

Lecture 5 - Factors Controlling Glacier Extent

Glacier Classification

Locations of Glaciers

Total	14.9 million km ²
Antarctica	12.5 million km ²
Greenland	1.7 million km ²
Arctic islands	
Alps	2900 km ²
Scandinavia	3100
Alaska	74,700
Canada	25,000
Caucases	1800
Himalayas	33,000
S. America	36,000
New Zealand	1000
S-Cen. Asia	109,000
Africa	12
New Guinea	15

Factors Influencing Glacier Location

1) **Latitude**

high lat. = low angle sun, no sun in winter

2) **altitude**

thinned air less efficient at holding heat

These two combine to give global distribution - glaciers at sea level in the polar regions, above 4000 m elevation in tropics, i.e., Irian Jaya (Indonesia)

3) **Aspect**

important regionally, esp. in marginal areas or areas of high relief. Gives differential receipt of radiation (N, NE best for glaciers in NH), and precipitation (drifting on lee - east - side) - so many cirques are on N, NE, or E slopes

4) **Relief**

If too steep, glaciers can't form
Antarctica - controlled by edge of continental shelf

5) **Distance from moisture source**

Coastal is better - continental interiors are dry
Also, **rainshadow effect** where clouds must rise over mountains

Classification of Glaciers

Topographic Scheme

Unconstrained by Topography

Ice Sheets

Ice Caps

Both superimposed on underlying topography and bury it. Flow reflects size and shape of glacier not bed. Cut off between two about ~50,000 km²

Antarctic Ice Sheets

Greenland Ice Sheets

But - Penney Ice Cap, Patagonian Ice Cap

These have components -

Domes - symmetrical, in excess of 3000 m thick, doesn't always reflect bedrock high

outlet glaciers/ice streams - rapidly moving ice that drains about 75% of Antarctica and most of Greenland.

Outlet glaciers - partially confined - 700 km long Lambert GL.

Ice Streams - confined by slow moving ice - IceStream B

rest of ice sheets/caps are dominated by **sheet flow** - slow moving ice

Ice sheets and caps form where input cannot be compensated by flow out through troughs, so it overtops topography.

Constrained by Topography

Ice fields - high elevation area characterized by numerous interconnected small alpine glaciers - similar to ice cap but strongly constrained by topography - generally accumulation area for ice drained by valley glaciers - Juneau Icefield

Valley glaciers - rock valley, may be cliffed, commonly dendritic with tributaries, 10-30 km long, but can be >100 km long.

Fjord glaciers - valley glacier enters fjord - part submerged and pinned below sea level. Calves fast in deep water. In some cases called **tidewater** glaciers - more general - doesn't have to be a fjord

Piedmont glaciers - valley glacier leaves steep confined valleys and spreads out in lobes in lowlands - Malaspina Gl.

Cirque glaciers - occupies bowl usually with cliffed sides in side of mountain, may head a valley glacier, much drifting of snow and rapid turnover

Ice aprons - thin icy masses clinging to steep mountain sides

Other Means of Classification

Land-based vs. Marine-based

vast majority land-based, marine-based rest on land largely below sea level.

Marine ice sheets are believed to be unstable, rare today (only WAIS)

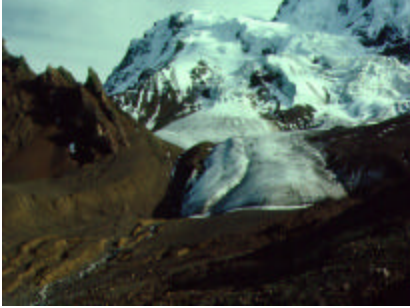
Warm/Wet or Cold/Frozen - ice temperature



Cirque glacier



Tidewater glacier (from T. Lowell)



Alpine glacier



*Piedmont lobe – Commonwealth
Glacier, Antarctica*