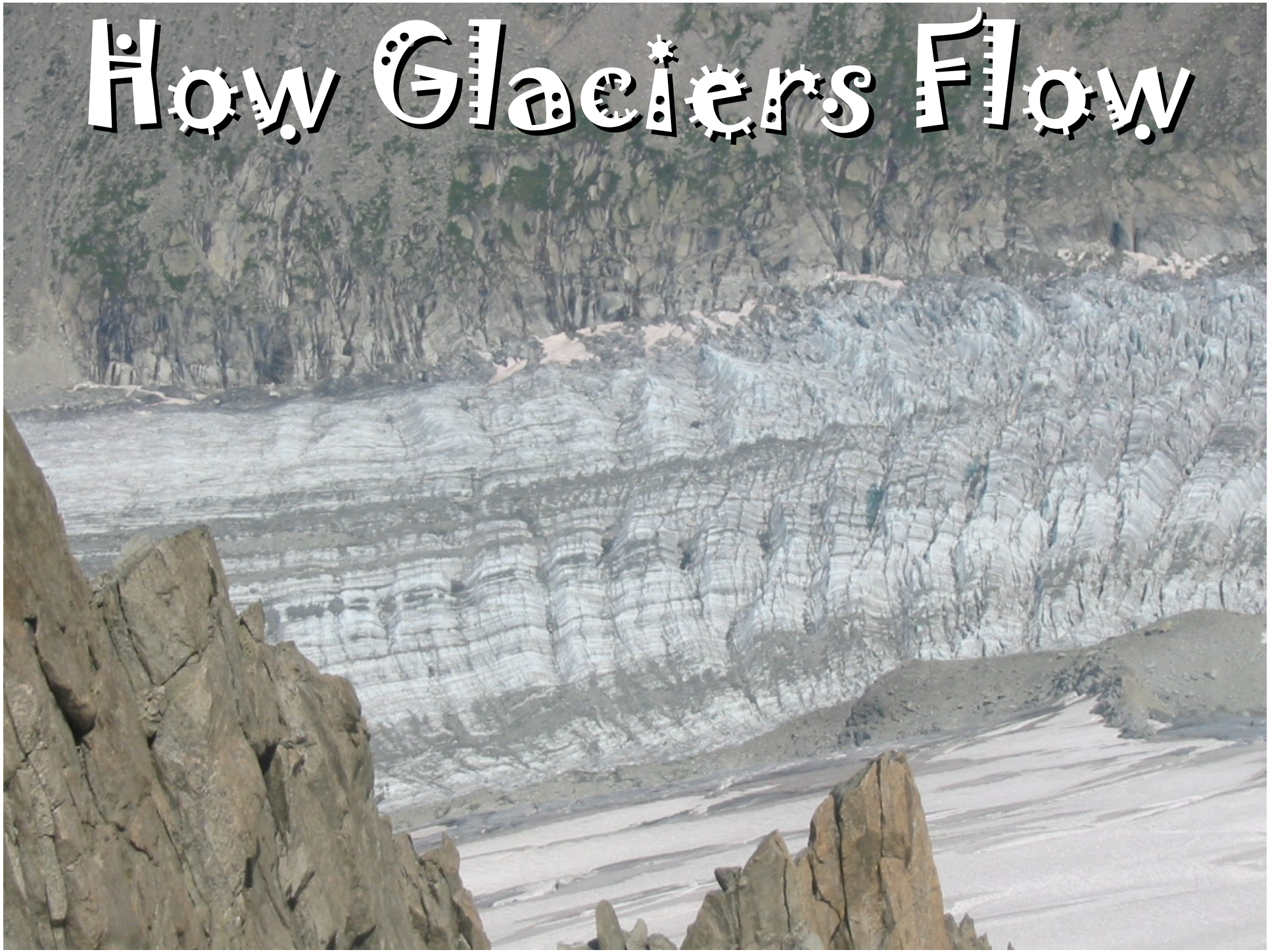
How Glaciers Flow



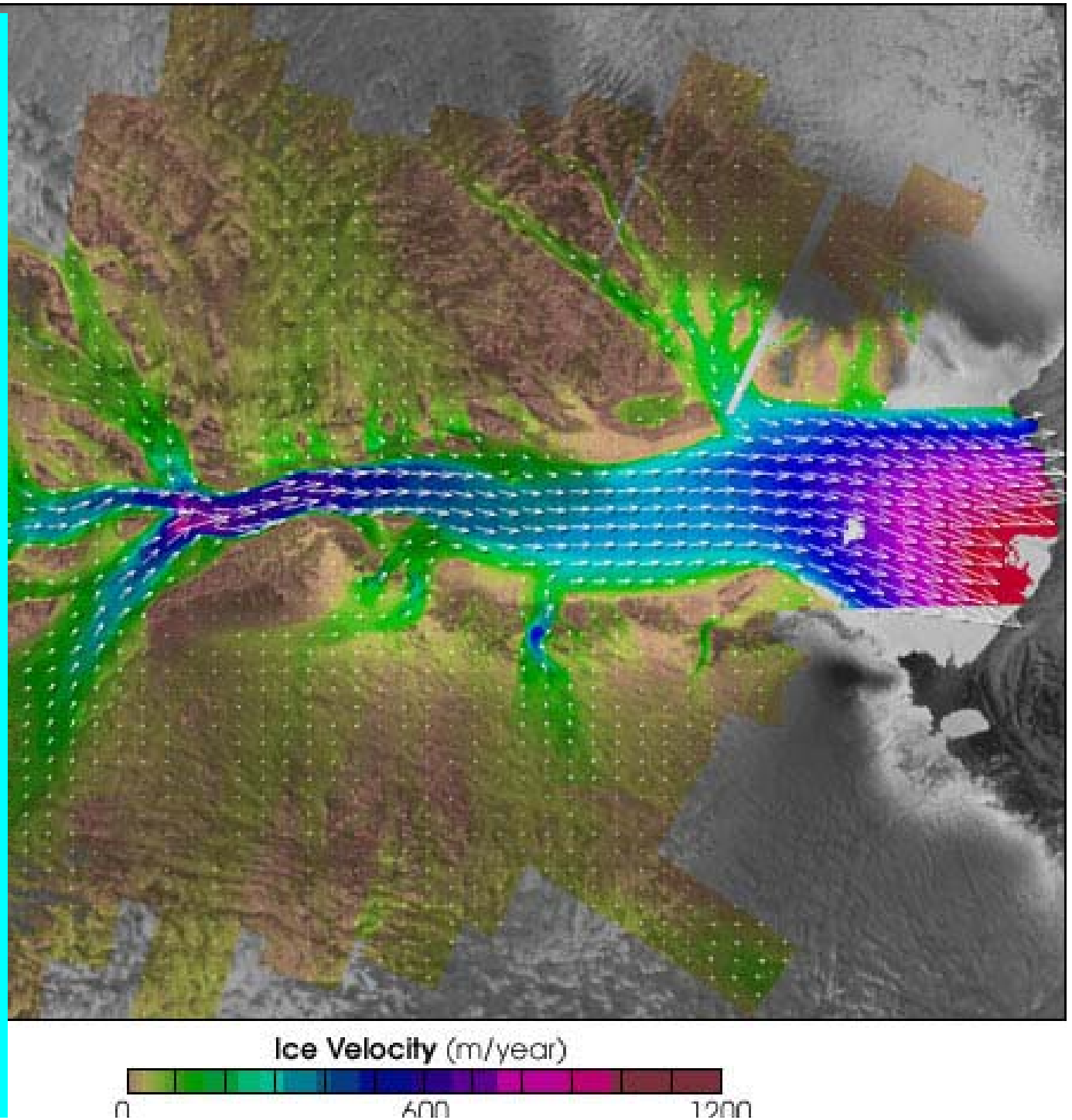
Processes of Movement

Creep – This is the gradual deformation of the ice of a cold (polar) glacier owing to internal pressure and accompanying intergranular motion.

