

Name _____

Date _____

Partners _____

Section _____

Meteorology Data on the Network

Purpose:

Become familiar with the types of meteorological data available on the network.

Equipment:

Station Thermometer

Min./Max. Thermometer

Anemometer

Barometer

Psychrometer

Rain Gauge

Psychometric Tables

Barometric Correction Tables

I. Surface observation.

Begin the first 1/2 hour of lab performing a surface observation. Make sure you include pressure (station, sea level, and altimeter setting), temperature, dew point temperature, wind (direction, speed, and characteristics), precipitation, and sky conditions (cloud cover, cloud height, & visibility). From your observation generate a METAR and a station model.

A. Generate a METAR for today's observation

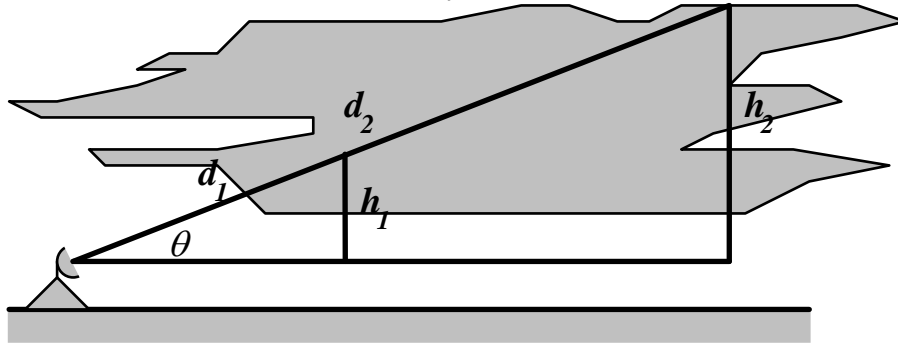
B. Generate a station model for today's observation.

**II. Radar**

Radar became operational at the beginning of World War II. Its primary purpose was to detect airplanes; however, it was also observed that rainfall produced a noticeable return of the radar signal. A standard weather radar transmits a $1 \mu\text{s}$ pulse of microwave radiation (wavelength is in the centimeter range) and waits for 1 ms for any return signals. The time delay between the initial pulse and the returned signal indicates the distance between the radar station and the rainfall. The direction of the transmitted pulses is constantly changed in order to get a full scan of the atmosphere around the radar station. The intensity of the returned signal gives an indication of the intensity of the rainfall.

- Distance to the rain** - Microwave radiation as well as all forms of electromagnetic radiation travels at 3.0×10^8 m/s. From physics we know that distance equals velocity multiplied by time ($r = v \cdot t$) so we can predict the distance to rainfall by knowing the time delay. We must also remember that radar is like an echo. The transmitted pulse must travel from the radar station to the rainfall and then back again. The actual distance to the rainfall is half the distance obtained by the previous calculation; therefore, the actual distance is calculated as $d = v \cdot t / 2$.

2. **Height of rainfall** - The radar station not only directs the pulse in a particular direction horizontally, but also can direct the pulse at a particular angle above the horizon. When this is done, the radar station can determine the vertical structure of the cloud. As illustrated below, the height sampled by the radar station changes with distance. At a particular angle the radar will sample the lower part of closer clouds and the upper part of more distance clouds. The height sampled within the cloud can be calculated by the formula $h = d \cdot \sin \theta$.



3. **Doppler Radar** - In addition to operating like conventional radar, Doppler radar measures the change in wavelength of the returned signal. If the rainfall is stationary the returned signal will have the same wavelength. If the rainfall is traveling away from the radar station, the wavelength is longer and if it is moving towards the station the wavelength is shorter. This physical principle is called the Doppler effect and is the reason why the horn of an approaching car has a higher pitch than the same car traveling away from you.

III. Network resources.

I will only focus on two locations for information. The first is the National Weather Service station at Wilmington, OH. The second is the Weather Processor developed at Purdue University. It was funded by and currently managed by Unisys.

A. KILN

KILN is the identifier for Wilmington, OH. The 'K' is appended to all stations in the United States and the ILN is a unique abbreviation for Wilmington. I want you to visit this site because there are some Doppler radar images here. To visit this site type in the following network address:

<http://www.erh.noaa.gov/iln/index.php>. There is a lot of weather information available here; however, we are going to focus on the radar at this site.

