

## A "HYDRO-THERMAL" INSTABILITY THEORY OF GLACIER SURGES (ABSTRACT)

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Glacier surge is a catastrophic glacier advance which can't be explained by variation in climate. We propose a "hydro-thermal instability" model which is capable of explaining surges of an inversion type glacier. An inversion type glacier has a cold ice zone in its lower part which is mainly frozen to the bed rock and a temperate snow zone in its higher part into which meltwater percolates in summer. This glacier is in a potentially unstable condition, since the movement of ice and water is dammed by the lower cold ice bank. If this bank is fractured by thrust faults, dammed water drains through the faults and warms the bank temperature to the melting point. Then a catastrophic advance (the surge) will occur. Here we determined the climate condition in which such an inversion type glacier can exist, *i.e.*, the freezing index during winter is more than 2000 ( $^{\circ}\text{C}$  day) and annual precipitation exceeds 700 (mm water) at the snow line of a glacier. Many surging glaciers fit the climatic condition for the inversion type. The ice sheets of Greenland and Laurentide are estimated to be in similar unstable condition. Their surges would cause rapid sea level rise and may stop deep water production in the North Atlantic Ocean.

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