Fracture – Internal compression or tension in glacial ice can cause it to fracture along fracture planes. The most obvious fractures occur close to the surface as crevasses.

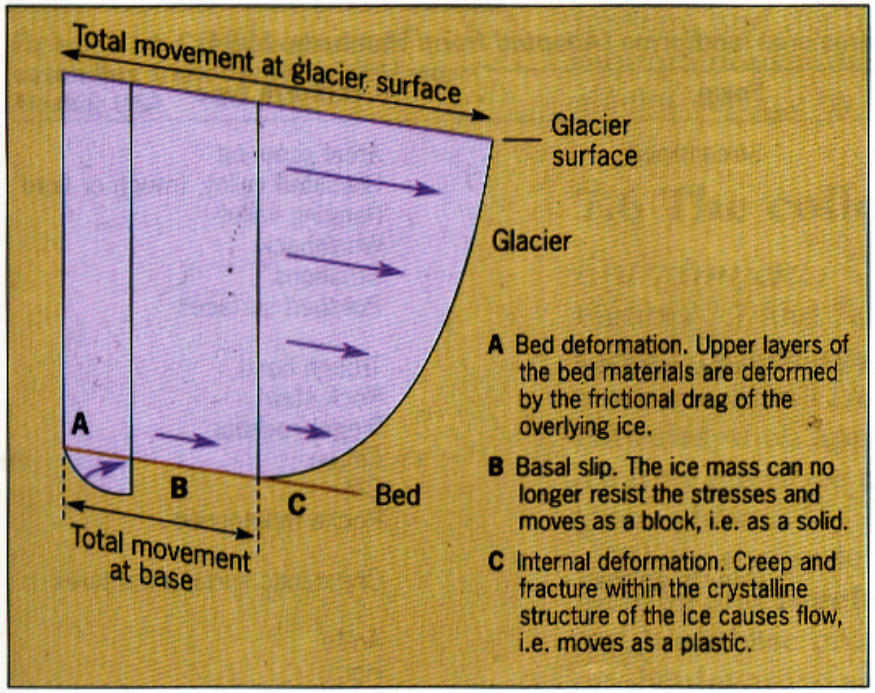
Basal Sliding/Slippage – the sliding movement of a warm (temperate) glacier over its rock floor. Plastic deformation takes place, resulting from the gradient of the slope and the weight of the ice. In a warm (temperate) glacier, the process of creep can be enhanced at the base of a glacier due to **pressure melting**. Meltwater at the base of the glacier can act as a lubricant and reduces friction.

This image shows the movement of the Lambert Glacier in Antarctica. Yellow represents the areas of no motion, which are either exposed land or stationary ice. The smaller tributary glaciers have generally low velocities, shown in green, of 100-300 meters per year, which gradually increase as they flow down the rapidly changing continental slope into the upper reaches of the faster flowing Lambert Glacier.

