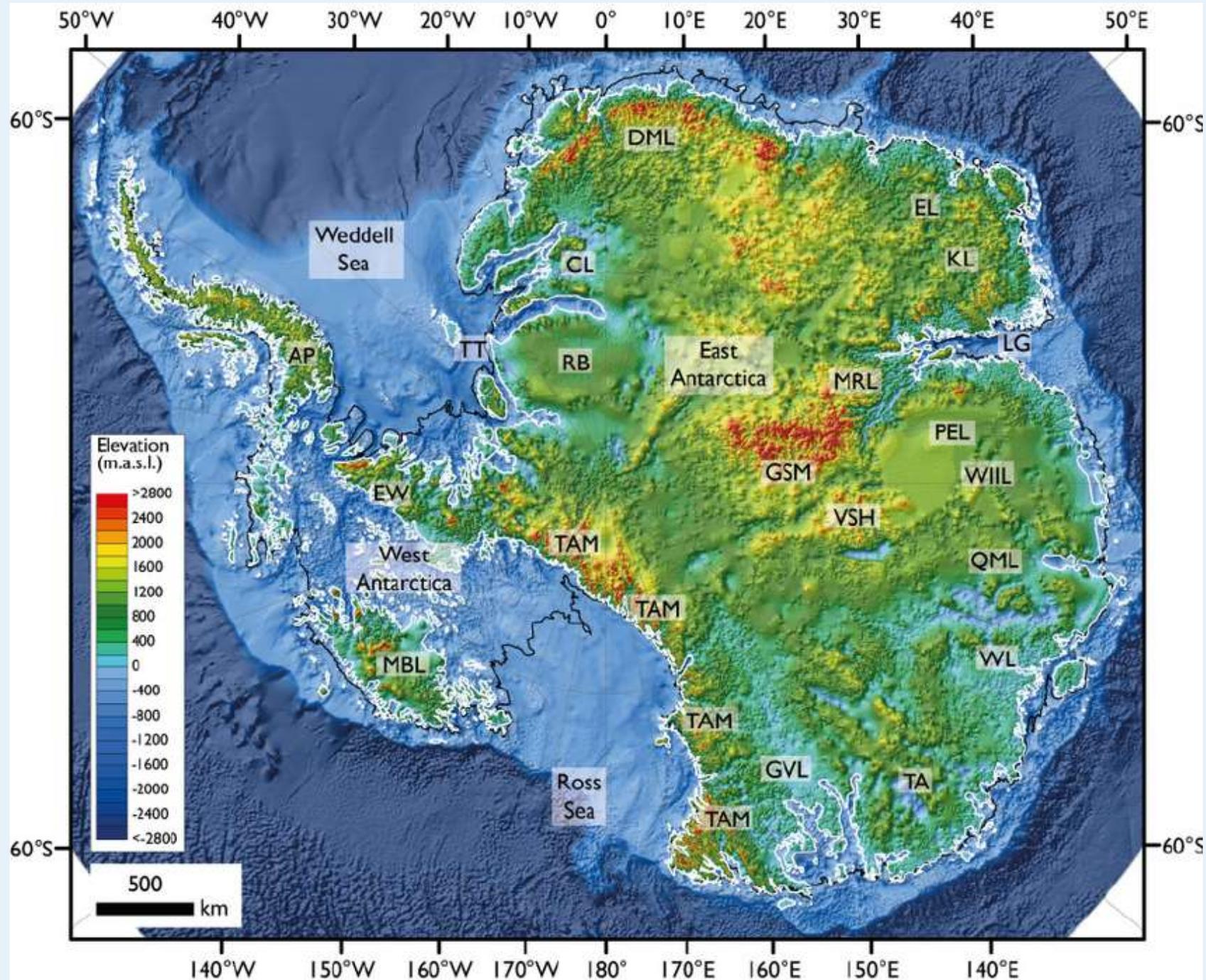
1. The world's largest ice sheet  
98% of the continent is covered by ice.
2. It spans 14 million km<sup>2</sup> and contains 25 million km<sup>3</sup> of ice, which could raise global sea levels by 58 meters.
3. The surface of the ice sheet rises to about 3000 meters above sea level in most places, exceeding 4000 meters in some areas, and descending to 1500 meters below sea level in West Antarctica.
4. In certain areas, the ice sheet is up to 4700 meters thick.
5. It consists of two parts: the West Antarctic Ice Sheet and the East Antarctic Ice Sheet.
6. The Antarctic ice sheet is drained by fast-flowing ice streams.



