General Meteorology	**Laboratory #3**
Name _____	Date _____
Partners _____	Section _____

Surface Observations and Nephanalysis

Purpose:

Develop the ability to perform a standard surface observation and translate it into a station model and a METAR. Develop an understanding of cloud types and the ability to identify them.

Equipment:

Station Thermometer	Min./Max. Thermometer
Anemometer	Barometer
Psychrometer	Rain Gauge
Psychometric Tables	Barometric Correction Tables

Background:

The goal of a standard surface observation is to quantify the following properties of the atmosphere at regular intervals.

Temperature	Sea Level Pressure	Sky Cover
Dew Point Temperature	Altimeter Setting	Cloud Height
24 hr Max. Temperature	Wind Direction	Surface Visibility
24 hr Min. Temperature	Wind Speed	Precipitation
		Weather & Obstructions

Airports routinely collect this data due to the impact that atmospheric conditions have on air travel. Surface observation are performed every hour, are coded into an aviation report, and distributed for use world wide. Although the US historically used the SA report, we have switched over to the METAR which is used world wide.

In this particular lab we will focus on measurements related to pressure and altimeter settings. We will make some of the other standard measurement; however, we will wait until later labs to discuss the finer points of visibility, and cloud type and height.

For more information about weather observations consult the Federal Meteorological Handbook at **http://www.ofcm.gov/fmh-1/fmh1.htm**.

Procedure:

I. Perform a surface observation

The following procedure will be followed to perform a surface observation. The order of the steps are not important; however, all portions must be completed and the appropriate spaces on the observation sheet must be filled in.

1. Read the station thermometer for the current air temperature. All temperatures will be measured in Fahrenheit.
2. Read the min. and max. thermometer for the extremes of temperature over the last 24 hours. Once the measurement is taken, reset the two thermometers.
3. Measure the wet bulb and dry bulb temperature using the sling psychrometer. Using the psychometric tables determine the dew point temperature. The tables are in Celsius and our measurements are in Fahrenheit. You will need to do a conversion before and after you use the tables.

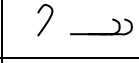
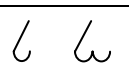
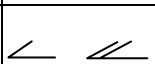
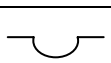
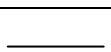
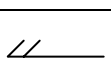
4. Determine the wind speed and direction using an anemometer. The wind speed is measured in knots. We will use either the radio stations anemometer or a hand held device which gives a rough value for the magnitude of the wind speed.

   1 knot = 1.15 mi/hr = 0.51 m/s

5. Read the station pressure using a mercurial barometer and an aneroid barometer. From the mercurial barometer make a temperature correction as well as a gravity correction. Determine the sea level pressure assuming an isothermal atmosphere and the altimeter setting assuming a standard atmosphere
6. Read the rain gauge and empty it. Since we do not have a rain gauge available at this time, we will use an alternate source of information for this part of the report.
7. Observe the sky cover and estimate the cloud height. This estimate will be very crude; however, we will use cloud identification to help us narrow the range of heights. We will say low level clouds (various forms of status) have a height between 0 and 6,500 ft, middle level clouds (alto) have a height between 6,500 and 23,000 ft, and high level clouds (cirrus) have a height between 16,000 and 43,000 ft. Notice that the measurement is made in feet not in meters.
8. Check the surface visibility using landmarks in the area. Since the clear line of site on campus is limited, we will have to resort to rough estimates or alternate sources of information.
9. Record the current weather and any special occurrences.

II. Cloud Identification

The following table describes the various types of clouds, their station model symbol, and the range of height for their cloud base.

Type	Description	Symbol	Height (ft)
Cirrus (Ci)	Thin, wispy clouds		16,000 - 43,000
Cirrocumulus (Cc)	Small, rounded white puffs		16,000 - 43,000
Cirrostratus (Cs)	Thin, sheet-like Sun and moon is clearly seen through them		16,000 - 43,000
Altocumulus (Ac)	Gray, puffy masses (size of your thumbnail)		6500 - 23,000
Altostratus (As)	Gray or blue-gray cloud Makes the sun look watery		6500 - 23,000
Stratocumulus (Sc)	Low, lumpy cloud layer (size of your fist)		0 - 6500
Stratus (St)	Uniform grayish cloud. Like a fog covering the sky, but not to the ground		0 - 6500
Nimbostratus (Ns)	Dark gray Wet looking clouds		0 - 6500
Cumulus (Cu)	Like puffy cotton Form rounded towers		~ 1000
Cumulonimbus (Cb)	Thunderstorm cloud Great vertical development		~ 1000

III. Sky Cover

When reporting sky cover, you must distinguish between individual layers of cloud. For each layer you must estimate the percentage of cloud cover and the height.

A. **Estimating height**. Although you may estimate cloud height from the cloud type, this is a very crude measurement. One improved method of estimated cloud height can be made if the lowest clouds are convective in nature. Using the attached Convective Cloud-Base Height Diagram you can estimate the height of the cloud base by using the surface temperature and the dew point temperature. The vertical lines are for the dew point temperature and the diagonal lines are for the dry-bulb temperature. Starting at the bottom of the diagram locate the dew point and the dry-bulb temperatures and follow their respective lines until they meet. From this meeting point follow the horizontal line to find the height of the cloud base.

B. **Percentage of coverage**. Determining the percentage of sky cover can be somewhat deceptive. The following rules will help more accurately estimate cloud cover.

1. If looking straight up and there is full sky cover to one side and clear sky to the other side, you have 0.5 sky cover.
2. If there is an advancing line of clouds at 45° from the horizon and the rest of the sky is clear, the sky cover is 0.1.
3. If there is a line of clouds which have passed overhead and the only remaining clear sky is from the horizon to 45° above the horizon, the sky cover is 0.9.
4. If clouds completely cover the sky except for a clear patch which extends 30° from zenith, the sky cover is 0.9.
5. If clouds completely cover the sky except for a clear patch which extends 60° from zenith, the sky cover is 0.5.

C. **Multiple layers**. When estimating cloud cover for higher layers, you can only report the cumulative amount of cloud cover. You **do not** try to estimate the sky cover of that layer if all the other layers were absent. You also want to distinguish between opaque and transparent cloud cover. Opaque sky cover is where the clouds are thick enough obscure the sky. Transparent sky cover is where the clouds are thin enough you can make out features behind the cloud layer such as blue sky, higher clouds, the moon, and the sun.

D. **Surface observation sheet**. Look at the attached Ceiling and Sky-Cover sheet for the notation necessary for reporting sky cover.

1. Generate a METAR for today's observation

2. Generate a station model for today's observation.