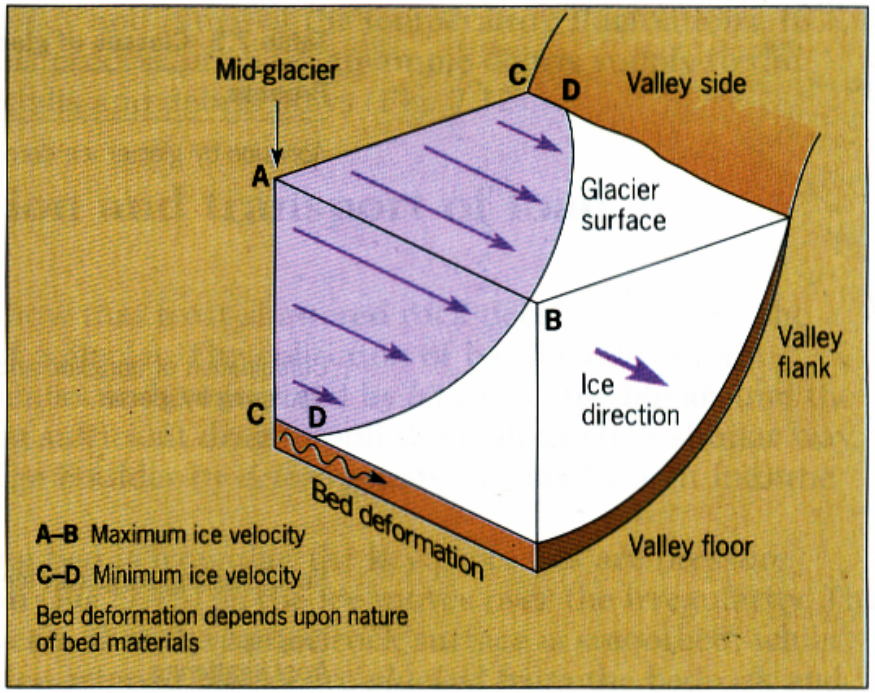


The Mechanism of Flow

Ice Velocity



Components of ice movement



Ice velocity within a glacier

There are three components shown:

