ESCI 1010 Lab 10
Climate Controls, Variability and Change

Before Lab: Review pages 418-478 in your Weather and Climate textbook. Pay special attention to the sections entitled "Climate Controls: A Summary", "Climate Change Recorded in Glacial Ice", "Tree Rings: Archives of Environmental History", "Natural Causes of Climate Change", and "Human Impact on Global Climate."

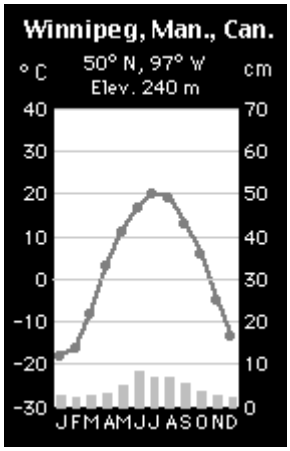
Summary: In this lab you will analyze climate variability and change that can occur at a variety of different time scales.

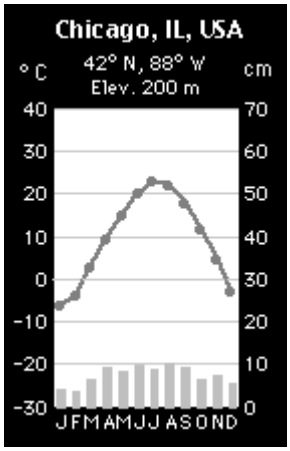
LAB EXERCISE

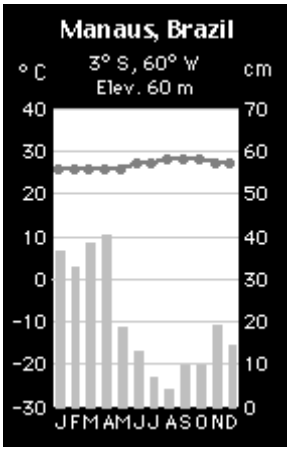
1. The following data below are climate data for Memphis, TN. Using these data, calculate the annual temperature range (hint: see the temperature chapter in the textbook on page 102).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temp (°C)	5.1	7.5	12.2	17.2	22.1	26.5	28.2	27.8	24	17.9	11.8	6.5	17.2
Precip (cm)	10.1	11.2	13.1	14	13.3	9.2	11.7	7.3	7.9	10.1	13.9	14.6	136.4

2. The city climates illustrated in the climographs below decrease in latitude from left to right. How does the annual temperature range depend on latitude?



