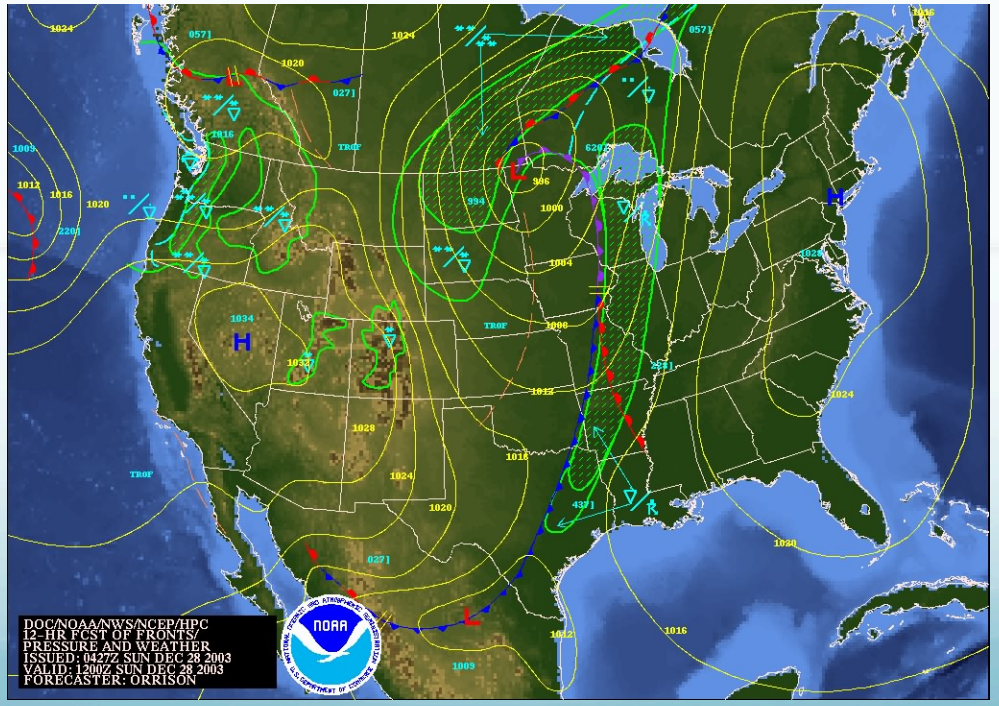
Chapter 3
Weather Maps

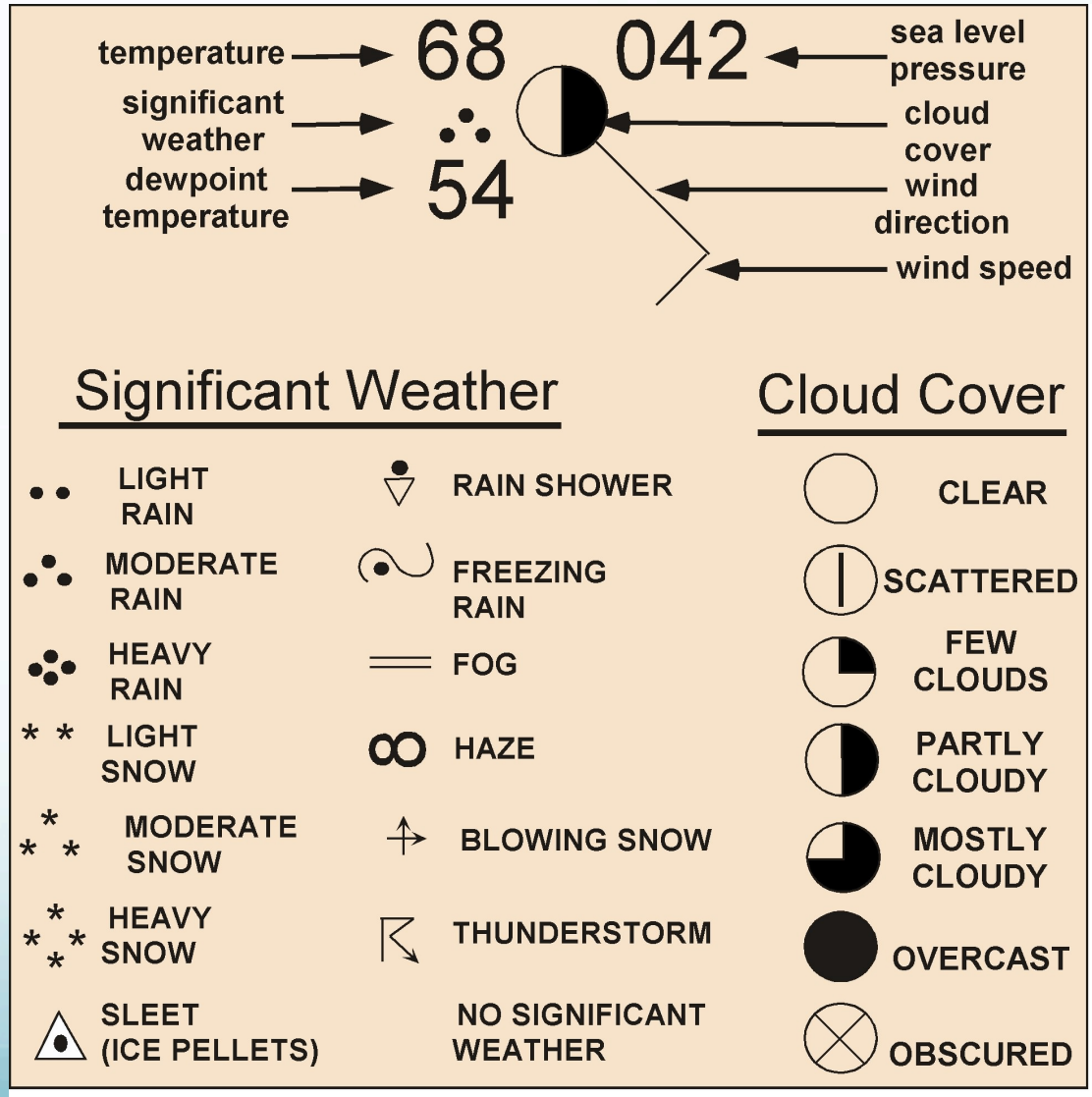


Surface Station Model

Used to plot surface weather observations on weather maps

It shows:

Temperature (**deg F**)
Dewpoint Temperature (**deg F**)
Coded Sea Level Pressure
Wind speed and direction
Cloud cover
Significant Weather

