**Introduction to Meteorology**

**Homework #5**

**Answers**

**1. What is the first, and possibly the most important requirement for**

**producing an accurate weather forecast?**

Accurately (or as accurately as possible) representing (observing) the present state of the atmosphere

**2. a) What government organization in the U.S., located near Washington D.C.,**

**is responsible for analyzing data, preparing weather maps and using super computers to run forecast models utilized for predicting the weather?**

**b) What government organization is responsible for issuing local and**

**regional weather forecasts, as well as hazardous weather watches and**

**warnings?**

**c) Both of these organizations are part of what larger government agency?**

a) National Center for Environmental Prediction (NCEP)

b) National Weather Service (NWS)

c) National Oceanic and Atmospheric Administration (NOAA)

**3. a) What does a hazardous weather *watch* indicate?**

**b) What does a *warning* indicate?**

a) Atmospheric conditions favor hazardous weather occurring over a

particular region during a specified time period, but the actual location and time of occurrence is uncertain.

b) Hazardous weather is imminent or actually occurring within the specified

forecast area.

**4. a) What is visualized in visible satellite images?**

**b) What is the disadvantage of using these types of satellite images?**

**c) What is brighter on an infrared satellite image cirrus clouds or stratus**

**clouds? Why?**

a) Visible light from the sun reflected by the earth and clouds

b) Cannot be used at night

c) Cirrus clouds, because they are colder

**5. Twice each day, thousands of observations are transmitted to NCEP and fed**

**into their high speed “supercomputer” which plots and draws lines on surface and upper-air maps. These generated maps are referred to as an**

analysis  **. After this initial process is complete, the computer then forecasts how this analysis of the atmosphere will change over time by using mathematical equations that govern the behavior of the atmosphere. This process is called** numerical weather prediction (NWP) **.**

**6. What are the “atmospheric models” that are utilized to execute this process?**

Consist of numerous mathematical equations that govern the behavior of the atmosphere (i.e. describe how atmospheric variables such as temperature, pressure, winds and moisture will change with time)

**7. How does the meteorologist use the computer models as “guidance” to**

**make his/her final forecast?**

The meteorologist uses their experience to understand which models tend to do better with different situations and which forecast scenario looks more realistic. The forecaster then puts this information together with their own observations (e.g. radar, satellite, etc.) and other forecasting tools (e.g. statistical models) to make a final forecast.

**8. What are the three basic sources of errors in computer model forecasts?**

1) Inherent model flaws

2) Inadequate/inaccurate observations

3) Chaos

**9. *Global models* are better at forecasting** large-scale features such as the

broad areas of precipitation associated with midlatitude cyclones **whereas *high-resolutions models* are better at forecasting** smaller scale features such as thunderstorms .

**10. Chaos theory states that small errors in observations and forecasts tend to**

**become**  amplified  **as the computer model projects further into the future. Therefore,**  short-term **forecasts are inherently better than**

long-term  **forecasts and there is a limit to**  how far into the future  **a forecast can be made with any skill.**

**11. a) What does it mean if there is a 70% probability of precipitation?**

**b) What is the probability that it will rain at your house?**

a) There is a 70% probability (it is ***likely***) that any given random location

within the forecast area will receive measurable precipitation

b) 70%

**12. How much cloud cover can you expect if the forecast is “partly sunny”?**

50 – 69%

**13. Is there any “skill” to the forecast on the “Accuweather” website**

**forecasting rain with a high temperature of 38 degrees for Pittsfield in 14 days?**

No

**14. a) What is a thunderstorm (definition)?**

**b) What type of environment do they form in?**

a) A storm that contains lightning and thunder.

b) Conditionally unstable

**15. What constitutes a “severe” thunderstorm?**

Must have at least ***one*** of the following:

1. Hail at least ¾” in diameter

2. Wind gusts of at least 50 kts (58 mph)

3. Tornado

**16. a) Are ordinary (air mass/single-cell) thunderstorms usually severe?**

**b) Are they “long-lived” thunderstorms?**

**c) What is it about these thunderstorms environment and what does this**

**do to the structure of these thunderstorms that results in the answer to**

**a) and b)?**

a) No

b) No

c) They form in a low wind shear environment so that the downdraft is

superimposed on the updraft and “squelches” it, causing the storm to dissipate less than one hour after it forms

**17. What is a “gust front”?**

The leading edge of cold, outflowing air from a thunderstorm that forms

when the cold downdraft reaches earth’s surface and pushes outward, horizontally in all directions

**18. a) What is a “downburst/microburst”?**

**b) In what two ways does this phenomenon cause damage/disasters?**

a) When a strong downdraftfrom a thunderstorm plunges to the ground

beneath the thunderstorm generating a strong radial burst of wind as it hits the ground

b) 1. Causes immense straight-line wind damage

2. Responsible for airline crashes

**19. a) What is lightning?**

**b) What is thunder?**

a) A discharge of electricity which usually occurs in mature thunderstorms

b) The lightning stroke can heat the air to an incredible 54,000°F, causing the

air to expand explosively, initiating a booming shock/sound wave

**20. a) Where can lightning strikes take place?**

**b) Where do the majority occur?**

a) Within a cloud; between clouds; from a cloud to the surrounding air or;

from a cloud to the ground

b) Within the cloud

**21. What part of the lightning stroke do we usually see?**

The return stroke

**22. a) Which is more common, negative or positive cloud-to-ground lightning?**

**b) Which is more dangerous? Why?**

a) Negative (90%)

b) Positive; Since the stroke must travel a much larger distance it requires a

greater charge potential and thus discharges a much larger current

**23. a) Where are most victims when they are struck by lightning? Why?**

**b) When is it recommended that people seek cover from an approaching**

**thunderstorm?**

a) Open places; they are the “highest” object

b) As soon as thunder can be heard

**24.**  Supercell thunderstorms  **are (by far) the most intense**

**thunderstorms and are responsible for most of the damaging hail and straight line winds and virtually all damaging tornadoes.**

**25. What percentage of supercell thunderstorms produce a tornado?**

About 15%

**26. a) What is a tornado?**

**b) Where are they most common?**

**c) What time of year are they most common?**

**d) What time of day are they most common?**

a) Violently rotating columns of air that extend from a thunderstorm cloud to

the ground

b) In the U.S., particularly the southern Great Plains (tornado alley)

c) Spring

d) Late afternoon to early evening

**27. a) What is the classification scale for tornadoes called?**

**b) What is it based upon?**

a) “Enhanced” Fujita scale (EF)

b) Severity based upon the degree of damage caused by the tornado

**28. Doppler radar provides more definitive evidence of a supercell**

**thunderstorm, and has permitted forecasters to provide tornado warnings, on average,**  12 minutes **before a tornado forms since it can detect**  rotation  **in a thunderstorm?**

**29. a) When is a tornado watch issued?**

**b) When is a tornado warning issued?**

a) Environmental conditions are conducive for tornado formation

b) 1. A rotating thunderstorm (supercell) is identified on Doppler radar

2. A tornado has been spotted

**30. a) Where is the best place to take shelter from a tornado if you are in the**

**vicinity of buildings?**

**b) Where is the best place if you are outdoors or on the road**

a) In a well constructed building (***not*** a mobile home), in a basement if

possible, otherwise in a small room on the lowest floor near the center of the building

b) Lie flat (with head covered) in a ravine, ditch or streambed