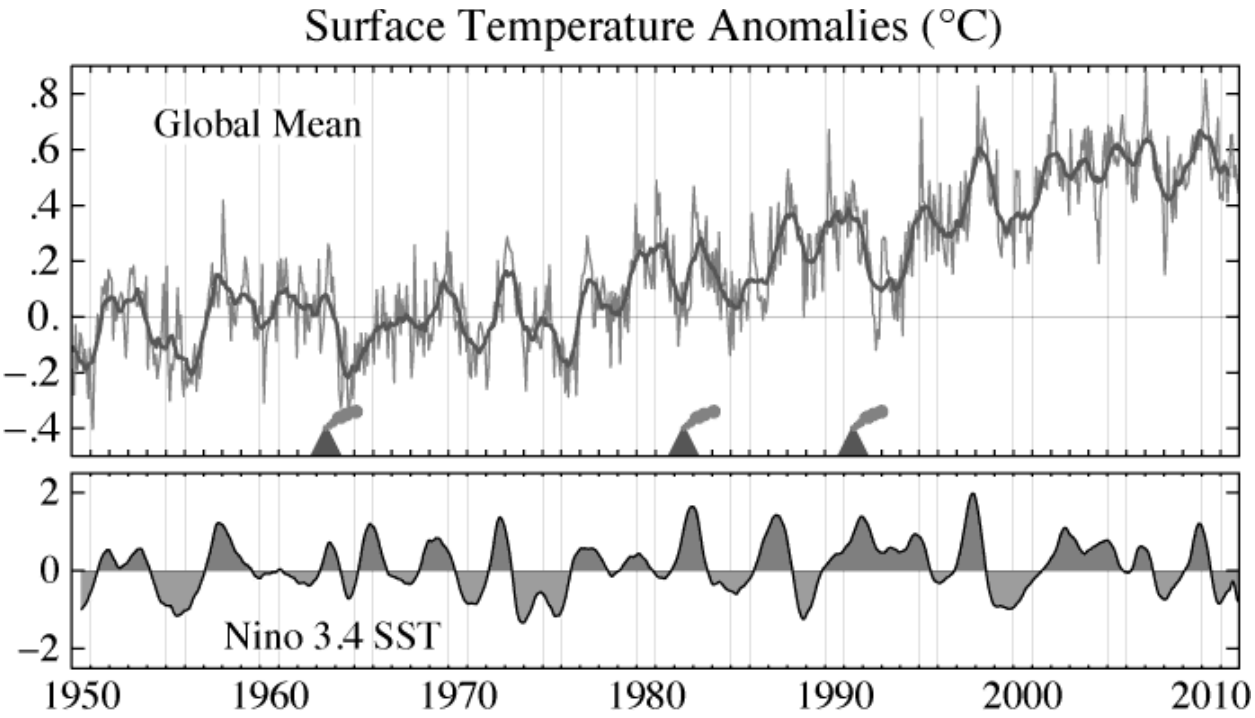




3. Why does the annual temperature range depend on latitude?

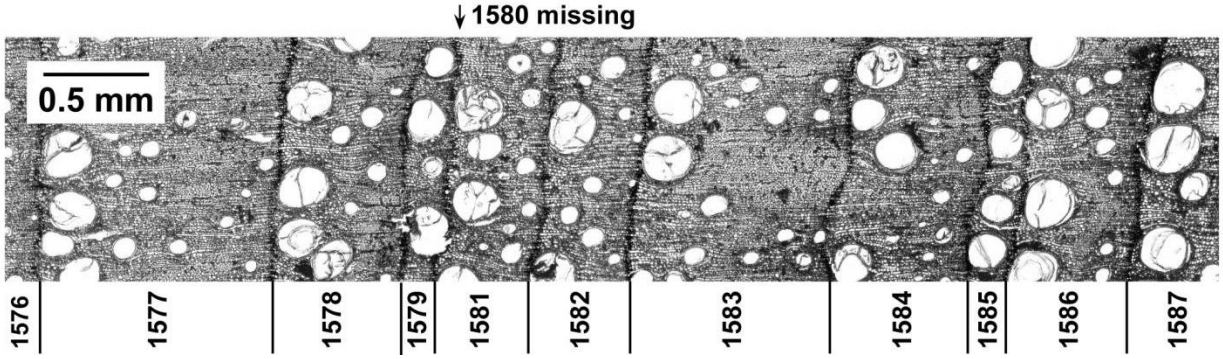
4. The climographs in Question 1 also show an increase in precipitation as latitude decreases. While localized factors can cause this observation to be more complicated, why is it logical to assume that globally on average, precipitation should decrease with latitude?

5. The figure below from NASA shows global mean surface temperatures, large volcanic eruptions, and an index of El Niño Southern Oscillation (ENSO). Ignoring the few years following each large volcanic eruption, provide evidence that ENSO can influence global mean temperatures (hint: When the global mean temperature arches upward in any year, is ENSO in a warm or cold mode?).

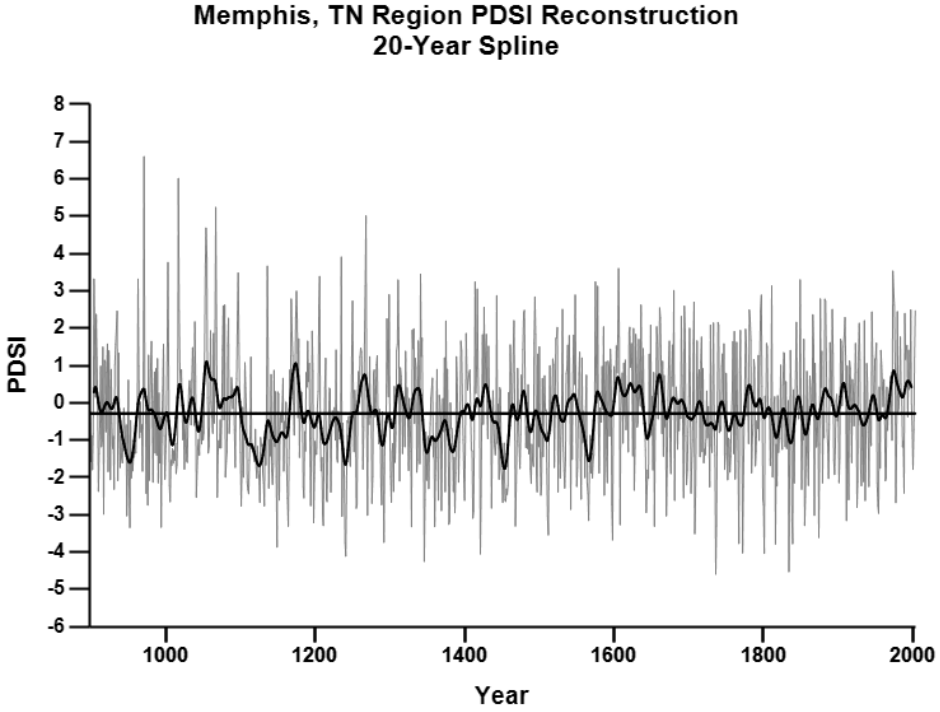


6. Now look at the few years following each volcanic eruption in the figure above. What happens to global mean temperature record during those few years after those events? Why would volcanoes have this impact?

