**ESS 431 PRINCIPLES OF GLACIOLOGY**

**ESS 505 THE CRYOSPHERE**

**Lecture 12 – Glacier Instabilities**

*Due Monday, November 4 2019, at start of class*

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| Kamb, B., C. F. Raymond, W. D. Harrison, H. Engelhardt, K. A. Echelmeyer, N. Humphrey, M. M. Brugman, and T. Pfeffer (1985). Glacier Surge Mechanism: 1982-1983 Surge of Variegated Glacier, Alaska. *Science* 227(4686), 469–479.  Joughin, I. and R. B. Alley (2011). Stability of the West Antarctic ice sheet in warming world. *Nature Geoscience* 4, 506–513.  Schoof, C. (2007). Ice sheet grounding line dynamics: Steady states, stability, and hysteresis. *Journal of Geophysical Research* 112(F03S28), doi: 10.1029/2006JF000664. *(optional)* |

1. Do all glaciers revert to stable configurations? Give an example or counter-example.
2. Approximately how fast were the lower reaches of Variegated Glacier moving in the two weeks centered on June 15, 1983?
3. Describe two observations that suggested that the high speeds were due to very fast sliding.
4. What did the dye-tracing measurements suggest about the basal water system during and after the surge?
5. Why did the surge end so abruptly?
6. Explain in prose and draw a schematic input and discharge ice flux diagram for the marine ice-sheet instability process for a 2D profile of an ice sheet. Do marine ice sheets have neutral equilibria?