**ESS 431 PRINCIPLES OF GLACIOLOGY**

**ESS 505 THE CRYOSPHERE**

**Lecture 10 – Glacier Variations and Climate**

*Due Monday, October 29 2018, at start of class*

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| Harper, J.T., 1993. Glacier Terminus Fluctuations on Mount Baker, Washington, U.S.A., 1940-1990, and Climatic Variations. Arctic and Alpine Research 25(4), 332–340.  Roe, G.H., and O’Neal, M.A., 2009. The response of glaciers to intrinsic climate variability: observations and models of late-Holocene variations in the Pacfic Northwest. Journal of Glaciology 55(193), 839–854.  Oerlemans, J., 2005. Extracting a Climate Signal from 169 Glacier Records. Science 308(5722), 675–677, doi: 10.1126/science.1107046.  Gerard, R. H., Baker, M. B., and Herla, F., 2016. Centennial glacier retreat as categorical evidence of regional climate change. Nature Geoscience 10, 95–99, doi: 10.1038/ngeo2863. |

1. Here are two more length records from the Pacific Northwest – Blue Glacier in the Olympics and South Cascade Glacier in the North Cascades (look up their locations on Google earth). Based on the reading, what are two possible reasons that only one re-advanced in the 1970s?



1. What is the simple metric for glacier response time, and what are typical values?
2. Based on the response time formula, what are two reasons we might expect glaciers on Mt. Baker to have short response times?
3. Name at least three challenges for attributing glacier changes to climate changes.
4. In their paper, Roe et al. (2016) are looking at whether or not observed glacial retreat could be a result of randomness in the system, or if it is statistically improbable without some global climate forcing. Don’t get too bogged down in the math – simply explain the yellow curves and purple boxes in figure 4, and what intuition that provides about the statistical likelihood of observing modern glacier behavior without the influence of a global climate change.