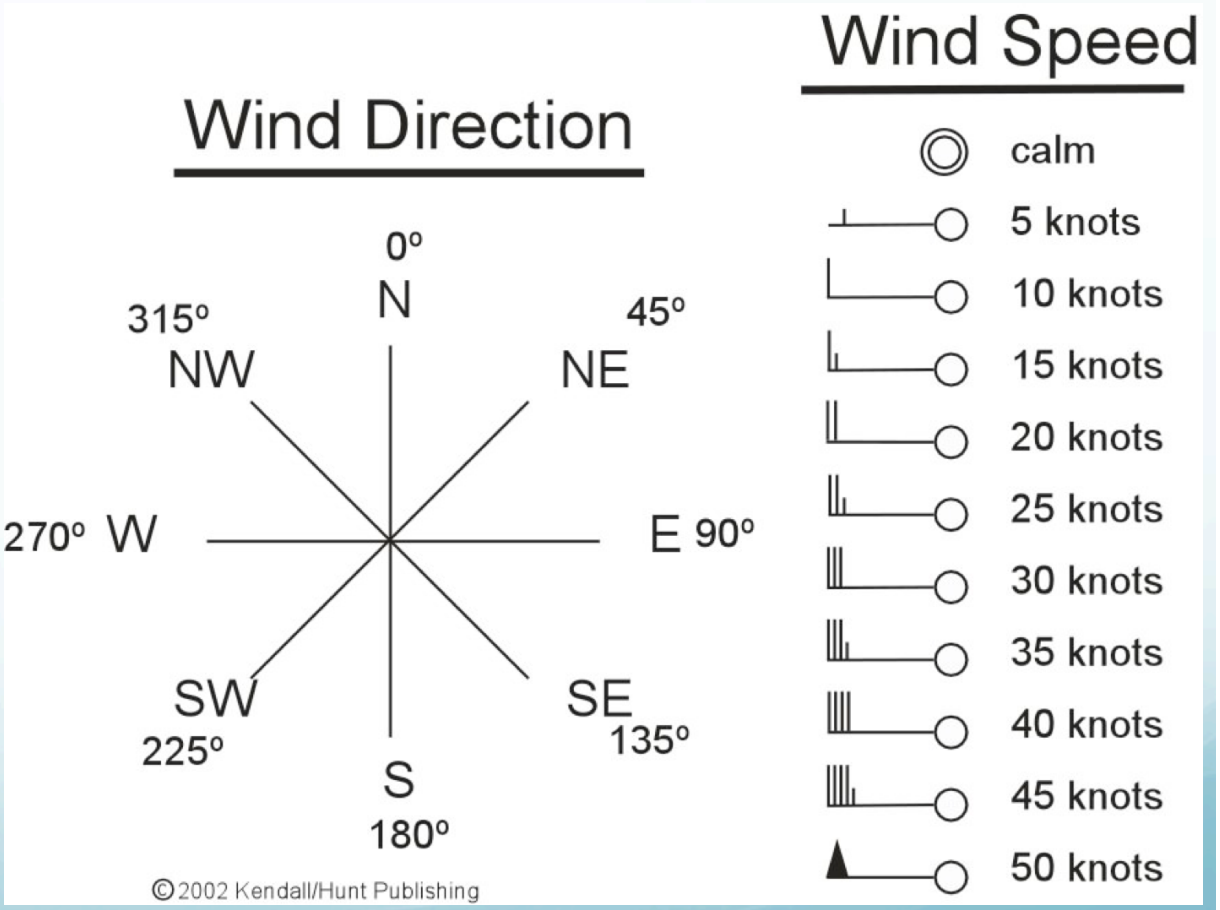


Decoding Sea Level Pressure

- **If coded Sea Level Pressure (SLP) is greater than 500:**
  - Put a 9 in front of the 3 digit coded SLP
  - Insert a decimal point between the last two digits
  - Add units of mb
- Example: coded SLP = 956
  - **Decoded SLP = 995.6 mb**
- **If coded SLP is less than 500:**
  - Put a 10 in front of the 3 digit coded SLP
  - Insert a decimal point between the last two digits
  - Add units of mb
- Example: coded SLP = 052
  - **Decoded SLP = 1005.2 mb**

Reading Wind Speed & Direction

- Recall how meteorologists refer to wind direction?
  - The direction the wind is blowing **from**



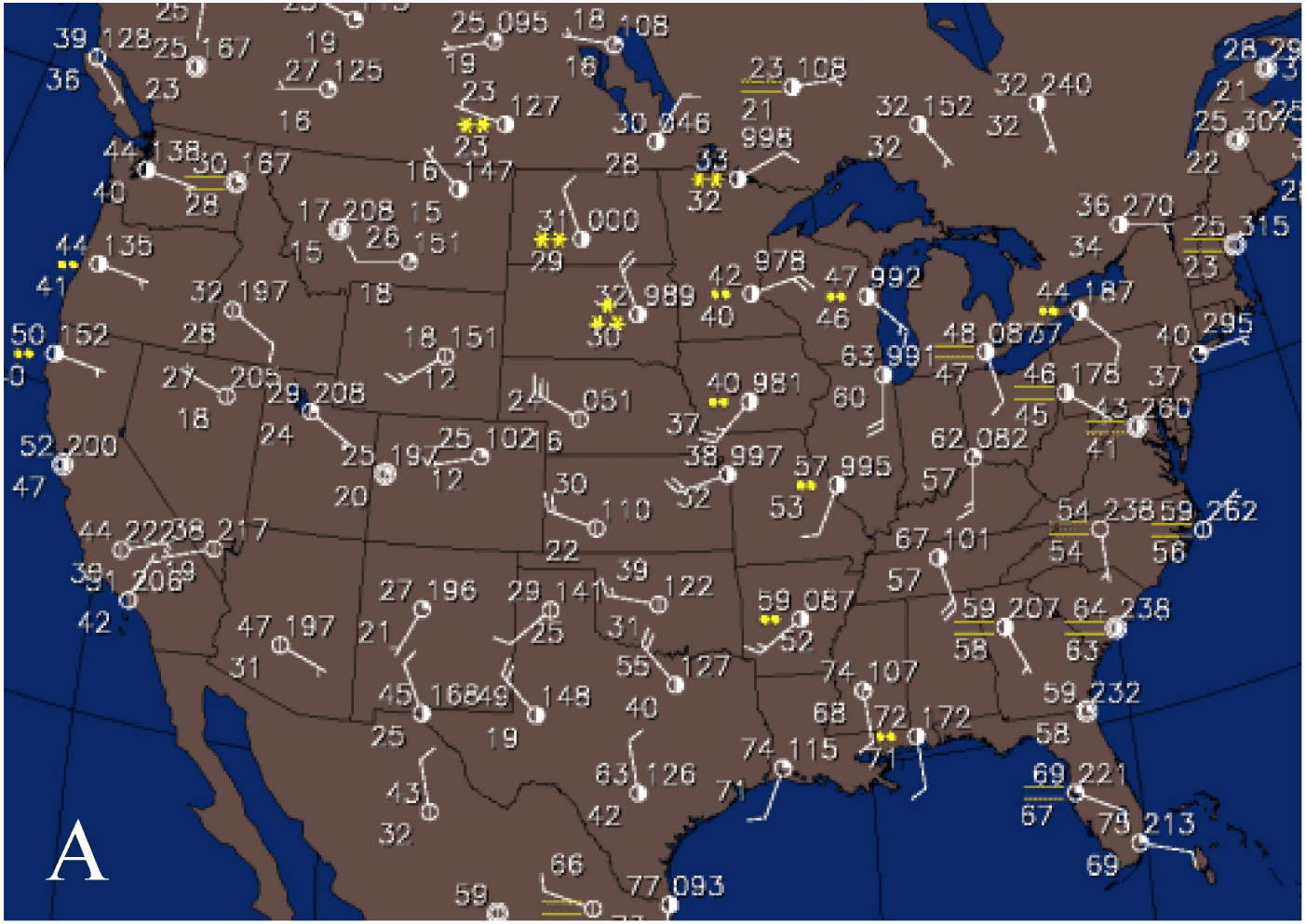
Surface Weather Map

<u>Find a place that:</u>

Is raining
Is snowing
Has clear skies
Has easterly winds
Has calm winds
Has > 20 kt winds
Is warmer than 70F
Has SLP < 1000mb

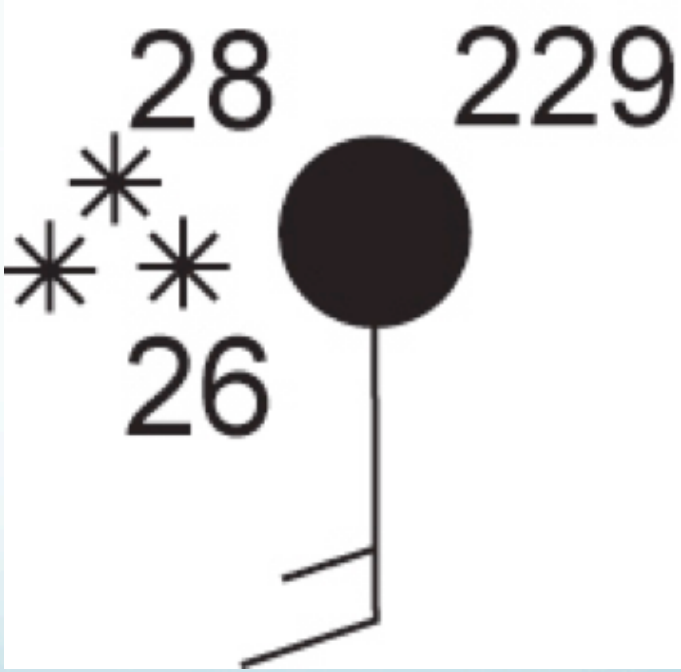
What other weather conditions do we see on this map?