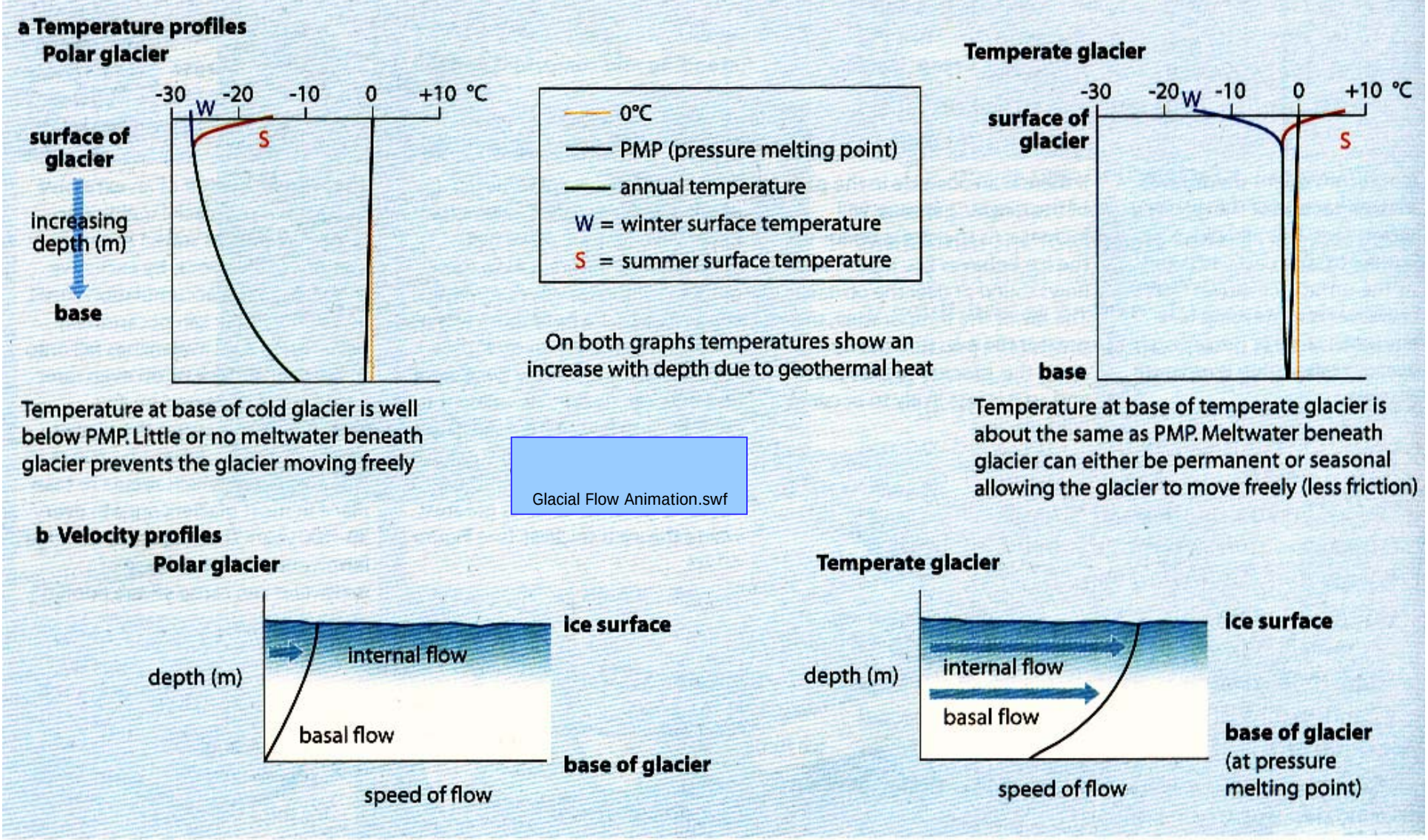
Basal sliding

Internal deformation

Bed deformation

Velocity increases with distance from the bed rock as frictional drag is lower. In a valley glacier, maximum velocity is achieved in the central and upper layers.

A Comparison of Temperature and Velocity Profiles in Polar (cold) and Temperate (warm) Glaciers.

