Chapter 13, Review Questions

1. What role might selective memory play in our personal assessment of the skill of weather forecasts?

   a. People tend to remember missed weather forecasts, but overlook the fact that most forecasts are on target. Changes or the potential changes in weather are routinely predicted to a high degree of accuracy.

2. Weather observation and forecasting require international cooperation. Why?

   a. Atmospheric circulation spans geographical and political boundaries so that weather forecasting requires international cooperation and the free exchange of observational data.

3. List the main steps involved in the preparation of a weather forecast.

   a. Weather forecasts require acquisition of weather data, representation of weather data on maps, analysis and interpretation of weather maps and data, generation of weather forecasts and guidance products, and dissemination of forecasts to users.

4. What are the sources of surface weather information on land and at sea?

   a. Weather data is collected from geostationary and polar-orbiting satellites, weather radar, surface and upper air stations, ships at sea, aircraft, radiosonde stations, dropwindsondes, and drifting and moored buoys.

5. Why must weather observations be taken at the same time everywhere?

   a. Weather observations must be taken at the same time everywhere in order to accurately represent the state of the atmosphere.

6. What is the chief source of observational data that are used to plot an upper-air weather map?

   a. Radiosondes acquire most of the data used to plot upper-air weather maps.

7. Surface air pressure readings are adjusted to sea level. Explain why.

   a. Adjusting surface air pressure readings to sea level enables meteorologists to compare surface pressure readings at different weather stations across the country.

8. Explain why the height of the 500-mb surface generally slopes downward from the tropics to the polar region.
a. Air is colder and denser at the polar regions, causing air pressure to drop more rapidly with height and the 500-mb surface to occur at a lower level. Air in the tropics is warmer and less dense, so the surface occurs at a higher altitude.

9. Why does weather forecast skill decline as the forecast period lengthens?

a. Weather forecast skill declines as the forecast period lengthens because of inaccuracies in initializing numerical models, missing data (especially over the ocean), and approximations in the models.

10. Explain why computer models are never likely to replace human weather forecasters.

a. Meteorologists are familiar with the limitations of numerical models and local and regional conditions that may influence weather patterns.

Chapter 13, Critical Thinking Questions

1. A cold-core anticyclone (polar high or arctic high) does not appear on a 500-mb weather map. Explain why.

a. Cold-core anticyclones and warm-core cyclones are surface weather systems that do not extend to the altitude of the 500-mb level. A cold-core anticyclone is a shallow mass of polar or arctic air and a warm-core (thermal) cyclone is a shallow mass of air that is heated intensely by the ground.

2. Describe how and why the height of the polar front jet stream changes between winter and summer.

a. The height of the jet stream depends on the mean temperature of the underlying air; therefore the jet stream would be at a higher altitude in the summer than in the winter.

3. Describe the role of numerical models in scientific weather forecasting.

a. A numerical model of the atmosphere consists of a set of mathematical equations that describe the approximate relationship among variables of state and the various processes operating in the atmosphere. Starting with initial conditions (the present state of the atmosphere), the model predicts future states of the atmosphere (weather forecasts). A weather forecaster uses the products of numerical models combined with his/her understanding of the atmosphere to predict future weather.

4. Weather observation stations are much more closely spaced over the continents than the ocean. Speculate on how this difference might influence a meteorologist’s ability to represent accurately the state of the atmosphere.
a. The greater the spatial density of weather observation points, the greater is the resolution of features of atmospheric circulation. Hence, the state of the atmosphere is more accurately represented where the spatial density of weather stations is relatively great. The state of the atmosphere represented over the ocean may not be as accurate as over land due to the greater distance between observation stations.

5. Why are special forecast centers (e.g., Storm Prediction Center) needed?

a. Special forecast centers focus on hazardous weather systems (e.g., winter storms, hurricanes) that have the potential of major impact on people and property. The Centers provide regional Weather Forecast Offices with analysis and forecasting products that will better ensure that the public is appropriately informed in the event that the potential for hazardous weather develops.

6. Describe the advection pattern that would cause a meridional flow pattern at the 500-mb level to become more zonal.

a. A meridional flow pattern will become more zonal at the 500-mb level if warm air advects into troughs while cold air advects into ridges.

7. How are teleconnections used in long-range forecasting?

a. The atmosphere is a continuous fluid so that changes in one part of the atmosphere can translate to changes elsewhere, perhaps thousands of kilometers away. Teleconnections are linkages in atmospheric circulation between these areas of the globe. For example, teleconnections are used when forecasting El Niño and La Niña events.

8. What are some of the factors that RFC hydrometeorologists must take into account when forecasting floods?

a. In developing flood forecasts, RFC hydrometeorologists must consider such factors as rainfall and snowmelt rates, water equivalent of the snow pack, topography, whether the soil is frozen in the drainage basin, soil type, and the capacity of drainage systems.

9. What might account for the decline in Atlantic hurricane track error since 1990?

a. Weather observing facilities were modernized in 1990, providing better data from newer equipment.

10. Distinguish between a weather watch and a weather warning.

a. Weather watches are issued when atmospheric conditions are favorable for the development of severe weather such as tornadoes. Weather warnings are issued when severe weather is actually occurring or is imminent.