What is the temperature and dew point at these locations?



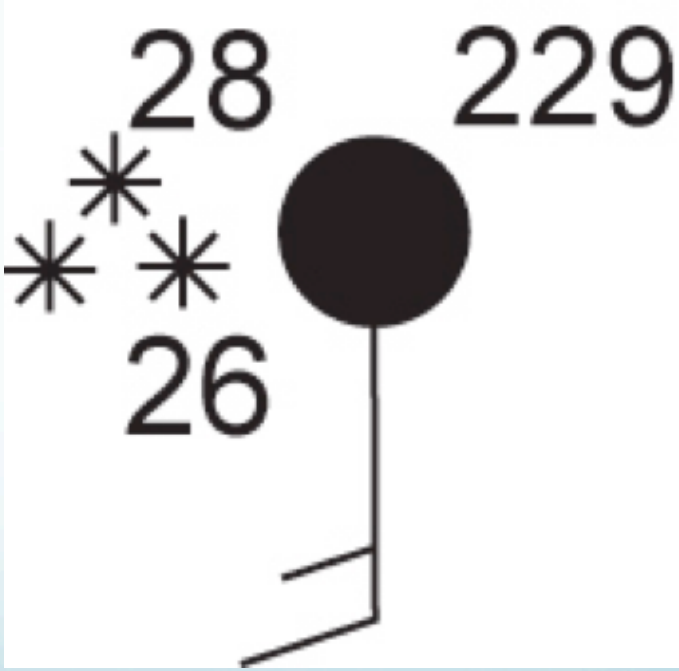
Clicker Question

- Using this surface station model, what is the temperature?
  A. 26 °F
  B. 26 °C
  C. 28 °F
  D. 28 °C
  E. 22.9 °F



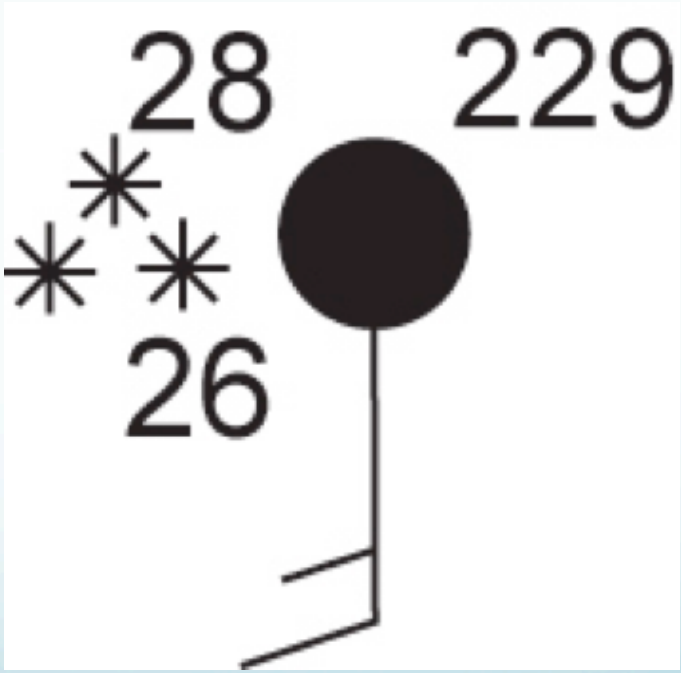
Clicker Question

- Using this surface station model, what is the current sea level pressure?
  A. 28 mb
  B. 26 mb
  C. 229 mb
  D. 1022.9 mb
  E. 922.9 mb



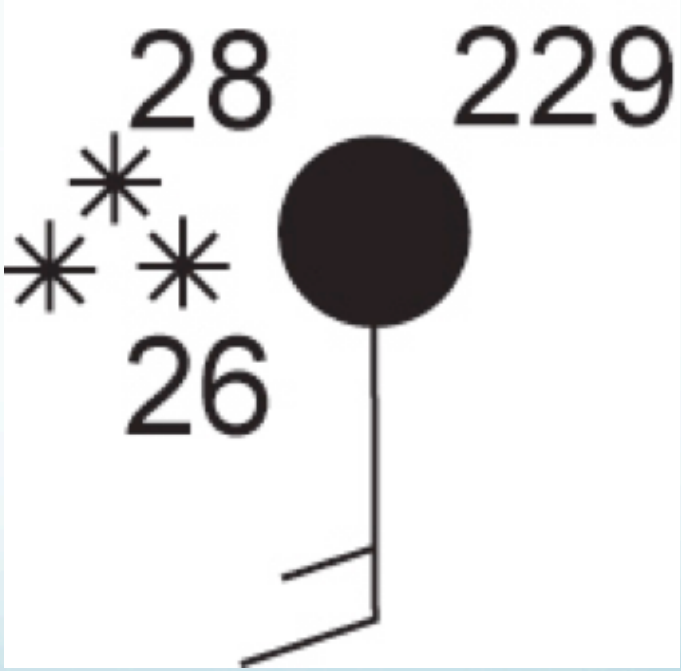
Clicker Question

- Using this surface station model, what is the wind speed?
  A. Calm
  B. 5 kts
  C. 10 kts
  D. 15 kts
  E. 55 kts



Clicker Question

- Using this surface station model, what is the current significant weather?
  A. No signficant weather
  B. Moderate rain
  C. Moderate snow
  D. Moderate hail
  E. Fog



Clicker Question

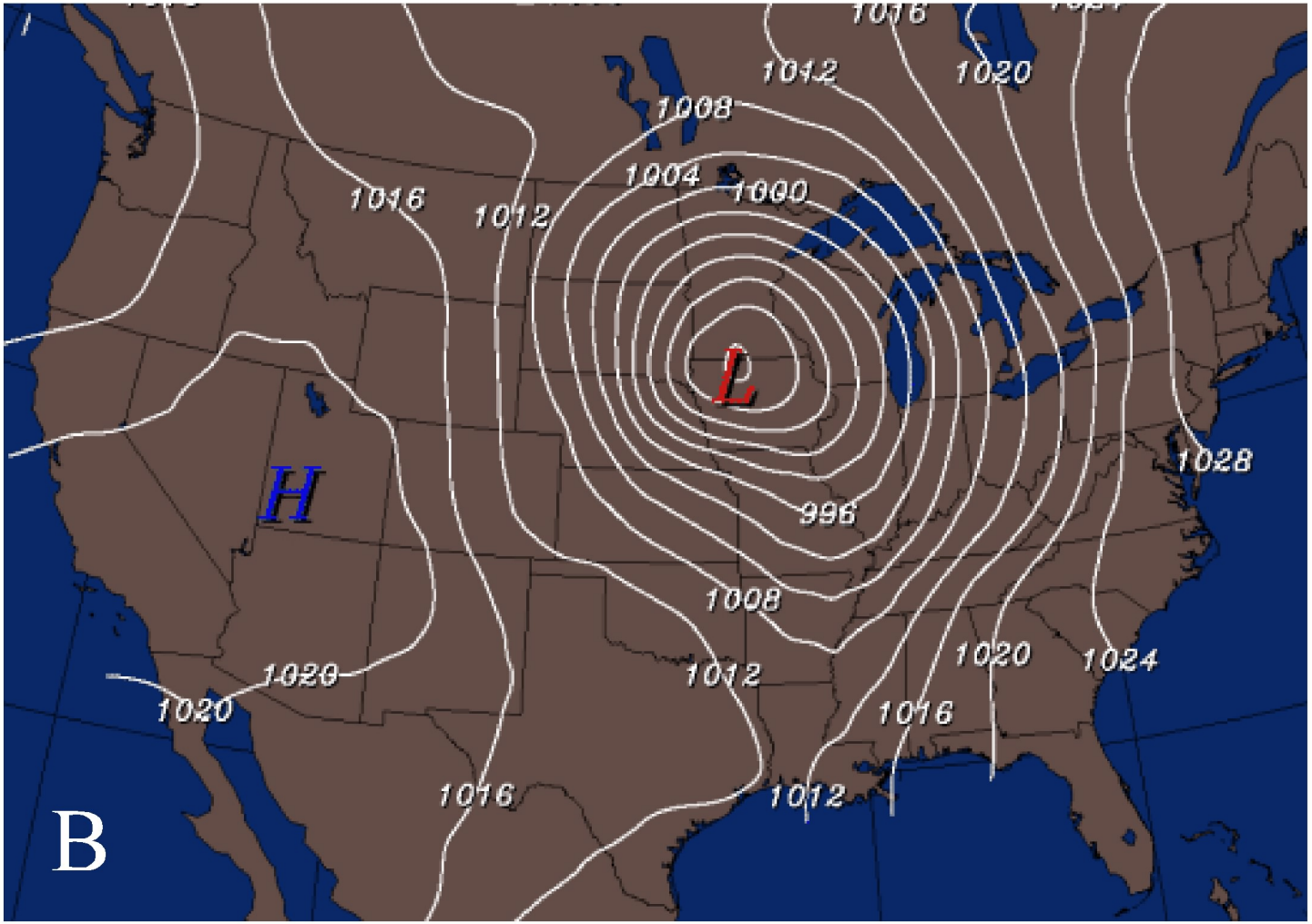
- This symbol  is used on a surface station model to indicate what type of significant weather?
  A. Rain
  B. Fog
  C. Freezing Rain
  D. Heavy Snow
  E. Thunderstorm