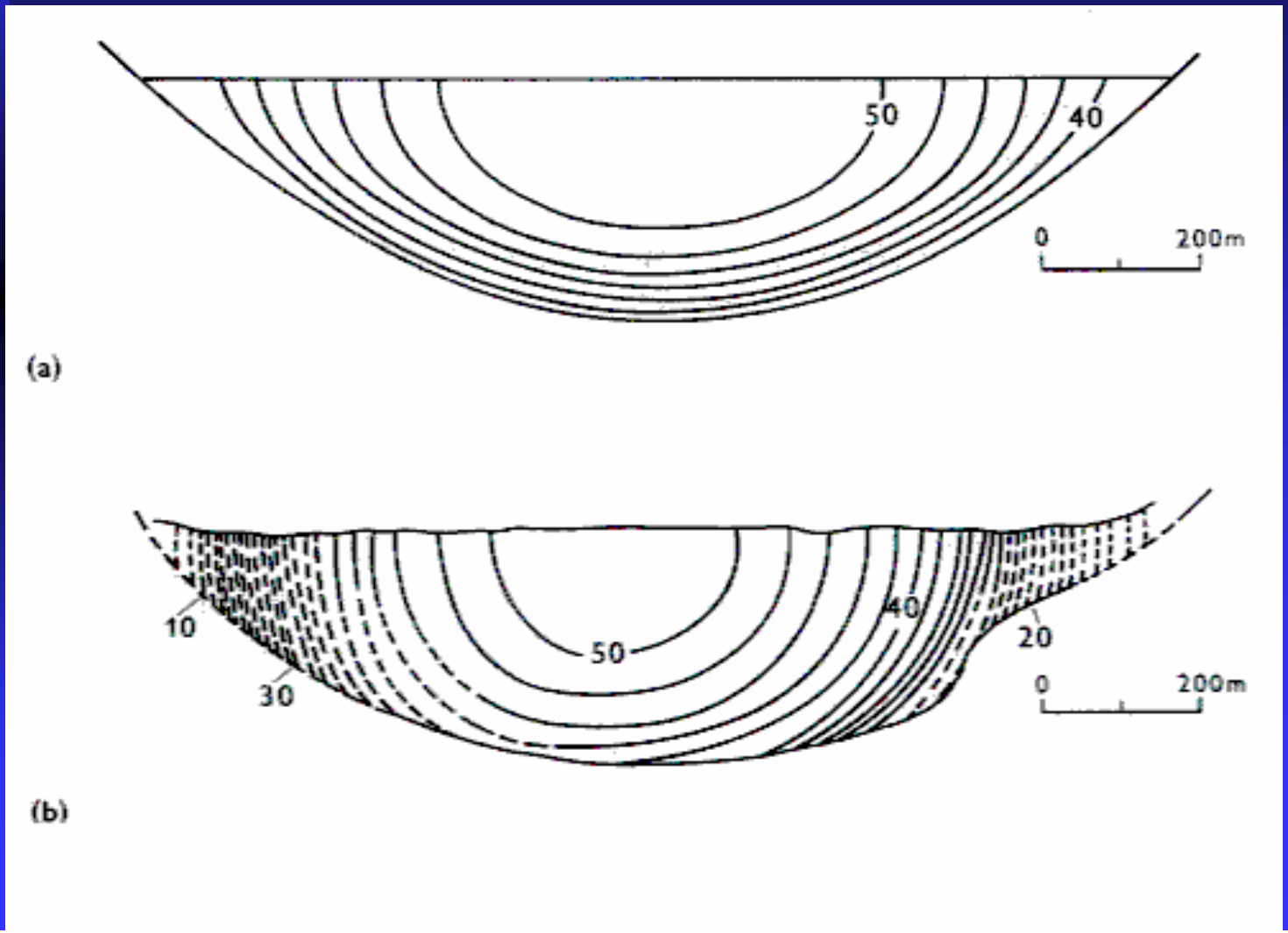


The distribution of velocity in a glacial channels.

(a) A glacier with no basal slip - a cold or polar glacier

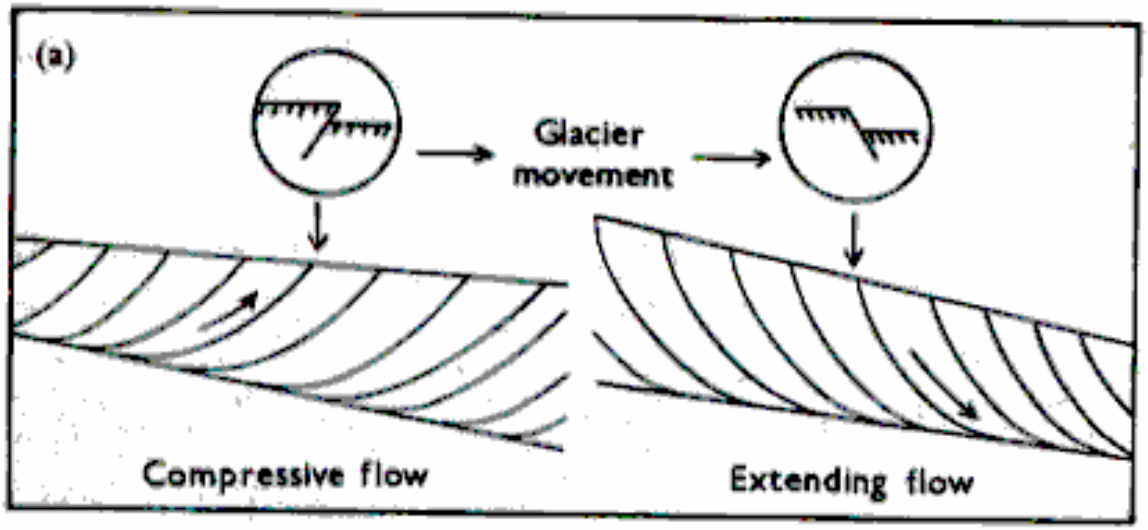
(b) The Athabasca glacier (with basal slip) – a warm (temperate) glacier.