# Antarctic Topography

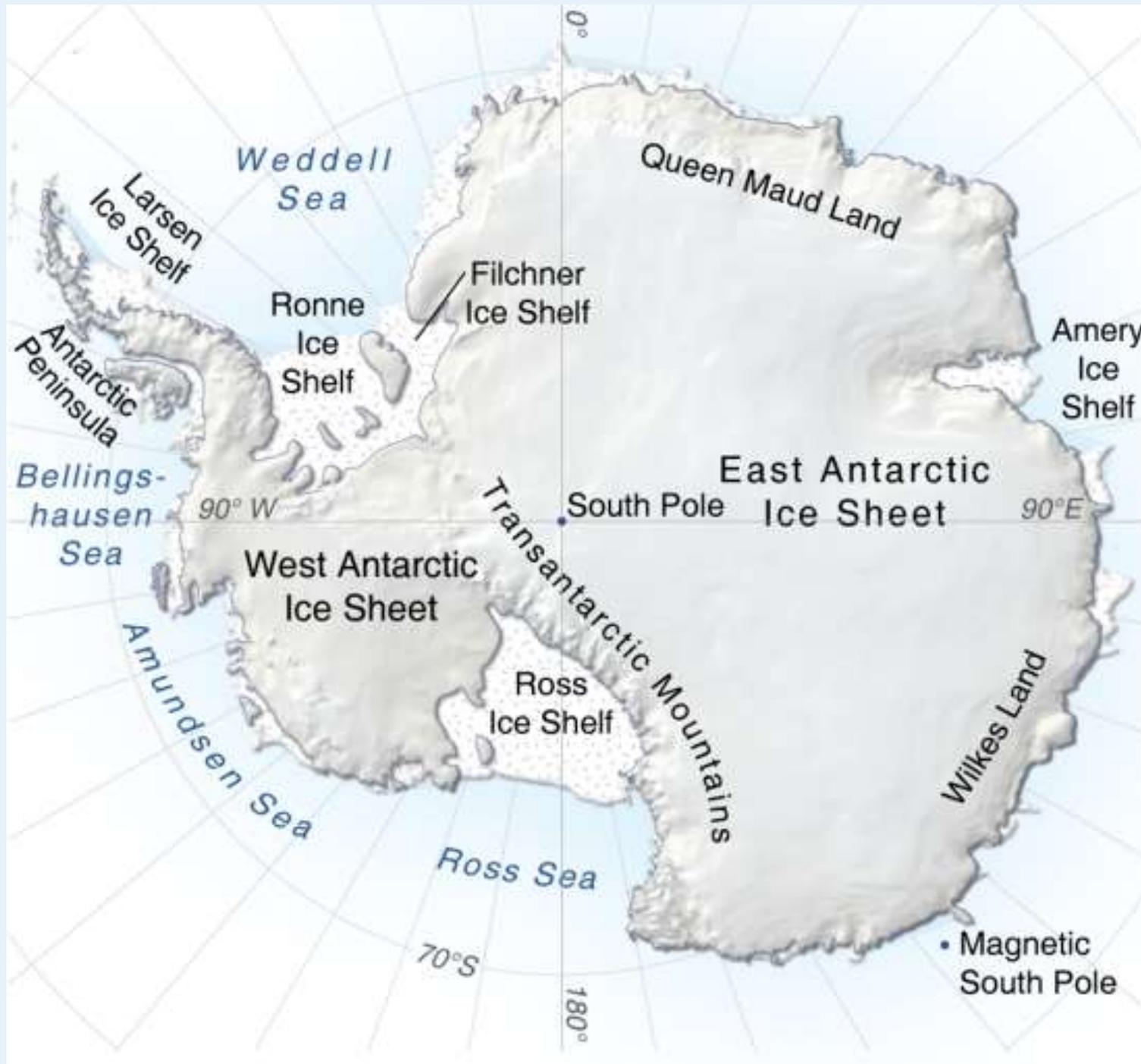


# "Subglacial Topography of Antarctica"



<https://tr.pinterest.com/pin/701576448183350580/>

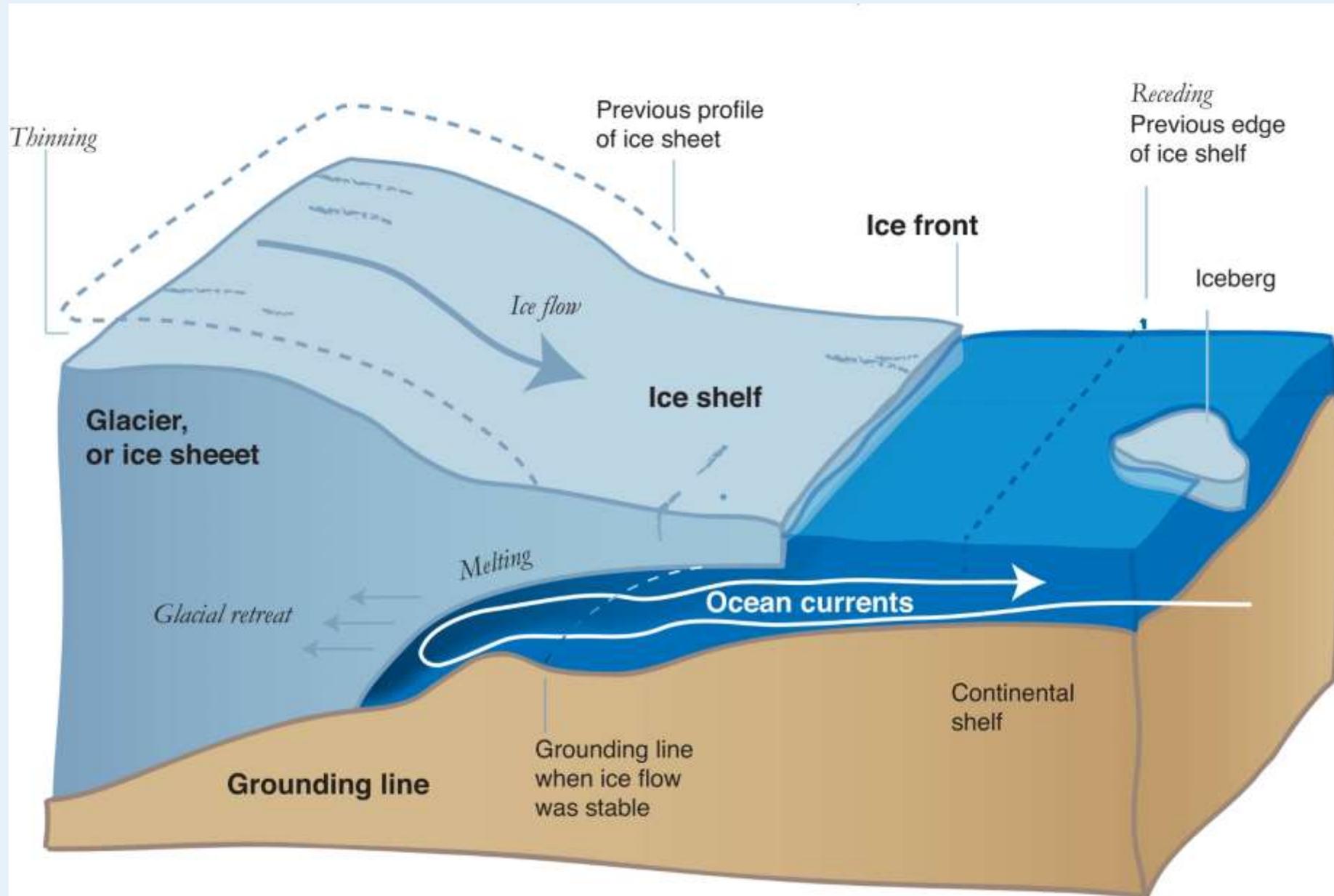