Contoured maps

<u>Contouring</u>: draw lines on a map that connect points with equal values

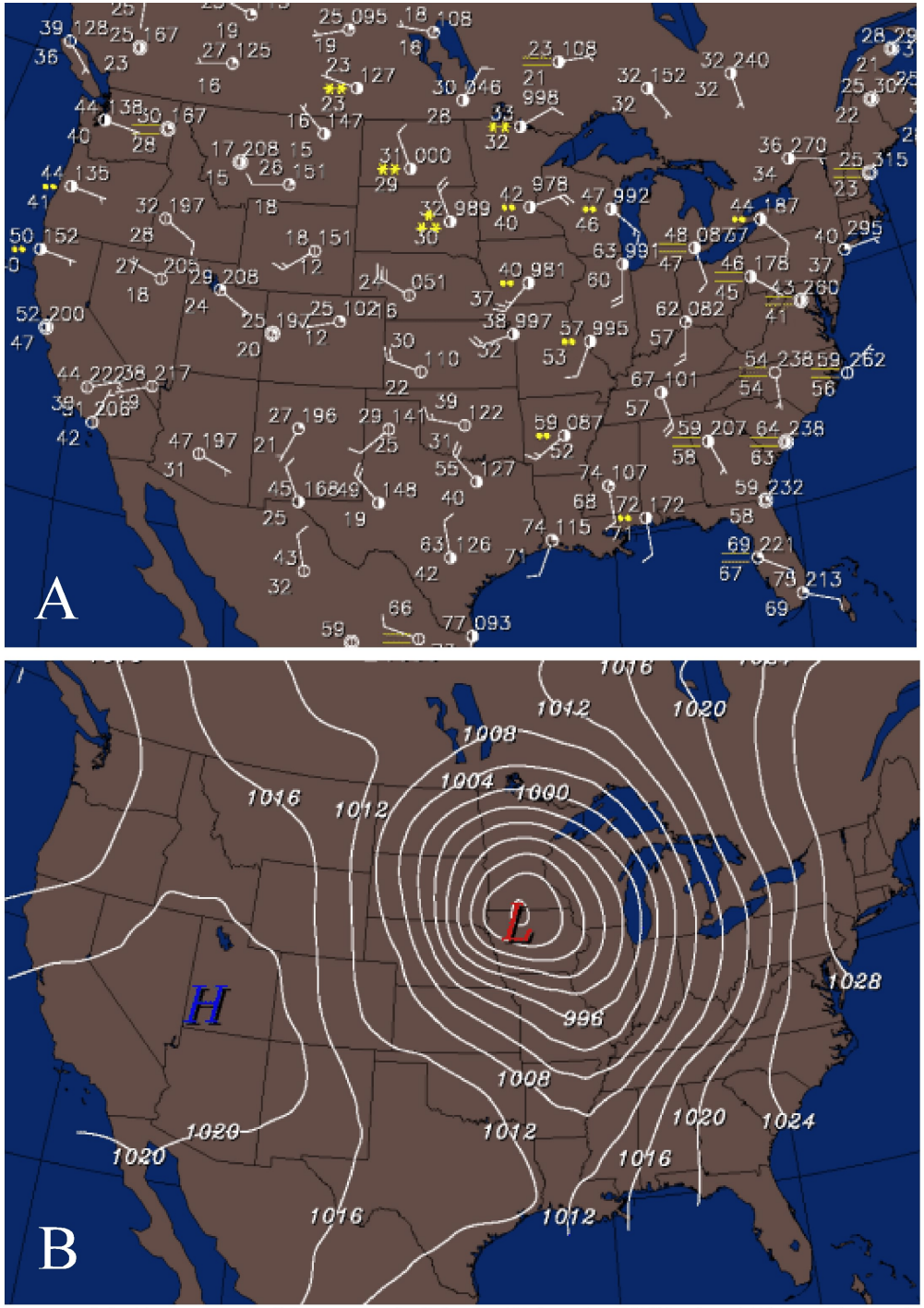
Iso<u>bar</u>: contour line of constant <u>pressure</u>

<u>Pressure gradient:</u> change in pressure over a given distance



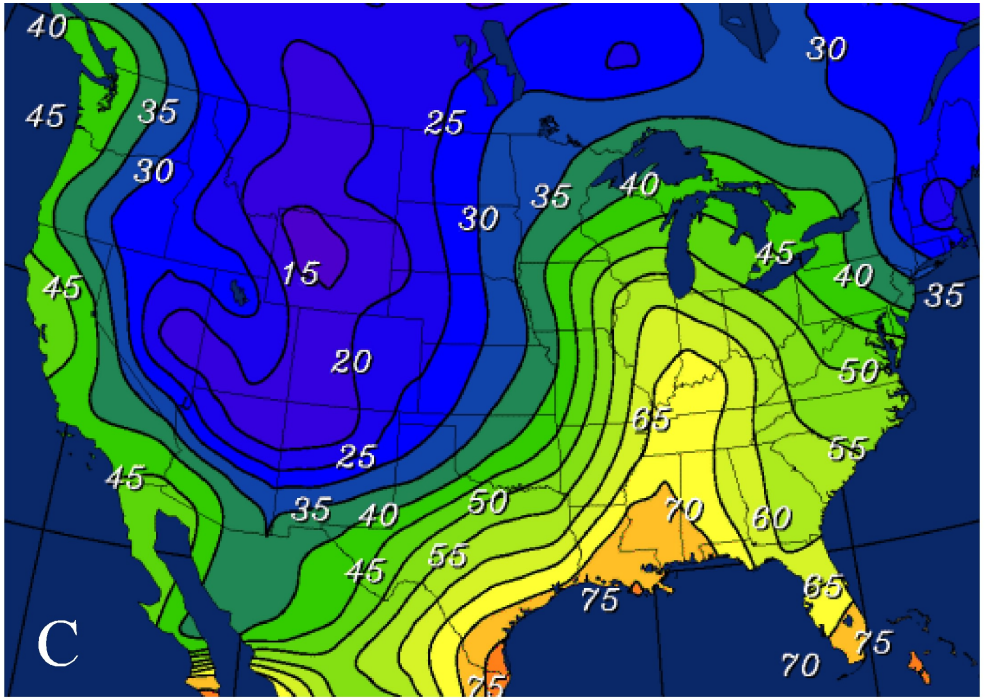
Courtesy of the Department of Atmospheric Science, University of Illinois at Urbana-Champaign

