

## Lab: Isobar Maps

### Introduction

Air pressure is determined by the weight of the overlying air and it varies from place to place and over time. Pressure variations bring about air motions that set the stage for much of the weather we experience. Knowing patterns of pressure across the country is basic to understanding what the weather is and what it is likely to be wherever you live.

Air pressures routinely reported on surface weather maps are values "corrected" to sea level. That is air pressure readings are adjusted to what they would be if the reporting station were actually at sea level. Adjustment of air pressure readings to the same elevation (sea-level) removes the influence of Earth's topography on air pressure readings. This adjustment allows comparisons of horizontal pressure differences that can lead to the recognition of pressure patterns. The patterns are made easily visible with the help of isobar maps. Isobars are lines that connect points of equal air pressure. The maps outline centers of high and low pressure which have a major influence on the weather.

Objectives: After completing this activity, you should be able to

- Draw lines of equal pressure (isobars) to show the pattern of surface air pressures across the nation at the time of the map.
- Locate regions of relatively high and low air pressures on the same surface map.
- Locate regions on the surface map exhibiting relatively large air pressure changes over short horizontal distances and broad areas with gradually varying air pressure.

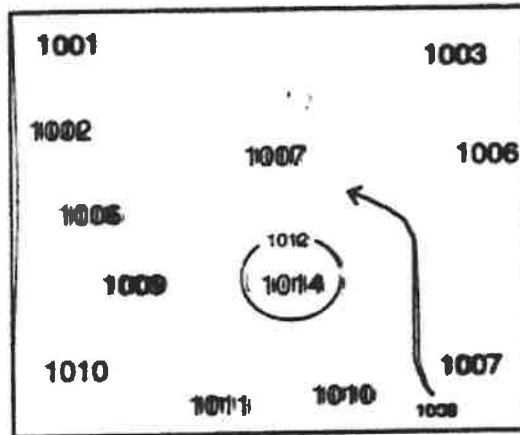
### 10 Rules for Drawing Isobars

1. Always draw isobars so that air pressure readings greater than the isobar value are consistently on one side of the isobar and lower values are on the other side.
2. Isobars intervals are always a multiple of 4 (with 1000 mb as the reference starting point) such as ... 992, 996, 1000, 1004, 1008, 1012, ...
3. When positioning isobars, assume a steady pressure change between neighboring stations. For example, a 1012 mb isobar would be drawn between 1013 and 1010, but a little closer to 1013 than 1010. It would be drawn in the middle between 1014 and 1010 values.
4. Adjacent isobars tend to look alike. The isobar you are drawing will generally parallel the curves of its neighbors because horizontal changes in air pressure from place to place are usually gradual.
5. Continue drawing an isobar until it reaches a boundary of the plotted data or returns back to its starting point to form a loop.
6. Isobars never stop in the middle of a map.
7. Isobars never split. They also never cross nor touch other isobars.
8. Isobars cannot be skipped if their values fall within the range of air pressures reported on the map. Isobars must always appear in sequence; for example, there must always be a 1000-mb isobar between 996-mb and 1004-mb isobars.
9. Always label isobars.
10. Isobars that go through a station of the same value should pass through the center of the number.

## Procedures:

### Part I. Drawing an Isobar Map as a Class

- The small surface map below shows air pressure in millibar (mb) at various locations. Each number centers on the location (a weather recording station) it represents. A 1012 isobar has been drawn around the station labeled 1014. By agreement, isobars on surface weather maps are usually drawn using the same interval (the difference in air pressure value from one isobar to the next isobar). This interval is 4 mb. Isobars that are drawn on surface weather maps follow a sequence of values that can be found by adding or subtracting 4 from 1000. Each succeeding isobar is a multiple of 4 from then on. Examples of isobar values are 988, 992, 996, 1000, 1004, 1008, 1012, 1016, 1020, 1024, 1028, 1032, ... Notice all values are multiples of 4. The conventional rules for drawing isobars are listed on the first page.