1. NEXRAD.

Find icon labeled "Radar " and click on it. A current radar image for the area will be displayed along with several options listed along the left side of the page. These options include switching between short range and long range scans. Click on long range and see how far that range really is. Is Chicago, IL included in this range? Indicate whether it is or not on the data sheet included with the lab. Notice on both the short and long range images there is a radar return in the immediate vicinity of the radar station. This is called ground clutter and should be ignored on clear days.

The radar scan image has a legend to the right which is useful for interpreting the data. The intensity of the returned signal is measured in decibels

(DBZ). On the left side of the page under “Additional Info” is “Radar Faq”. Click on this link and you are directed to an information page. Scroll down this page until you get to “What do the colors mean in the reflectivity images?” Read through this description and answer the next two questions about the radar. Scroll to the top of this information page and find the section labeled “Is everything I see on the images an accurate picture of my weather?”. On the data sheet indicate the range at which the radar can pick up most precipitation. My purpose for the questions is not to trick you but to make sure you visit the various locations within the site. If you have difficulty finding the answer to my question, come and see me and we can visit the site together.

3. **Tornadoes.**

Clicking on the “Back” button of your web browser should get you back to the home page for the Wilmington Weather Office. Above the map of southern Ohio, you have several links. One is labeled “Climate and Past Weather.” Click on it. On the next page, click on the tab “Local Data/Records” and then under the label Climate Data click on “Severe Weather Climatology.” On this new page, click on the link “Tornado Climatology.” This page will give you a map of the counties surrounding the Wilmington Radar site. Click on Greene County and you will get a list of tornados that have struck Green County since 1950. (This page is broken, so I fixed it and put it at <http://people.cedarville.edu/employee/gollmers/esci2410/tornadostats.htm>. Go to this link to answer the following question.)

Look through this list to find the tornado that resulted in the most deaths. This is the famous Xenia Tornado. On your data sheet record the date the tornado struck along with the number of deaths and injuries. Also record the length and width of this tornado’s track on the ground.

B. WXP

The Weather Processor at Unisys provides standard weather product which are updated automatically. The network address for WXP is <http://weather.unisys.com/>. I will briefly navigate you through some of the products available and will ask you to answer questions along the way. Although the weather products are dynamic (constantly changing), the structure of the site is static. Therefore, my questions will focus on the structure of the site rather than the actual products.

1. **Main Page.**

The initial WXP web page contains an index along the left side and a current surface map. This surface map identifies the low and high pressure regions, fronts, and enhanced infrared information. To get more information about WXP go to the index and click on "Information." Scroll through this page and record on your data sheet the frequency at which different products are updated. Click on the back button to get to the main page. The next item in the menu is "Contents" and gives a direct means of seeing every product available on this site. This page is useful once you are familiar with which products are of interest to you.

2. **Surface Map.**

To see a better surface map than the one available on the main page click on "Surface Data" in the index. Next click on the surface map image. This "Composite" surface map is the most important one because it includes the station model for various locations around the country. This map can become quite cluttered, but you can still get a flavor of what is happening around the country. Regional data plots are also available which let you focus in on areas of interest to you. These regions are just as busy as the composite map because although it magnifies a particular region of the map it includes more stations. Click the back button and go to the "Regional Plots" under the "OtherPages" on the right side of the page. Next click on the "Midwest" and answer the questions on your data sheet.

Click on the back button twice to get back to the top of the Surface Data page and find the "contour plots" under "Other Pages." Click on the image representing the "current temperature plot." The edge running between two different colors on this plot corresponds to the isotherms (lines of same temperature). Go to the data sheet and answer another question.

Hit the back button and look at the other contoured data products. Count the number of contour data products available and record that on the data sheet.

3. **Satellite Data.**

Go back to the main menu and select "Satellite Images" from the index. All of the products on this page are derived from GOES East and West. There are both visible and infrared images present. Also this site keeps 12 hours of images around. For the next question I want you to do some exploration. You are to find a visible image where you can see the terminator. The terminator is the line which divides the night and day portion of the earth. Now go to the infrared image corresponding to the visible image with the terminator. What is fundamentally different about these images and why? Record your response on the data sheet.