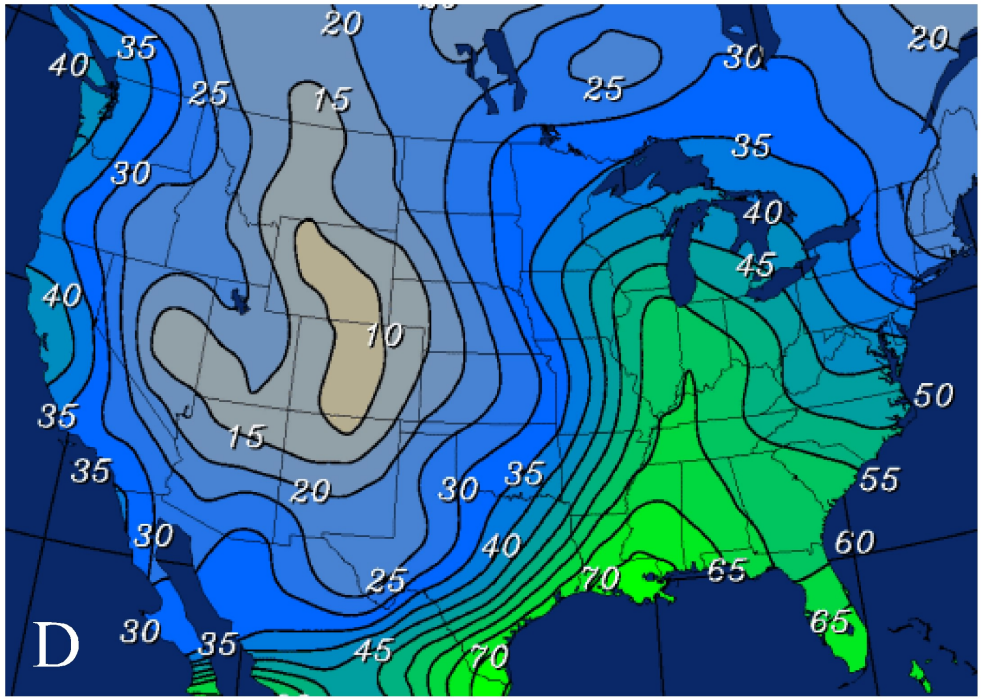
- Is there a relationship between the winds and the pattern of the isobars?
- What type of weather is associated with the higher pressure location?
- What about for the lower pressure region?



Courtesy of the Department of Atmospheric Science, University of Illinois at Urbana-Champaign

- **Isotherms:**
  - Lines of constant temperature
- **Temperature gradient:** change in temperature over a given distance
- **Isodrosotherms**
  - Contour lines of constant dewpoint temperature
- How do the areas of warm temperature compare with dewpoint?





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Clicker Question

- An isobar is a contour line of:
  A. Constant pressure
  B. Constant temperature
  C. Constant dew point temperature
  D. Constant wind speed
  E. Constant wind direction

Clicker Question

- You would expect to find strong winds on a weather map where the pressure gradient is _____, which is also where the isobars are _____.

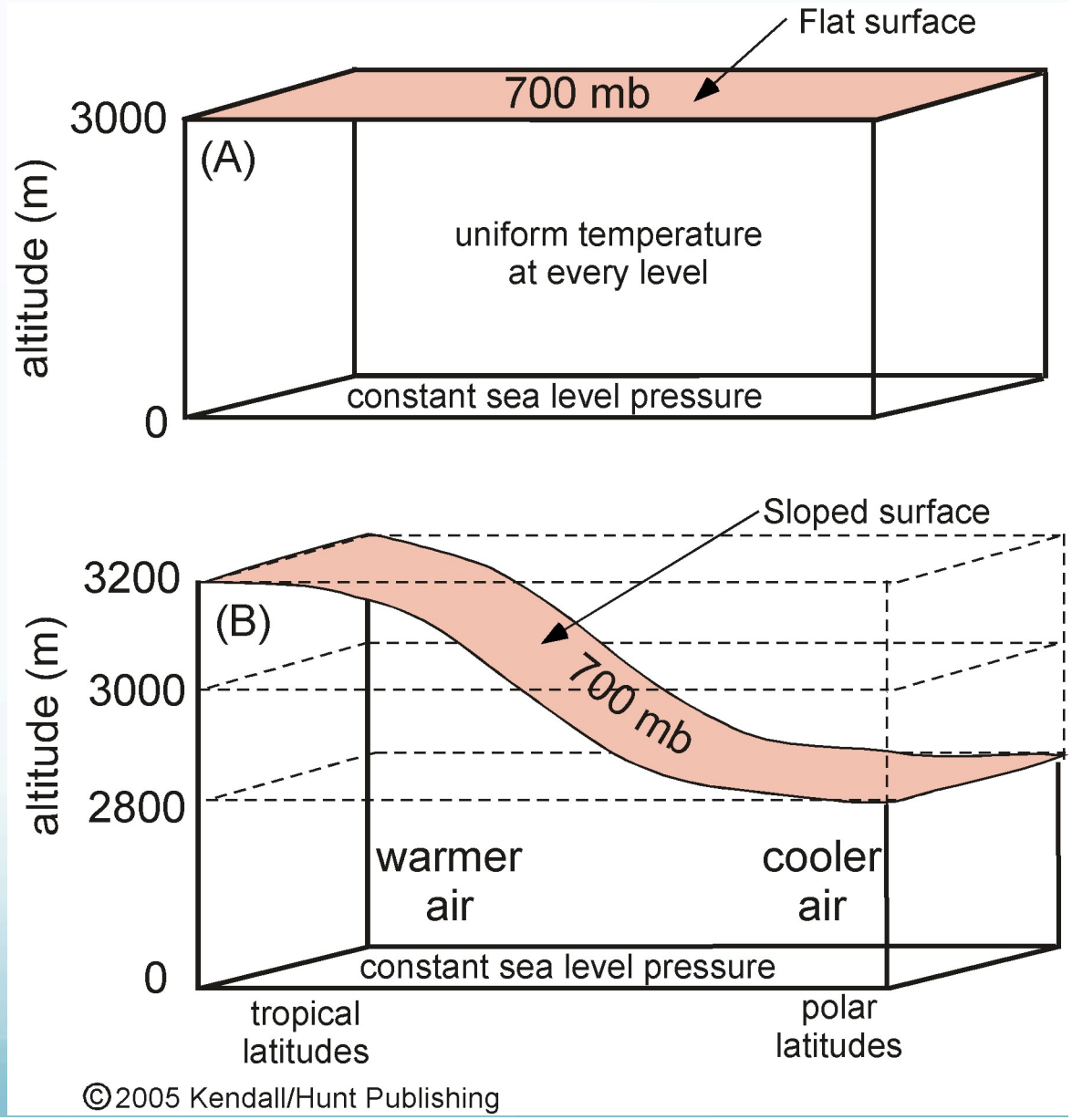
A. Large, spaced far apart
B. Large, spaced close together
C. Small, spaced far apart
D. Small, spaced close together

Pressure as a vertical coordinate

- Typically we use height (altitude) as a vertical coordinate in everyday life.
  - Since pressure always decreases with height, and above any given spot on the earth each height has a unique pressure we can also use pressure as a vertical coordinate.
- Why do meteorologists use pressure as a vertical coordinate?
  - Aviation interests
  - Rawinsondes measure pressure directly
  - The mathematical equations used in meteorology are easier to interpret if pressure is used as a vertical coordinate