# Antarctic Ice Shelves



# Antarctic Ice Shelves

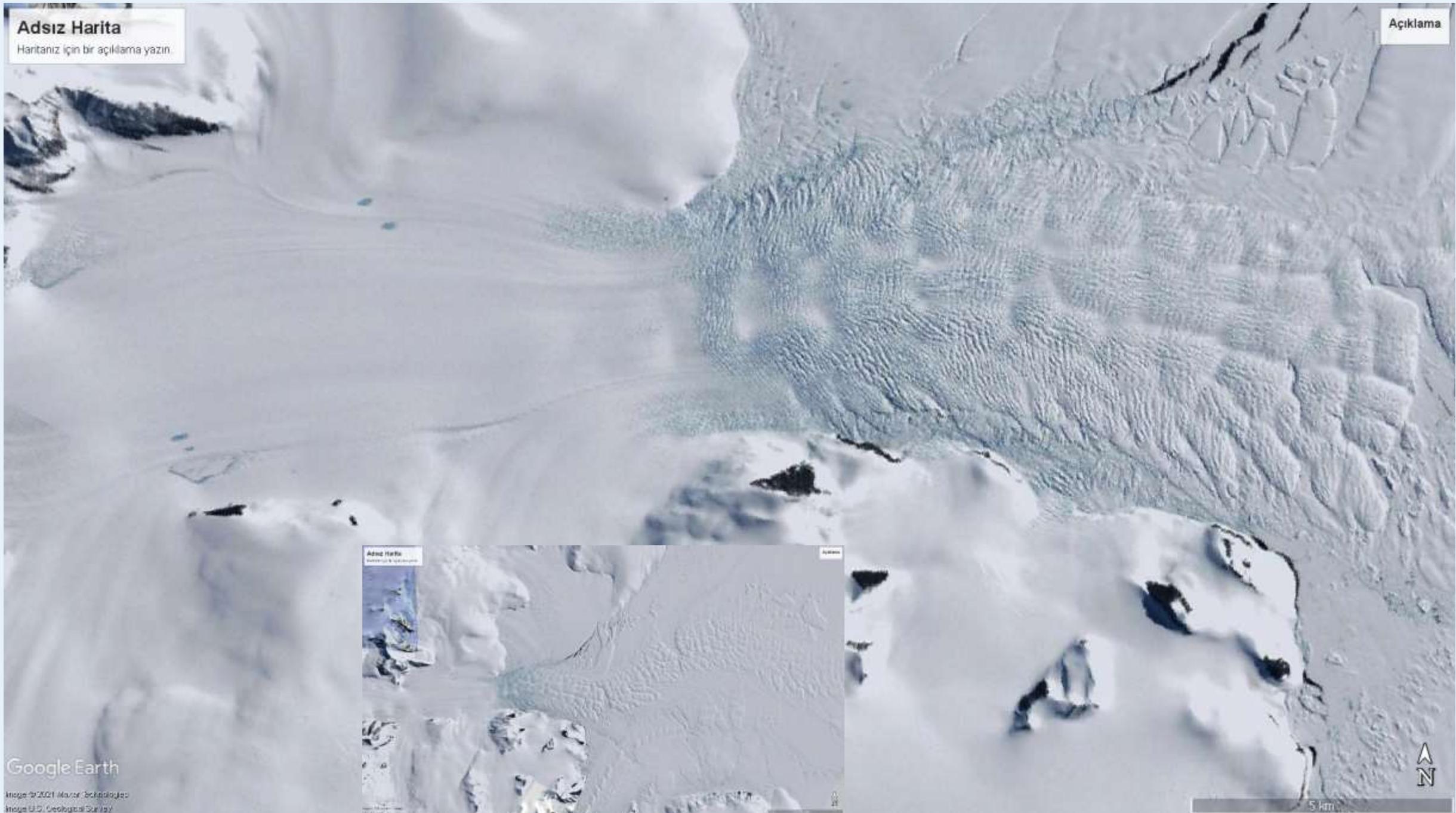
[https://www.youtube.com/watch?v=HW-BFwa193A&ab\\_channel=Shockwave](https://www.youtube.com/watch?v=HW-BFwa193A&ab_channel=Shockwave)

[https://www.youtube.com/watch?v=0QVVzFPChAU&ab\\_channel=NASAVideo](https://www.youtube.com/watch?v=0QVVzFPChAU&ab_channel=NASAVideo)