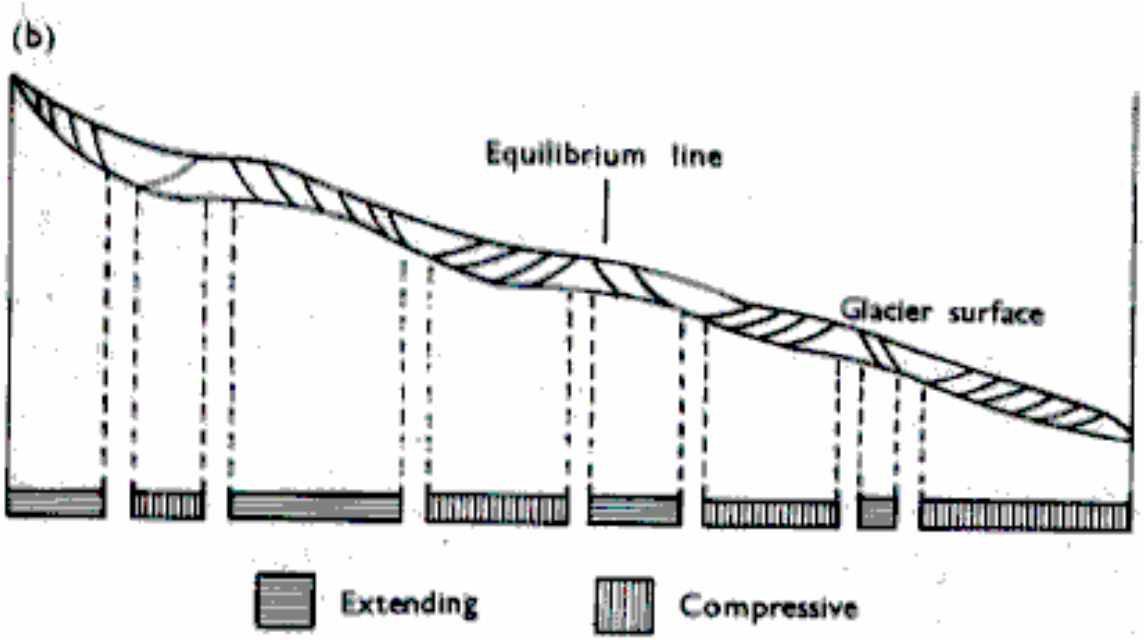
"isovels" are in metres per year.



Ogives and medial moraines

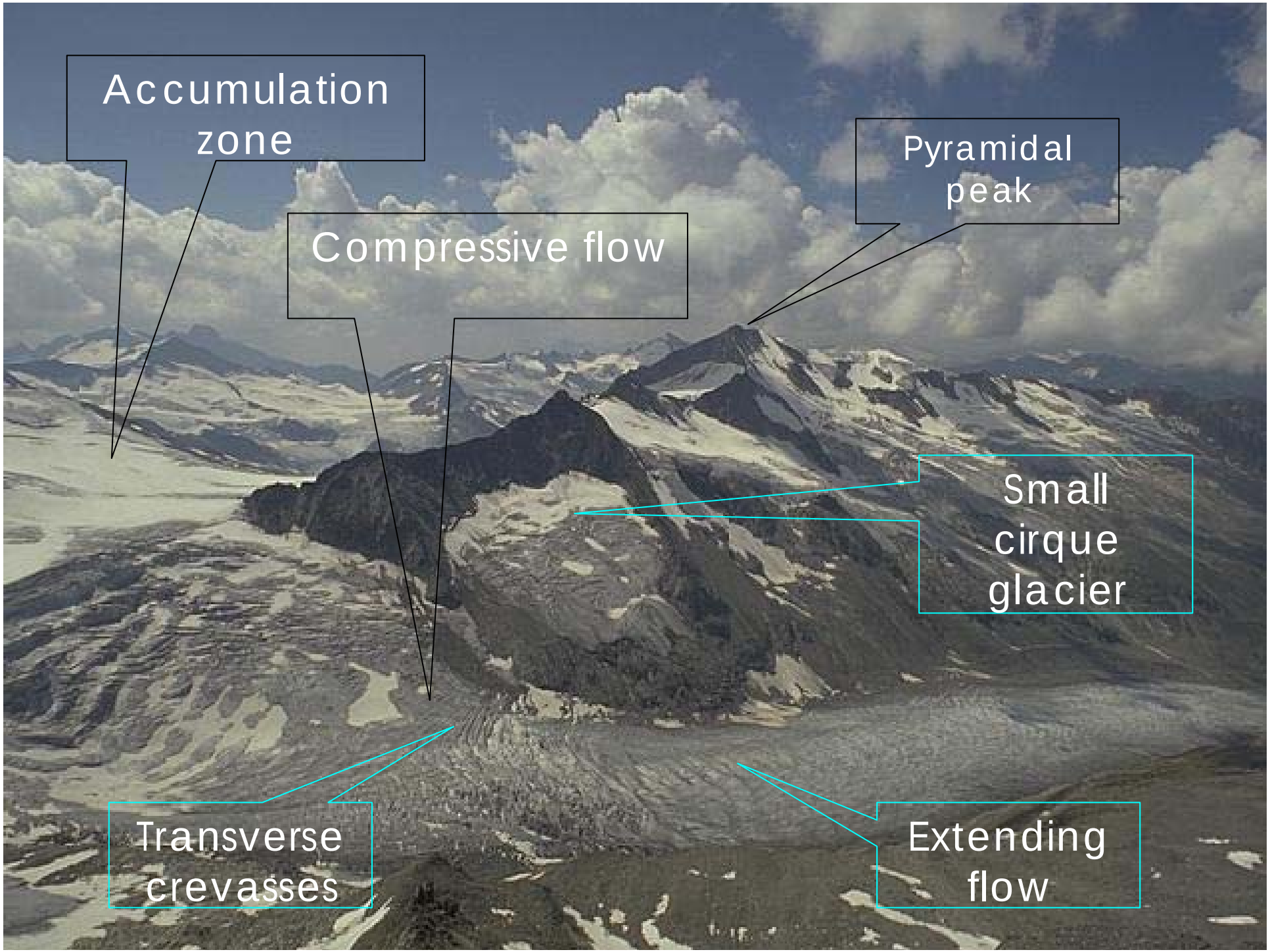
This photograph of the Gilkey Glacier, Alaska shows a series of ogives (the wave-like features running from right to left) and medial moraines. The ogives are associated with ice flow down icefalls, with one ridge and depression corresponding to one year's ice flow. The medial moraines mark the boundaries of converging streams of ice.





