

Lecture 8: Basal Thermal Conditions

GES-441

Pressure Melting Point - point at which a substance (ice) melts under pressure.

At sea level = 0 C

Under 1500 m of ice = -1 C

Heat is generated at the bed by geothermal heat and friction.

A **temperate** glacier is one that is at the pressure melting point (PMP) throughout

A **polar** glacier is below the pressure melting point

Temperate glaciers are **wet-based**, meaning there is water at the bed. However, not all wet-based glaciers are temperate. Even a cold glacier can have local patches of wet conditions at the bed due to fast ice flow, thick ice, or high geothermal heat. In general, however, polar glaciers are **cold-based** or frozen to their beds.

In a temperate glacier, ice is at the PMP throughout. As the PMP decreases with depth, this results in a negative temperature gradient - ice is warmer near the surface than at the bed. Heat generated at the bed cannot escape up through the ice because of this negative gradient. So, it is used at the bed to melt ice and produce water.

In polar glaciers heat can be conducted away from the bed as the temperature at the bed is higher than that at the surface.

Spatial Variations

Ice sheets have both wet and frozen zones. There are also transition zones of wet-melting and wet-freezing. Thermal zones under the ice sheet ultimately are responsible for determining the processes, such as erosion and deposition, that happen at the bed.