4. **NAM Forecast Model.**

Go back to the main menu and select "NAM Model" under the "Forecasts" of the index. NAM stands for the North American Mesoscale model. This model is one of the operation weather models used in the United States. The model is run to simulate 84 hours of weather. The products generated from this model run allows you to see the weather forecast in 6 hour increments and at multiple levels within the atmosphere. Usually you will see the model output represented on 4 panel forecast charts as illustrated by the default image on this page. Click on the current 4 panel forecast plot. What do the 4 panels of the 4 Panel Forecast plot represent? Place this answer on your data sheet. The cyan lines represent pressure contours and the color shading is an indication of precipitation. From the legend at the bottom of the chart what precipitation range is represented by the color yellow? Notice also that there are brown lines on this chart. The brown lines (Look yellow to me!) are contours of the thickness of the 1000 - 500 mb layer.

5. **Skew T-ln p.** Go back to the main menu and select "Upper Air Data" from the index. The mandatory levels give a station model representation of the atmosphere at 850, 700, 500, 300, and 200 mb. If you want a vertical look at the atmosphere from one location, you should select "Upper Air Sounding." Do so

and you have an image of Washington D.C.'s current Skew T-ln p. We are interested in the sounding at Wilmington, OH. Scroll down the page until you find the listing for Wilmington. Both the SkewT and the sounding data are available. Associated with the name Wilmington is a station identifier and number in parenthesis. Write those down on your data sheet.

You will notice a number of colored lines on the Skew T-ln p. Below the plot is a short description of the Skew T-ln p. Read through this description and identify which colors go with which quantity on the chart. Record those colors on the data sheet. If you want more information about Skew T-ln p, scroll back to the beginning of the Upper Air Sounding Plots section of this page. Below the Washington D.C. sounding there is some text followed by a "More Information" link. Selecting this link will provide additional information about Skew T-ln p. Notice also that below this "More Information" link is a map of the U.S. which gives the location of all the upper air sounding stations in the United States. You can click on the station identifier on this map and go directly to that station's SkewT-ln p plot.

DATA SHEET**I. NEXRAD**

Can Chicago be seen on the long range scan from the Wilmington, OH radar? _____

What dBZ corresponds to the color yellow in radar reflectivity? _____

What dBZ value typically represent light rain? _____

What is the range of the WSR-88D for detecting precipitation? _____

II. Greene County Tornadoes

On which date did the famous Xenia Tornado hit? _____

What number of people were killed? _____ Injured? _____

What was the length and width of the Xenia Tornado path? _____

III. WXP Product update frequency

Every hour at _____	Surface data
Every hour at _____	Radar data
Every hour at _____	Satellite data
2 times daily at _____	Upper air data
2 times daily at _____	NAM model data
2 times daily at _____	NAM MOS data
1 time daily at _____	GFS MOS data
2 times daily at _____	GFS model data
2 times daily at _____	Archive data
_____	Hurricane data
1 time daily at _____	ECMWF model data

IV. Midwest Data Plot

On this plot how many stations are represented in Ohio? _____

Does North Dakota show up on this map? _____

V. Contour Plots

On the temperature contour plot the maze color lies between yellow and orange. What is the value of the isotherm corresponding to the edge between yellow and maze?

How many contour products are available on this page? _____

Terminator on the visible GOES image

What is the GMT time recorded on the upper right of the image when you clearly see a terminator? _____

What is fundamentally different about the visible and infrared images at this time and explain why this difference exists?

VI. NAM Forecast Plots

What do the 4 panels of the 4 panel forecast plot represent?

Upper left _____ Upper right _____

Lower left _____ Lower right _____

What precipitation range is represented by the color yellow on the forecast plots? _____

VII. Upper Air Data

What is the station identifier and number for Wilmington, OH? _____

What colors are used for the following lines on the Skew T-ln p?

Pressure _____ Temperature _____

Mixing ratio _____ Dry adiabat _____

Wet adiabat _____