(a) Compressive and extending flow and associated slip lines.

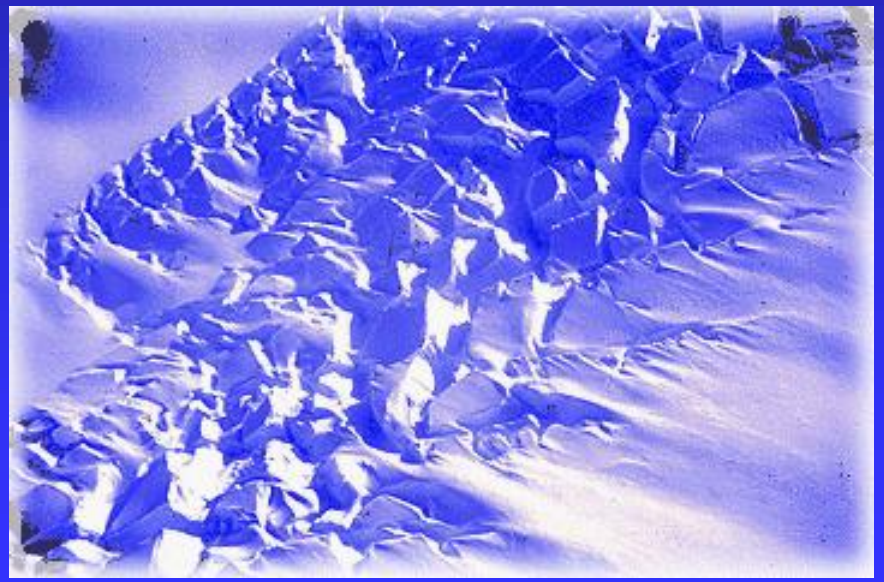
(b) The distribution of compressive and extending flow on an idealised glacier.


Accumulation zone
Pyramidal peak
Compressive flow
Small cirque glacier
Transverse crevasses
Extending flow

The surface (marginal) crevasses of a glacier.


Crevasses.swf

Crevasses in the ice are a hazard for field parties trekking over ice.



A crevasse into which rock debris is falling from the glacier's surface

Black lines of debris mark the shear planes within the ice of a glacier snout.