Homework Question Set #5
NATS 101, Section 13
Fall 2010

The following questions cover Lectures 21-25. Provide thorough, complete answers for maximum credit. Three of the following questions will be randomly graded, with equal credit given to each question.

Due Friday, November 6 by 5pm. Submit completed assignment to D2L as .doc or .pdf file. Scanned copies of handwritten answers are fine, provided the document is neat and clearly legible. Note that diagrams or pictures can—and should—be used to answer many of the questions. Please scan in any drawings or diagrams in your answers, if possible. For the problems involving calculations, clearly label and provide appropriate accompanying textual description for equations used.

1. If an area is described as a "good air mass source region" what information can you give about it? List the temperature and moisture characteristics of each of the major air mass types.

2. What are lake effect snows and how do they form? On which side of a lake do they typically occur? From what direction would the wind be blowing for the following cites to experience heavy lake effect snows: a) Chicago, Illinois b) Cleveland, Ohio and c) Buffalo, New York. Explain your reasoning. You will need to look at a map to see where these cities are located with respect to the Great Lakes to help construct your answer.

3. Compare and contrast the type(s) of precipitation and clouds found at a cold front vs. a warm front. Provide physical explanations for any differences.

4. In class lecture, an animation was shown of the passage of a cold front in Tucson during April 1999. This animation is posted to the lecture notes page. Write a thorough description of the sequence of events associated with the cold front passage you observe in the movie animation. This description should include your observations of: sky conditions, cloud types, wind direction and speed (at the surface and aloft), and precipitation. At what specific local time does the actual cold front pass through Tucson? Explain how you can tell.

5. If you live in a city in the Great Plains or Midwest part of the United States and experience a strong blizzard, where would the surface low most likely be in relation to your city and from what direction would the wind most likely be blowing during the blizzard? Explain your reasoning based on the idealized structure of a mid-latitude cyclone. From where would such a storm originate and why?

6. Question #15, Chapter 11 Ahrens.

7. What is the most intense stage of mid-latitude cyclone development within the Bjerknes polar front model? Describe (or draw) how a mid-latitude cyclone would appear at this stage, a) as seen in a visible or infrared satellite image and b) on a surface weather map with accompanying weather fronts. Where would the upper-level low be located in relation to the surface low at this stage? Explain why.

8. What do mid-latitude cyclones tend to "die out" after they become occluded?

9. It is typically observed in winter that mid-latitude cyclones rapidly intensify when the surface low moves off the gulf coast or east coast of the United States. Explain why this happens. What is the name for these types of storms when they occur on the Atlantic seaboard and which direction do they typically move? *Hint: A classic example of this type of storm is described in detail in the Ahrens text.*

10. A local TV meteorologist in Tucson says the following statement when describing the forecast for the next five days during a winter month: "A piece of energy off the California coast is going to help wind up a strong Pacific storm system that will affect southern Arizona with heavy snow and rain next weekend." Explain what the meteorologist is physically meaning by "a piece of energy." Why does the "piece of energy" help make a more intense winter storm?

11. How are computers used to generate numerical weather prediction (NWP) forecasts? Why are these forecasts generally unreliable after about a week to give a weather forecast for a particular time and place, irrespective of which NWP model is used at any spatial resolution?

12. On a recent holiday visit to my uncle, he and I got into a conversation on the subject of global warming. One statement in the conversation I distinctly remember when I described to him my work was: "Why should I even believe that scientists can tell me how much it's going to rain this winter or many years from now when the guy on TV gets tomorrow's forecast wrong more than half the time?" Do you agree or disagree with my uncle's statement? Support your opinion with facts and logical reasoning.