- To draw isobars, find the highest or lowest air pressure value on the map. If you chose the highest value, then your highest isobar will be the one that is closest to, but not exceeding the highest air pressure value. The 1012 isobar was chosen because the highest air pressure reading on the map was 1014. Notice on the map that the 1012 isobar encircles the 1014 pressure value. The 1012 isobar could not be drawn any other way, because all the other values on the map are below 1012. The isobar cannot go where it would not naturally occur numerically in sequence (Rule # 1). Notice that 1012 was drawn even though there is not a value of 1012 on the map. Remember, when drawing isobars, you cannot skip an interval (Rule # 8).
- Notice that all air pressure readings are lower than 1014. Therefore all of the other isobars we draw will be lower. The next lower isobar after 1012 is the 1008 isobar. This isobar has been started for you. Try to complete the isobar. As you draw the line remember the above rules for drawing isobars.
- The letter "H" or "L" are used to mark the center of High and Low-pressure areas. On the map the pressure inside the 1012 isobar is higher than the pressure outside the isobar. **Place an H in the center of the 1012 circle.**
- A High pressure system is one that has its highest pressure in the center and pressure decreases outward in all directions. A Low pressure system is one that has its lowest pressure in the center and pressure increase outward in all directions.

### Part II. Drawing Isobars on a Real Surface Air Pressure Map

- On the attached page is a complete surface air pressure map for the U.S. It is dated 1800Z 19 SEP 96. The 1800 represents 18 hundred hours (military time) which equals 6 pm. Zero hundred hours is midnight (12 am). The Z is short for Universal Standard Time which is based on the time in Greenwich, England (0° Longitude). Greenwich is 5 hours later than Eastern Standard Time in the U.S. (our time zone) So if you subtract 5 from 18 you get 1300 hours or 1:00 pm for the eastern U.S. The 19 SEP 96 means September 19, 1996.
- Find the lowest air pressure value. **Write the value in the space above the map.** Do the same for the highest pressure value on the map. In the space between the high and low write all the standard isobar values (such as 1004, 1008, 1012, etc) that fall numerically between these the lowest and highest pressure values. These are the isobars values that you will need to draw on the map. The lowest isobars (1008, 1012, 1016) have already been drawn.
- Notice that the 1012 isobar is drawn twice. The reason for this is that the 1012 isobar that forms the loop around Kansas, cannot go south to connect with the 1012's in Texas because you have to go past a 1013 and 1014 mb values. Numerically, 1012 does not fall between 1013 and 1014, right? By comparing your isobar to near by values, helps to direct your path. You cannot wander into areas in which the value of your isobar would not numerically fall in sequence (Rule # 1).

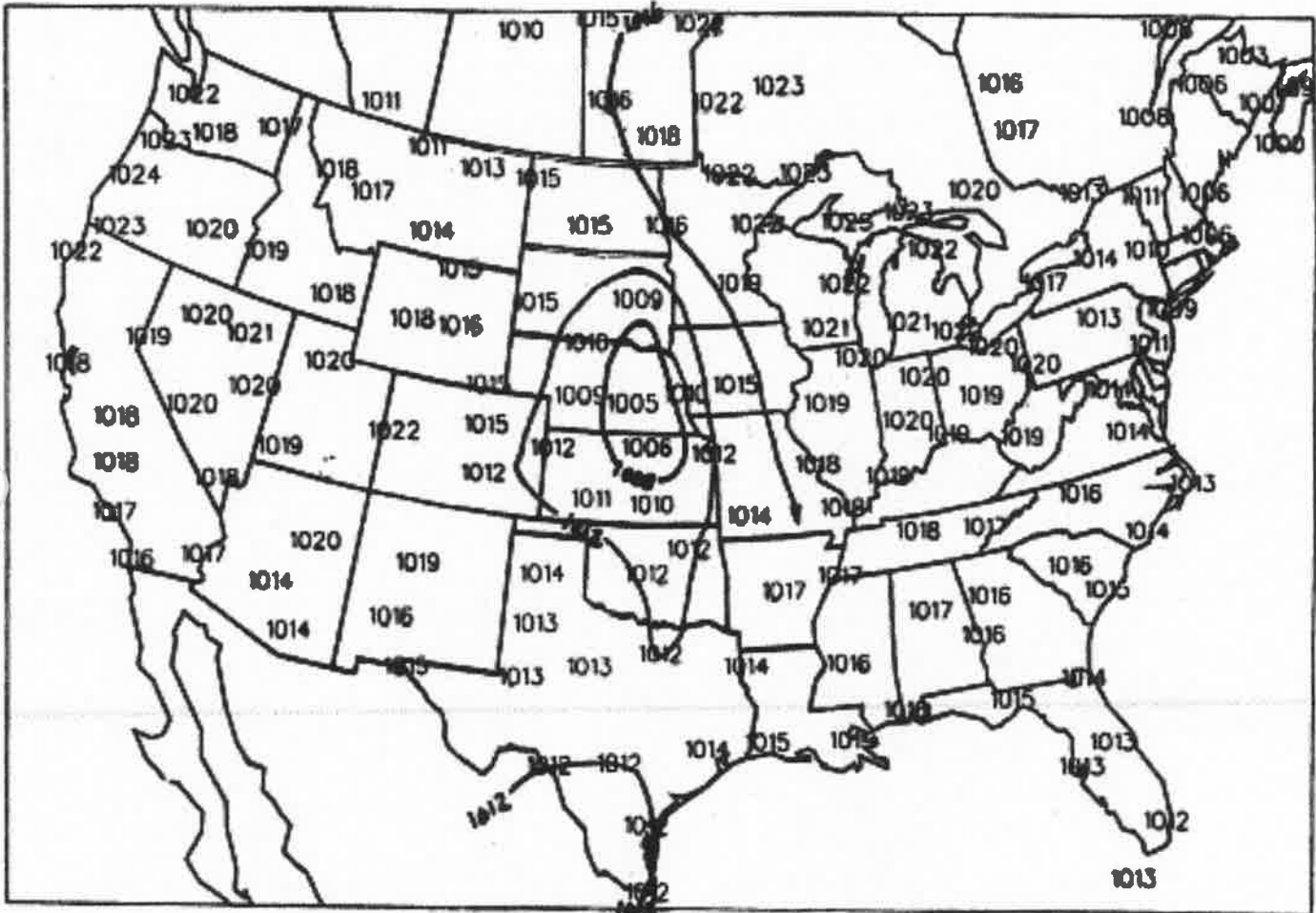
- Complete the isobar map, by continuing where the 1016 isobar stopped.
- Label all isobars.
- When you are done, find the area of lowest pressure. Write an L in the center of the isobars that enclose it. Do the same for the area of highest pressure.
- Now you are ready to do an isobar map all by your self. Don't forget to label your isobars and the center of high and low pressure.