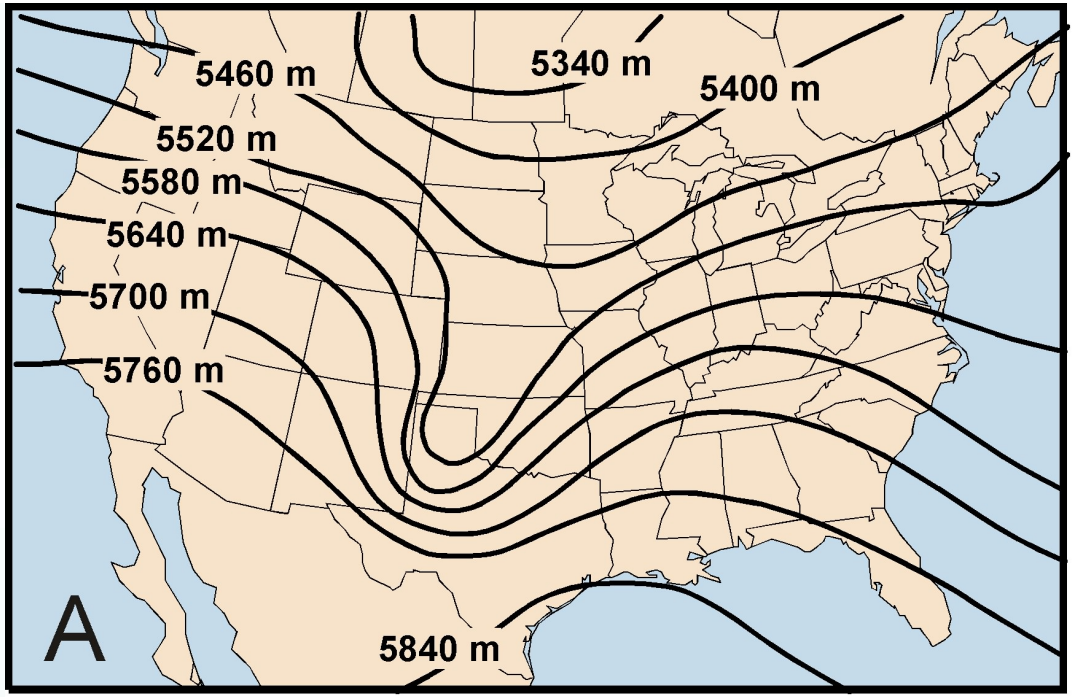
Constant Pressure Maps

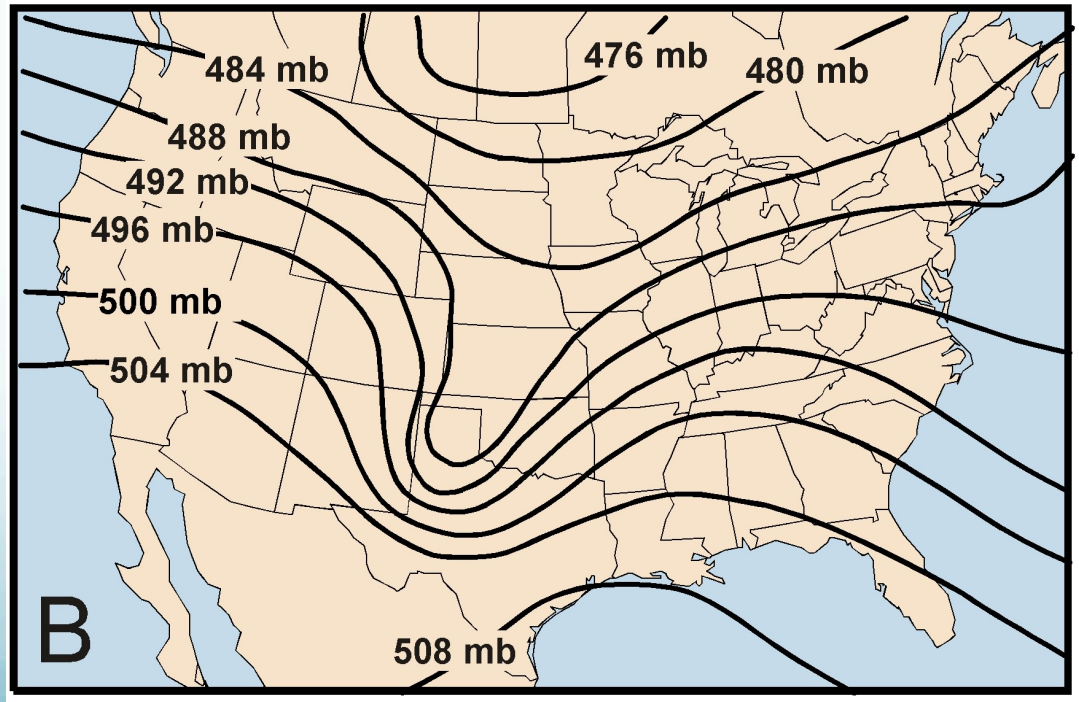
- **Pressure surface**: an imaginary surface above the ground where the pressure has a constant value
- How does the pressure change, at an elevation of 3000 m, as you move from left to right in this figure?
  - Why?
  - Temperature!
  - In general constant pressure surfaces slope downwards from the tropics to the poles.



Constant pressure vs height maps

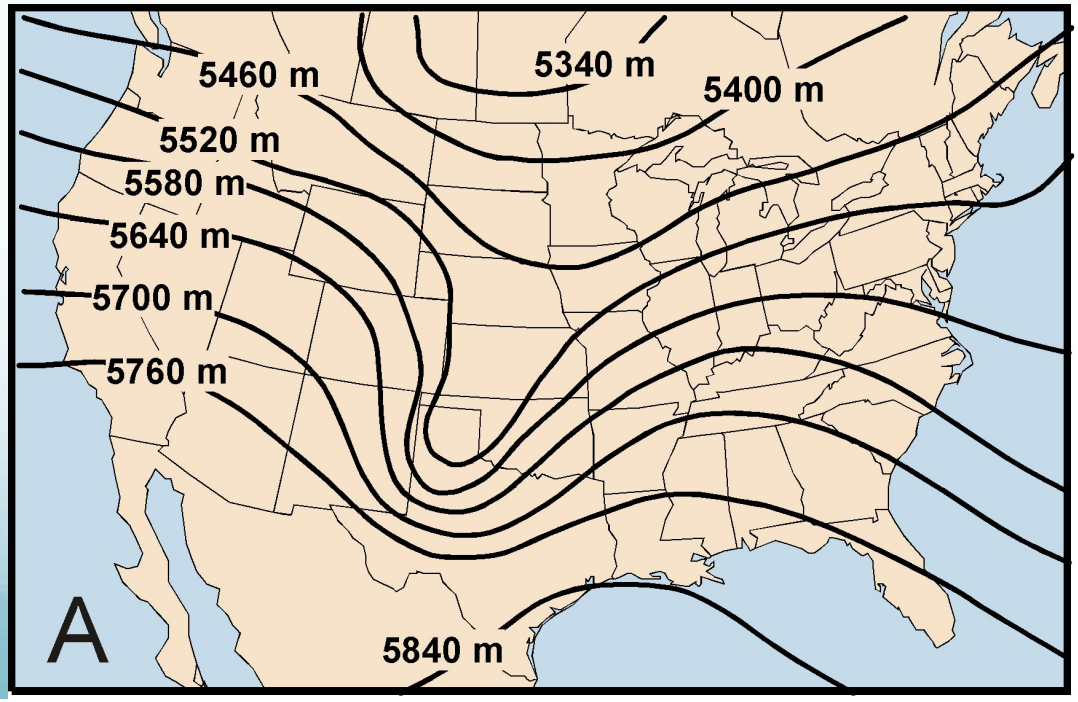
- **Constant Pressure Map**: The contours indicate the height of the constant pressure surface
  - Similar to the way that a topographic map shows the height of the earth's surface.
- **Constant Height Map**: The contours indicate the pressure on the constant height surface.





