Long-term climate and permafrost monitoring in the Canadian Cordillera

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Since 1974, long-term air and ground temperatures have been measured at a network of eight sites between Plateau Mountain (50° 15' N, 114° 31 W) and MacMillan Pass (63° 10' N, 135° 23' W) in the Canadian Cordillera. The boreholes range from 2.5 to 30 m deep. In addition, air temperature is monitored continuously at six other sites in the Cordillera and one site (Galena Creek rock glacier) in Wyoming. Early monitoring used three-level soil temperature recorders for air, and thermistor cables for ground temperatures. Since 1992, most air temperatures are obtained by using thermistors and data loggers.

None of the data collected so far show increasing mean annual air temperatures. Instead, a decrease of 0.6 to 1.6°C has been encountered at the two sites with a record exceeding 20 years. This agrees with the persistence of permafrost at all sites. Where changes in hydrology occur at peat plateau, palsa or lithalsa sites, the location and temperature of the permafrost may change. Better drainage causes more extensive and colder permafrost, while poor drainage causes thawing and redevelopment where the drainage and topography are suitable. Drainage changes are usually induced by beavers or Man.

Where melting snow descends a steeper slope and pools at its base, it can cause much deeper active layers and even temporary perforation of the permafrost. Both peat and large angular blocks provide conditions for colder ground temperatures than in neighbouring soils and rocks. Hence rock glaciers can be active below the regional lower limit of permafrost.