

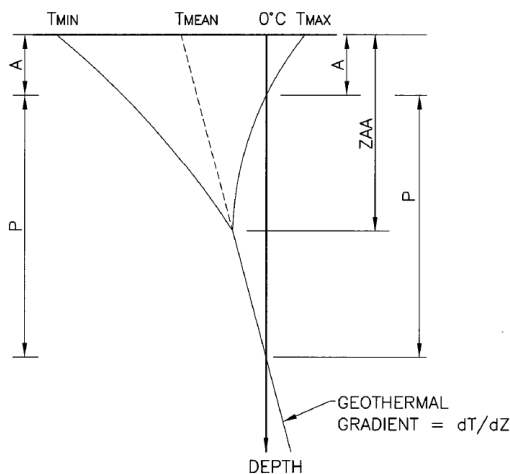
SIO 115 Homework 4 (due Friday 10 February): Permafrost

Please write your answers on a separate sheet with your name clearly written at the top. Please use plenty of space for your working. You will be graded on your writing style as well as the content of your answer. The marks for each answer are in parentheses. Please make it clear which question part your answer is for (i.e. maintain the numbering from the questions themselves).

- 1. Permafrost.** (a) What are the three main types of permafrost zones found in the northern hemisphere? [3]
(b) What are the following: (i) talik; (ii) thermokarst; (iii) yedoma? [3]
(c) What is the “active layer” and what factors govern its thickness? [2]
(d) What are the implications of thawing of permafrost on global climate? [2]
(e) Once a thermokarst lake starts to form, what are the processes that accelerate the thawing of permafrost? [2]

2. Permafrost temperature profiles. The figure shows a generic “trumpet plot” which shows the annual extremes of T-profiles taken at various depths a location where permafrost exists.

- (a) Why do the T-profiles change shape throughout the year? [2]



Abbreviations

- A Depth of active layer
P Depth of permafrost
ZAA Depth of zero annual amplitude

- (b) How do you obtain the depth of the active layer from this plot? [1]
(c) How do you obtain the depth of the permafrost from this plot? [1]
(d) How might you expect the shape of these plots to change as surface temperatures rise? [2]

3. Permafrost monitoring. (a) Why is monitoring permafrost challenging from a satellite-based instrument? [2]

- (b) What remote sensing instruments exist to monitor permafrost at present? [2]

(c) What would be the ideal instrument if it existed? (See NSIDC website for some ideas <https://nsidc.org/cryosphere/frozenground/studying.html>), pages 98-99 of Duguay 2005 PDF on webpage, and the YouTube video we watched in class [2]