Meteorologists use constant pressure maps

- Trough – area of low heights on a constant pressure map
- Ridge – area of high heights on a constant pressure map



Common constant pressure maps

- Constant pressure maps are typically available twice per day at 00 and 12 UTC.
- Why are these maps only produced twice per day?
  - They are based on the rawinsonde data

Pressure Level	Approximate Altitude (ft)	Approximate Altitude (km)
850 mb	About 5,000 ft	About 1.5 km
700 mb	About 10,000 ft	About 3.0 km
500 mb	About 18,000 ft	About 5.5 km
300 mb	About 30,000 ft	About 9.0 km
250 mb	About 35,000 ft	About 10.5 km
200 mb	About 39,000 ft	About 12.0 km

Upper Air Station Model

What are the differences between the surface and upper air station model?

Temperature units?

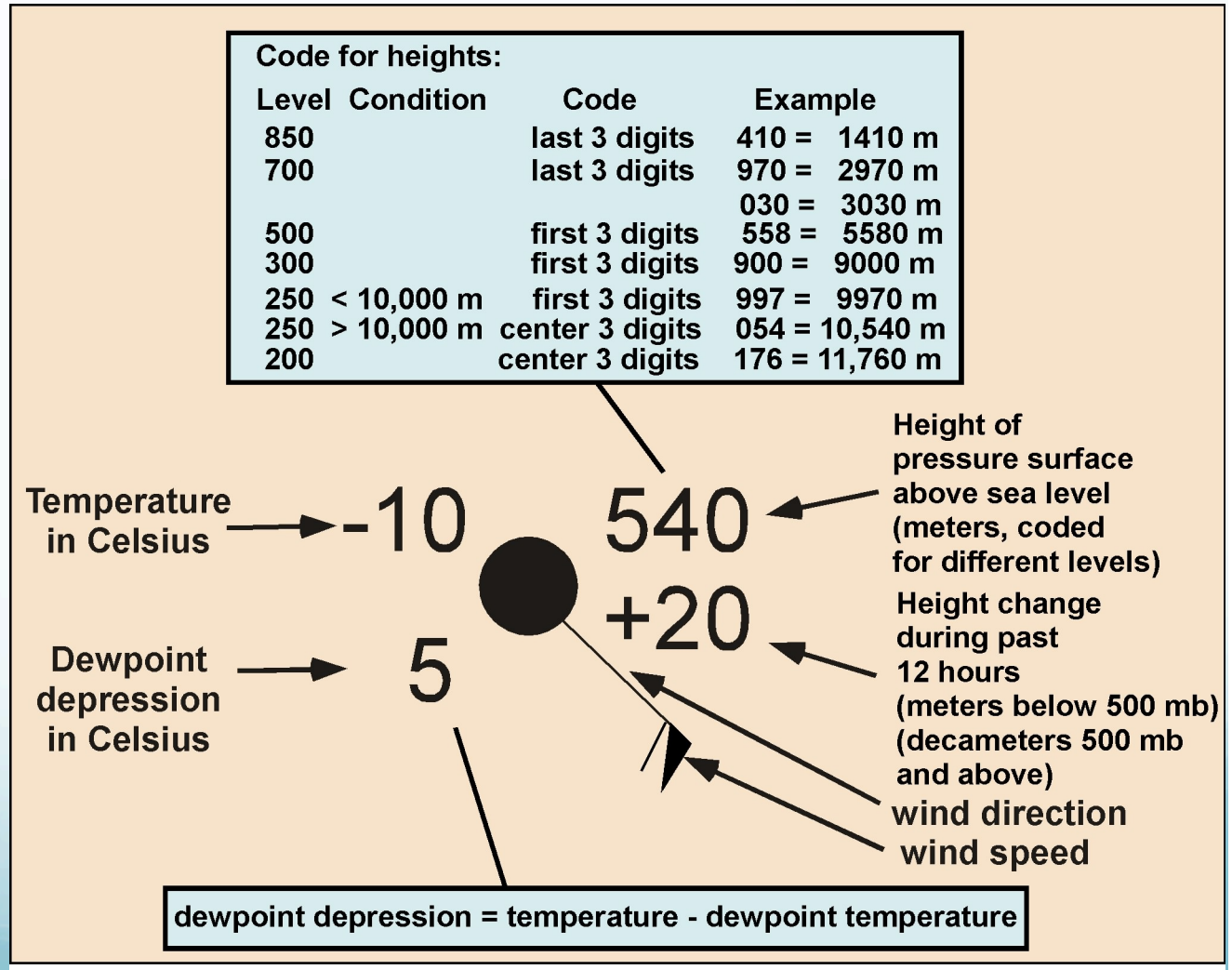
Celsius!

Dew point temperature?

<u>Dew point Depression</u> (in Celsius!)

Pressure?

Height of pressure surface above sea level (in meters!)



Clicker Question

- Using this upper air station model, what is the temperature?
  A. –30 °F
  B. –30 °C
  C. 8 °F
  D. 8 °C
  E. 54.0 °C

Clicker Question

- Using this upper air station model, what is the dew point temperature?
  A. –30 °C
  B. 8 °F
  C. 8 °C
  D. –38 °F
  E. –38 °C

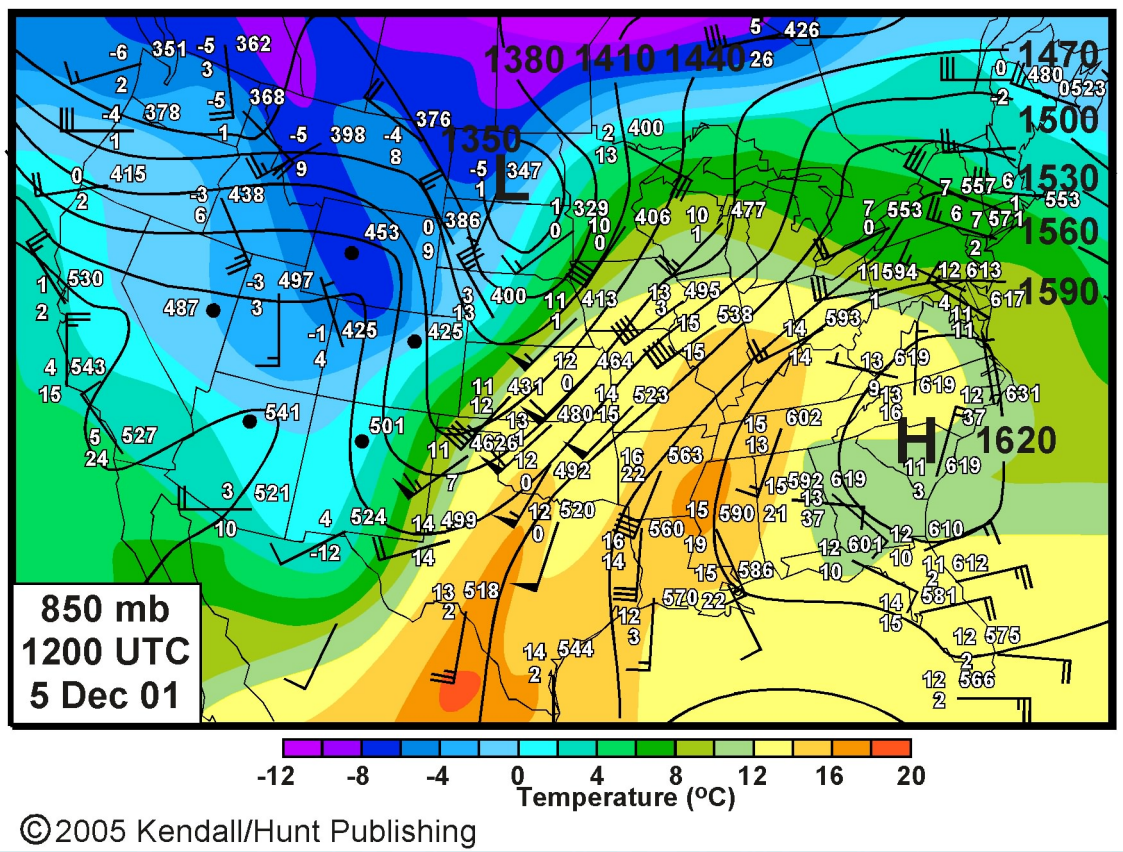
Clicker Question

- Using this upper air station model, what is the wind speed?
  A. 70 kts
  B. 50 kts
  C. 30 kts
  D. 20 kts
  E. Calm

Clicker Question

- Using this upper air station model, what is the wind direction?
  A. Northeast
  B. Southeast
  C. Northwest
  D. Southwest
  E. No direction (Calm)

Ex. 850 mb Weather Map



What data are plotted on this map?