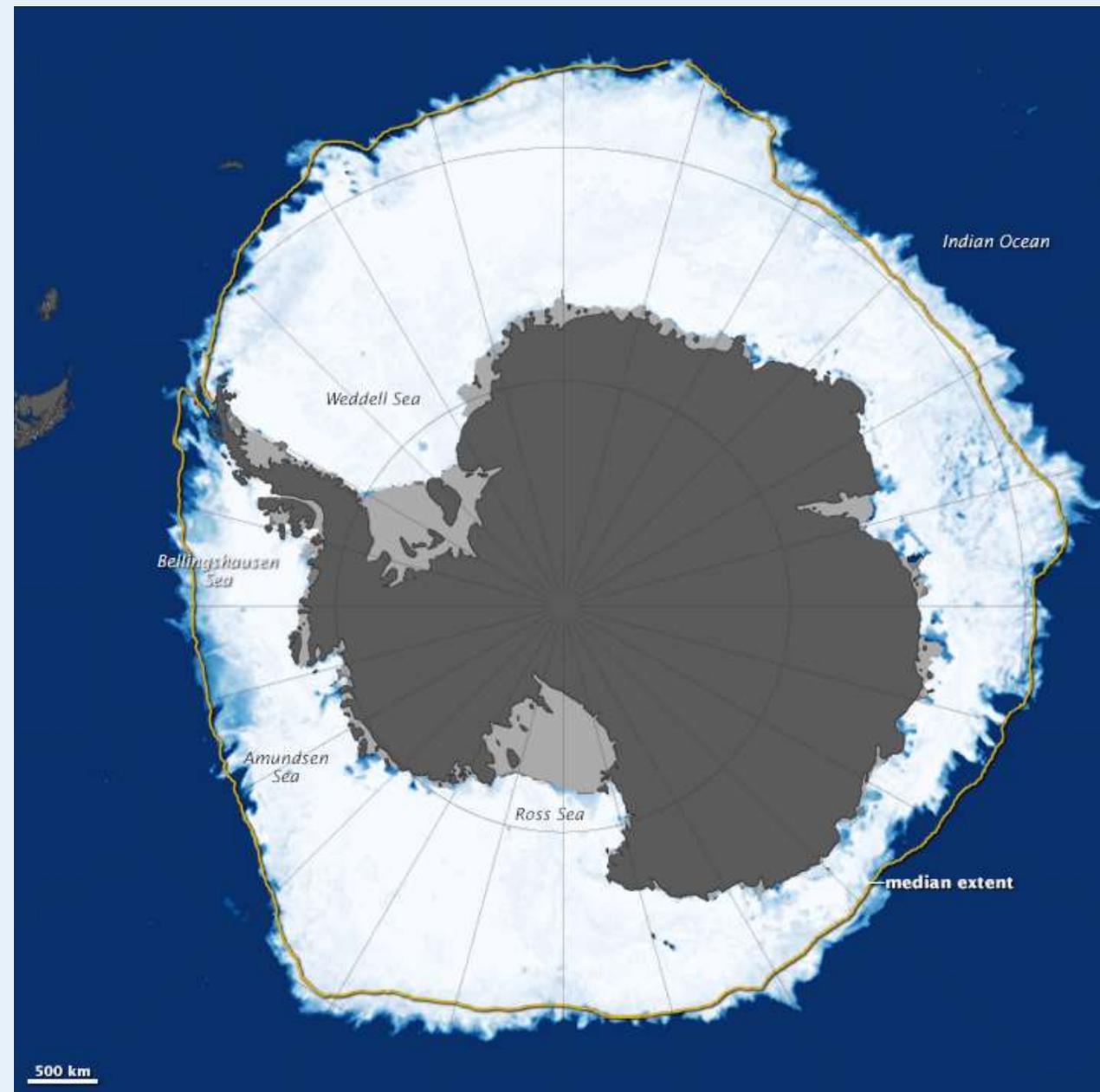


<https://nsidc.org/news-analyses/news-stories/paving-runway-runaway>

# Antarctic Ice Shelves



# Antarctic Sea Ice



<https://earthobservatory.nasa.gov/images/82160/antarctic-sea-ice-reaches-new-maximum-extent>