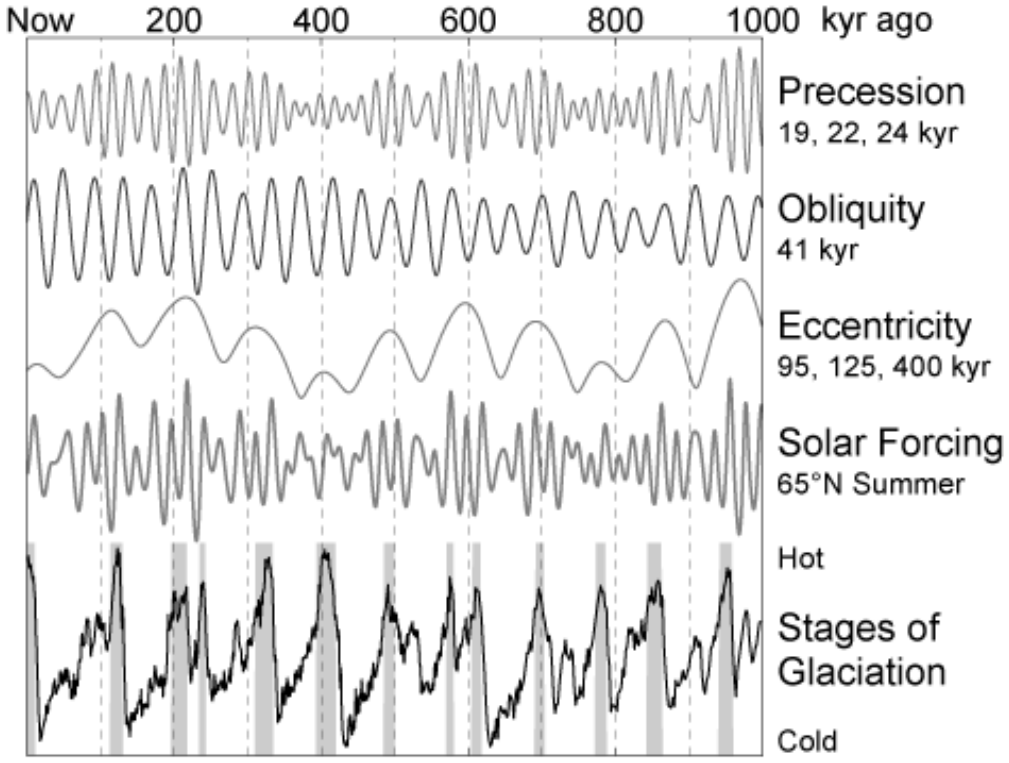
7. The figure below is a photomicrograph of the annual growth rings in a Blue Oak specimen from Rock Springs Ranch in San Benito County, California. Note the alternating pattern of wide and narrow rings. Is 1577 an example of a good or bad year for this tree? What about 1585?



8. The North American Drought Atlas is a 2.5 x 2.5 degree grid of summer (June-August) Palmer Drought Severity Index (PDSI) reconstructions derived from tree rings. Negative PDSI values indicate drought, while positive PDSI values indicate wet conditions. The reconstruction for the Memphis, TN region is in the figure below running from 899-2003. The individual years are in gray with a 20-year smoothing spline overlaid in darker black to highlight the decadal-scale variability of summer PDSI over Memphis, TN. What do you note about droughts in the past compared to those today?



9. The figure below shows reconstructions of Earth's precession, obliquity, eccentricity, and the stages of glaciation for the past one million years. Today is at the left side of the figure. Using this figure, answer questions 9a-9c.



a. What are precession, obliquity, and eccentricity?

b. The terms you defined above (precession, obliquity, and eccentricity) are collectively referred to as _____ cycles.

c. When was the last time we had as little ice as we have today (note: the time is at the top of the figure and in thousands of years, so 200 is 200,000 years)?

10. One of the frequent misunderstandings about the current warming trend and its strong link to anthropogenic forcing is that people will look at the last 10-15 years or so of data, not see much trend, and argue that global warming has stopped. Why is such an argument incorrect in the context of climatology (hint: remember the definition of climate, especially the time frame it is computed, and the natural factors that can influence climate at various time scales like ENSO and volcanoes in Questions 5 and 6)?