

Basal motion



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The motion of glaciers, which is essentially the motion of ice down the slopes due to gravity, can be due to two mechanisms: internal deformation of the ice due to high pressure exerted by the ice layers above and; basal sliding of the ice along the ground (Glaciers Overview 3).

Basal sliding means that the glaciers move by sliding along the landscape at their base. This happens because when the temperatures are warmer, the bases of the glaciers thaw, which creates a thin water film. This causes the glaciers to slide along their bases.

This type of motion usually happens with temperate glaciers which form at comparatively warmer temperatures. The motion of glaciers due to basal sliding is faster than those that are frozen at their bases, which can slide only due to internal deformations (Glaciers Overview 3) The fast moving glaciers are categorized into surging glaciers and tidewater glaciers depending on the way they flow. Surging glaciers follow a cycle of high speed ice flow, followed by low speed ice flow. The high speed cycle extends from a month to a couple of years, which the low speed cycle continues till a couple of decades (Background 6).

Tidewater glaciers are the glaciers which end in the sea with a grounded ice-cliff from which icebergs are discharged. These mostly occur in the comparatively warmer oceanic regions (Viel 10) The dynamics of both these types of glaciers is attributed to basal motion. This has been proved by multiple case studies done by scientists on different glaciers of each type. Some of these are as below: 1. Variegated glacier - This is a surge type of glacier in Alaska. The study of its dynamics was done by Humphrey and

Raymond, who collected the data related to its erosion and sediment deposits.

They found that the glacial sliding power per unit bed area was a product of the sliding velocity and the basal shearstress. While this simple formula is still to be found true in case of other glaciers, the relation between the glacial slide and basal motion cannot be ignored n(Hallet & Anderson 6) 2.

Trapridge glacier - This is again a surge type glacier located in Yukon Territory in Canada. The movement of this glacier is also attributed to basal sliding. A study of the glacier shows a thin permeable layer below the glacier (Flowers & Clarke 4). Many research projects were carried out to study the glacier.

One of the researchers Clarke in 1976 proposed that the motion of the glacier was due to basal ice sliding, and the idea was further strengthened by Fowler who in 2001 proposed a mathematical formulation based on the same idea (Frappe 9) 3. Hubbard Glacier - This is the largest temperate tidewater glacier. It is located in Alaska (Motyka & Truffel 1). The movement of this glacier into the sea has been a part of extensive research studies. A measurement of the surface ice velocity was taken and compared with the ice thickness. The results showed that the motion was due to basal sliding (Motyka & Truffel 12) 4.

Columbia Glacier - This is a retreating tidewater type glacier located in south-central costal Alaska. A study of the motion of this glacier showed a large distance of travel combined with short period speed variations, both of which are characteristic of basal motion. And hence it was concluded that the motion of the glacier is predominantly due to basal sliding (O'Neel Pfeffer

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