# Antarctic Sea Ice

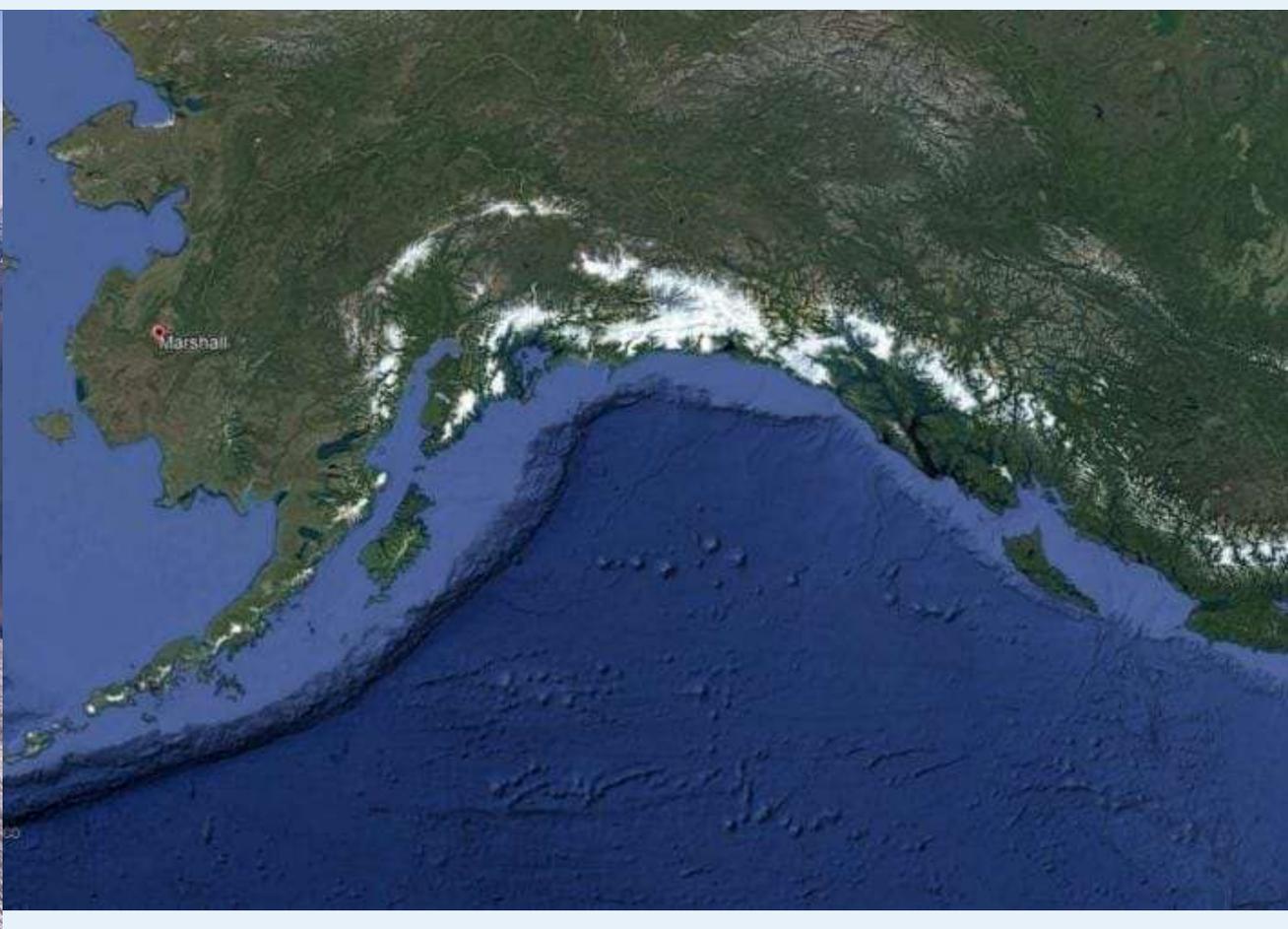


# Greenland Ice Sheet

1. It is the second largest ice mass in the world.
2. Covering 1.7 million km<sup>2</sup> and holding 2.8 million km<sup>3</sup> of ice, it has the potential to raise sea levels by 7.2 meters.
3. It covers 79% of Greenland's surface.
4. The surface of the ice sheet rises up to 3000 meters above sea level.