What atmospheric features can we see on this map?

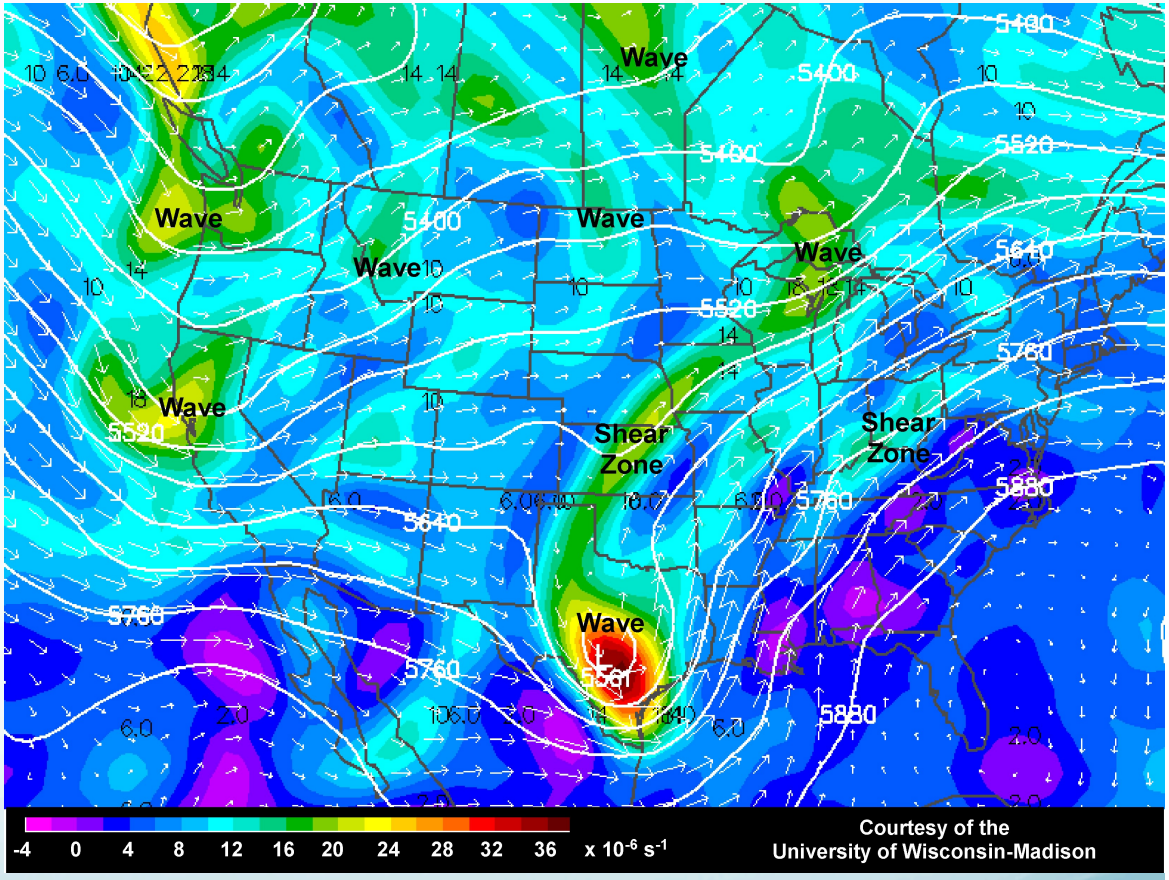
Ex. 500 mb Weather Map

Vorticity: a measure of the local rotation (spin) in a flow

Positive vorticity indicates counterclockwise spin.

Negative vorticity indicates clockwise spin.

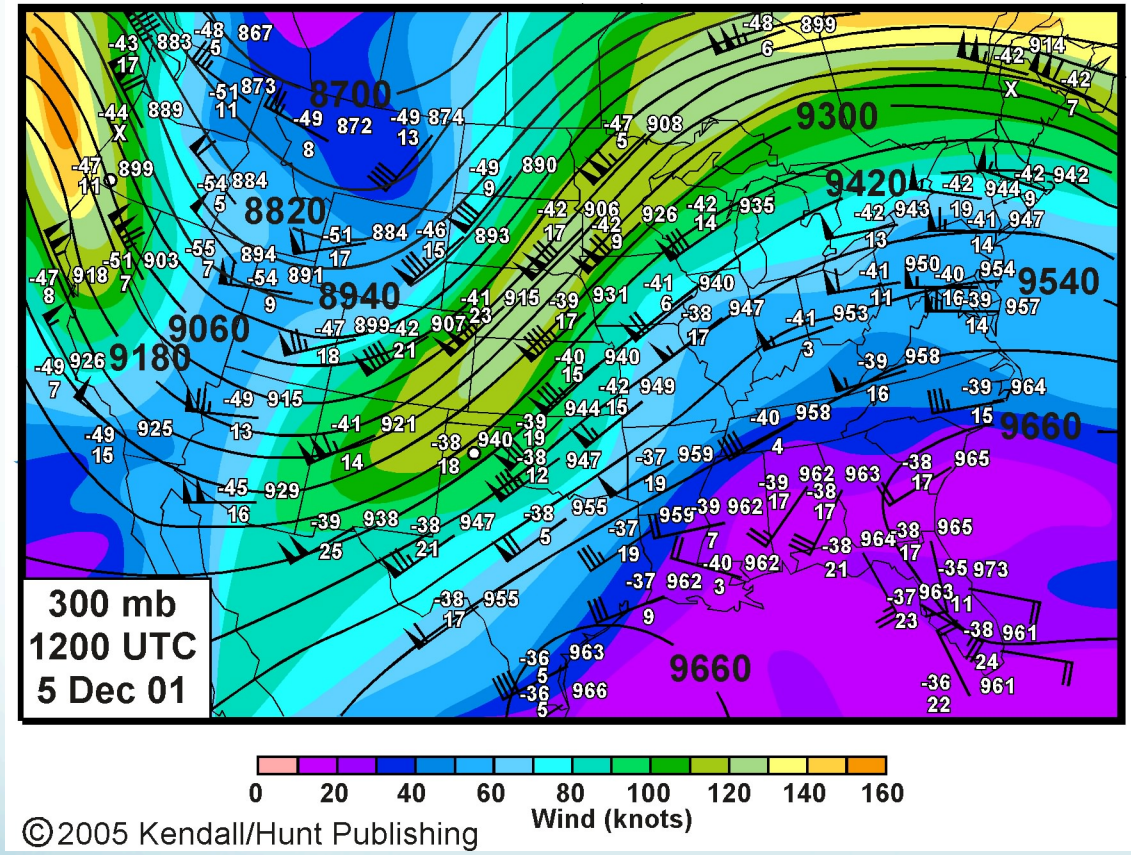
Locate the areas of positive and negative vorticity on this map.



What data are plotted on this map?

What atmospheric features can we see on this map? Longwaves, shortwaves

Ex. 300 mb Weather Map



Isotach: contour line of constant wind speed

Jetstream: band of strong winds that circle the earth at mid-latitudes

Jet Streak: region of exceptionally strong winds embedded in the jetstream

What data are plotted on this map?

What atmospheric features can we see on this map?

Clicker Question

- An area of low heights on a constant pressure map is referred to as a _____.
  A. A ridge
  B. A trough
  C. A jetstreak
  D. A valley

Clicker Question

- What do we use to get the data that is displayed twice a day on upper air weather maps?
  A. Radar
  B. ASOS weather stations
  C. Rawinsondes
  D. Satellite imagery

Clicker Question

- True or false: Isobars are normally shown on constant pressure maps.
  A. True
  B. False