## Part II. Drawing Isobars on a Real Surface Air Pressure Map

Lowest Pressure value

Isobar Values You will Need to Draw

Highest Pressure Value



Plot of Sea level Pressure (mb) for 1800Z 19 SEP 96

## Part III. Current Isobar Map.

- On the last page is an isobar map. I have altered some of the values to make it a bit easier to complete. The same map is on the front and back. The extra map is incase you mess up.
- You are to complete it by yourself as much as possible. If you get stuck holler.
- When you are done, label the centers of High and Low pressure.

## Analysis Questions

### From the Introduction

1. What is the standard interval or spacing between isobars? \_\_\_\_\_
2. Below is a sequence of isobars. Cross out all values that are NOT accepted sequencing for isobars.  
980, 982, 984, 986, 988, 992, 994, 996, 1000, 1004, 1006, 1008, 1010, 1012, 1014, 1016, 1020
3. Read each and state if it is true or false concerning the rules for drawing isobars.
  - a. Isobars are drawn in multiples of 2 mb spacing.
  - b. Isobars must not touch other isobars
  - c. Isobars are not allowed to return to their starting point.
  - d. Adjacent isobars tend to parallel each other.
  - e. Isobars cannot end in the middle of the map.
  - f. Isobars can end at the edge of the map.
  - g. You should draw a 1012 isobar closer to a 1013 mb reading than a 1010 mb reading.
  - h. You only need to label every other isobar on the map.

### From the 03 March 2010 Air Pressure Map. Part III map

1. What time is it in Pottstown at the time of the map? \_\_\_\_\_
2. What is the highest reported air pressure on the map? \_\_\_\_\_ mb
3. What is the lowest reported air pressure on the map? \_\_\_\_\_ mb
4. List the isobars that you used on the map. (Don't forget to label these on the map)
5. There were several areas of low and high pressure on this day (Did you remember to label these areas on the map with an H or L?). For the following areas, indicate whether the minimum or maximum pressure value in that area is a relative Low or High by circling the appropriate choice and list its value in millibars

<u>Area</u>	<u>Pressure Type</u>	<u>Pressure value(mb)</u>
Southern California	High ..... Low	_____
Central East Coast	High ..... Low	_____
Minnesota	High ..... Low	_____

6. What was the air pressure at the Philadelphia station? \_\_\_\_\_
7. What kind of pressure system is dominating our area on this day? \_\_\_\_\_



Part III. Completing a Current Isobar Map (A duplicate in case you make a mistake)