# Alaska Glaciers

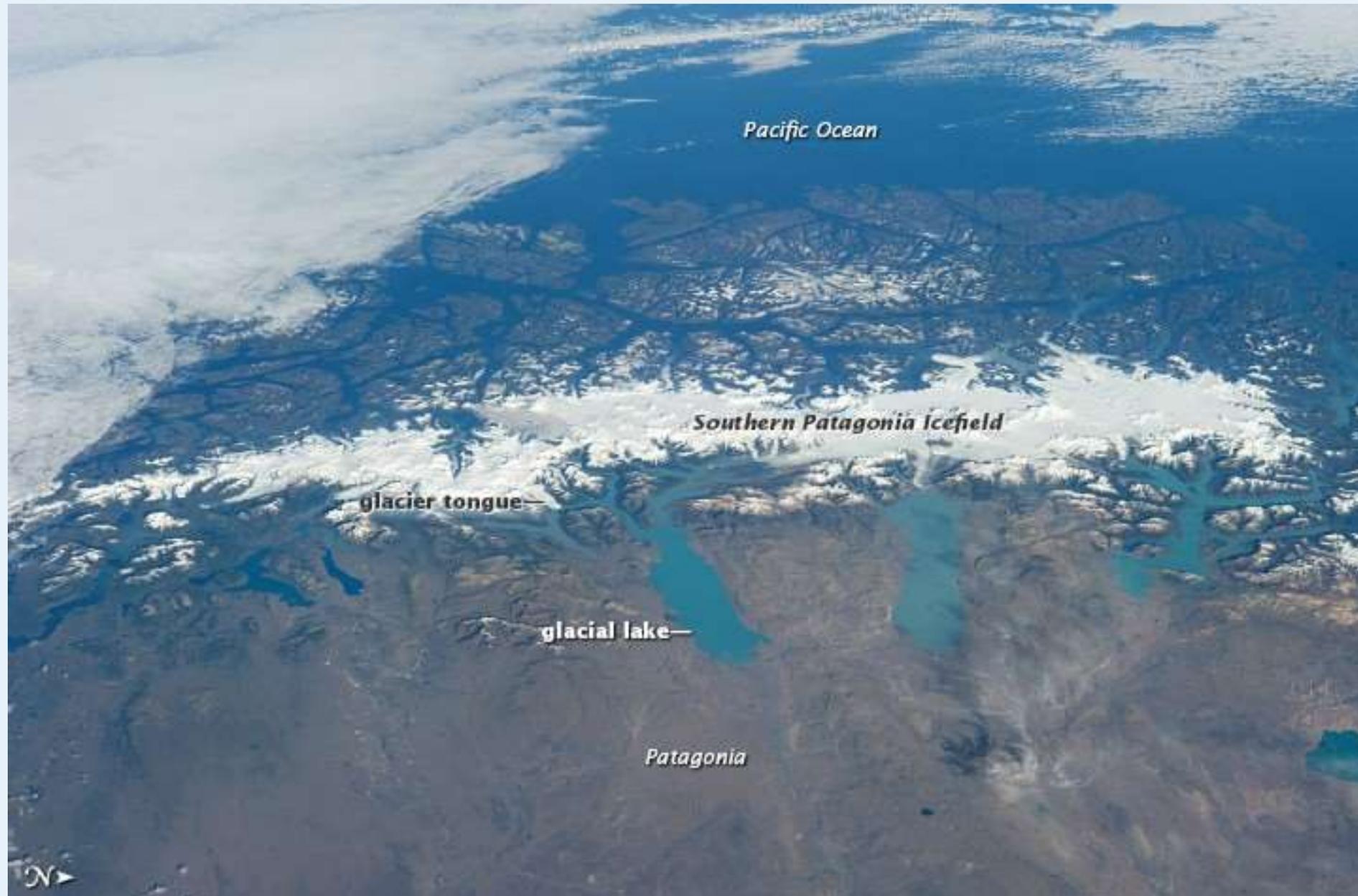


# Patagonia Glaciers

1. These are small ice caps located at the southern part of South America.
2. They are situated in the southern part of the Andes, between Chile and Argentina.
3. The ice caps are divided into two sections: northern and southern.



