1. What are positive and negative feedbacks?

2. The snow and ice albedo feedback.
   (a) Briefly describe this feedback (you can use a figure if this helps).
   (b) Is this a positive or negative feedback?
   (c) In this feedback situation, what happens to the albedo if there is global cooling?

3. (a) Briefly describe the water vapor feedback.
    (b) Is this a positive or negative feedback?

4. In class, we derived equation (5.5):

   \[
   \left( \frac{\Delta T_S}{T_0} \right) \approx \frac{\frac{\Delta S}{\epsilon_0} - 4 \frac{(\Delta \epsilon)_{CO_2}}{\epsilon_0}}{1 + \left( \frac{16T_0}{1-\epsilon_0} \right) \frac{\partial \alpha}{\partial T_S} \text{ice} + \left( \frac{4T_0}{\epsilon_0} \right) \frac{\partial \mu_{H_2O}}{\partial T_S}}
   \]

   (a) This expression takes into account the ice-albedo feedback, with \( \alpha \) the albedo. Is \( \frac{\partial \alpha}{\partial T_S} \) positive or negative? If there is an increase in temperature that changes the albedo, will that cause a further increase in temperature, or will the response be to decrease temperature?
   (b) This expression was derived assuming that an increase in CO2 changed the bulk emissivity in two ways. Which two terms in this expression account for that, and what do they describe?
   (c) If these changes in bulk emissivity are a result of an increase in temperature, do these changes result in a further increase in temperature, or do they act to reduce temperature? (In other words, are these a positive or a negative feedback? Is one positive and one negative, or are they both positive or negative?).

5. Clouds can be either a positive or negative feedback. Explain (pictures may help).

6. What is the Hadley-Walker circulation? Draw a picture of a Walker cell (include relevant directions: east-west or north-south).

7. What is El Niño and La Niña? How do these affect weather patterns in NM?

8. MJO
   (a) What is the Madden-Julian Oscillation (MJO)?
   (b) Give one example of how it influences global weather patterns.
   (c) Give one example of how it affects climate.

9. (a) Why is it so hard to model weather?
    (b) Why is it so hard to model climate?