# Patagonia Glaciers



# Arctic Region



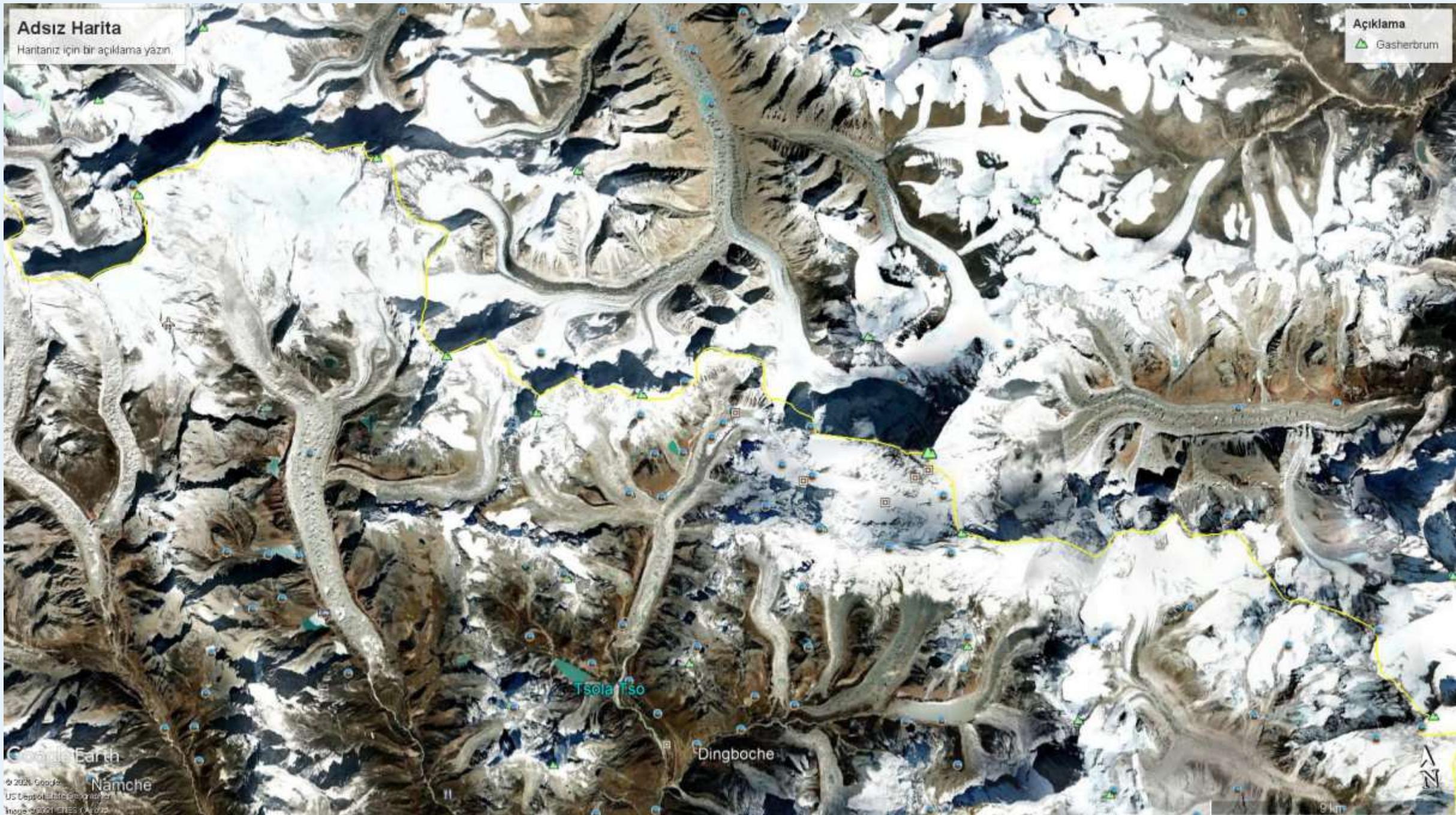
# Himalayas and Karakoram Mountains

<https://www.carbonbrief.org/animation-satellite-images-of-surging-glaciers-in-asia>

<https://youtu.be/Oum9XbtkgNg>



# Himalayas and Karakoram Mountains



# Himalayas and Karakoram Mountains



# Himalayas and Karakoram Mountains



Baltoro Glacier (62 km)



# Himalayas and Karakoram Mountains



# Himalayas and Karakoram Mountains

## Concordia, Baltoro



# Alps

