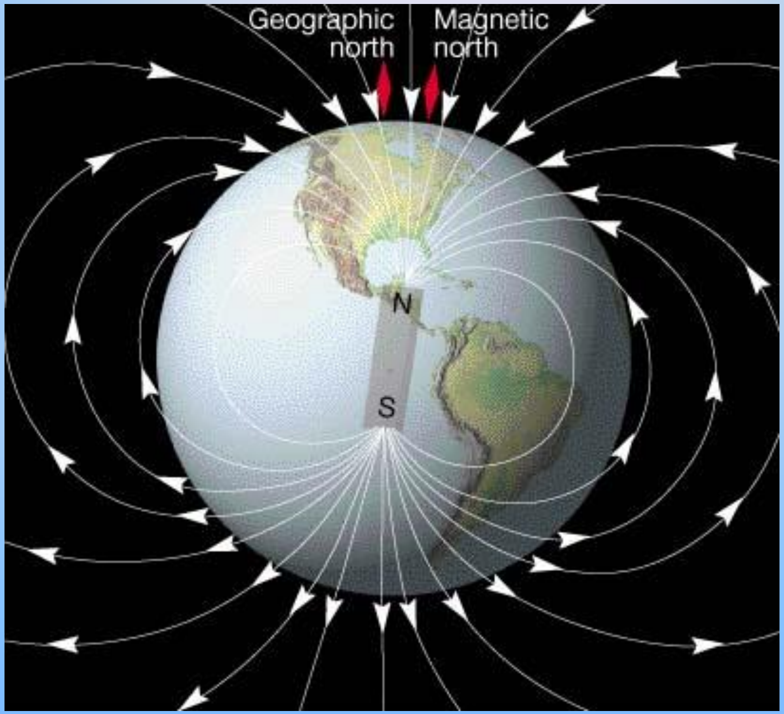
Fields

- No, not these fields.
- We will consider *scientific* fields.

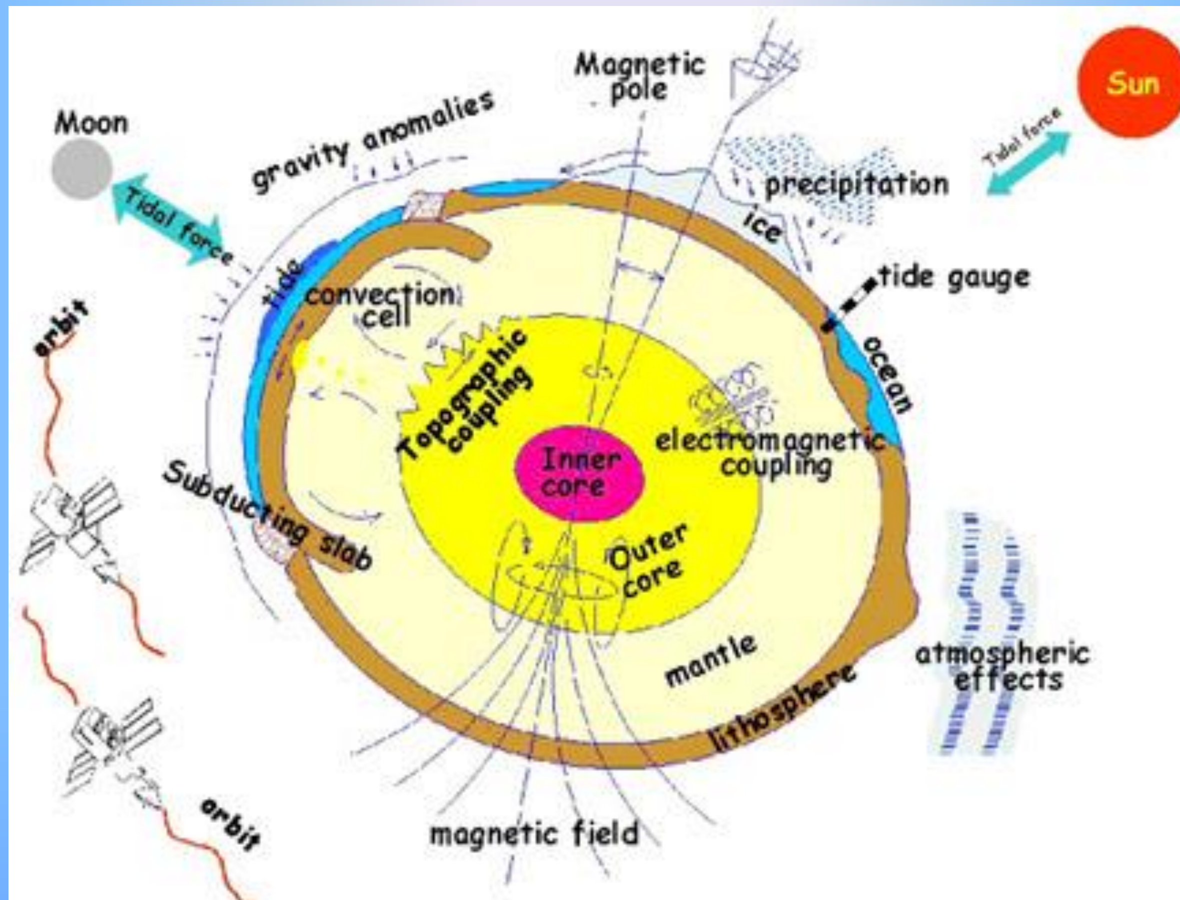
- A **field** is a region ___**space**_______ in which there is a __**quantity**_______ that can be measured at __**every location**_.

A. Examples of Types of Fields



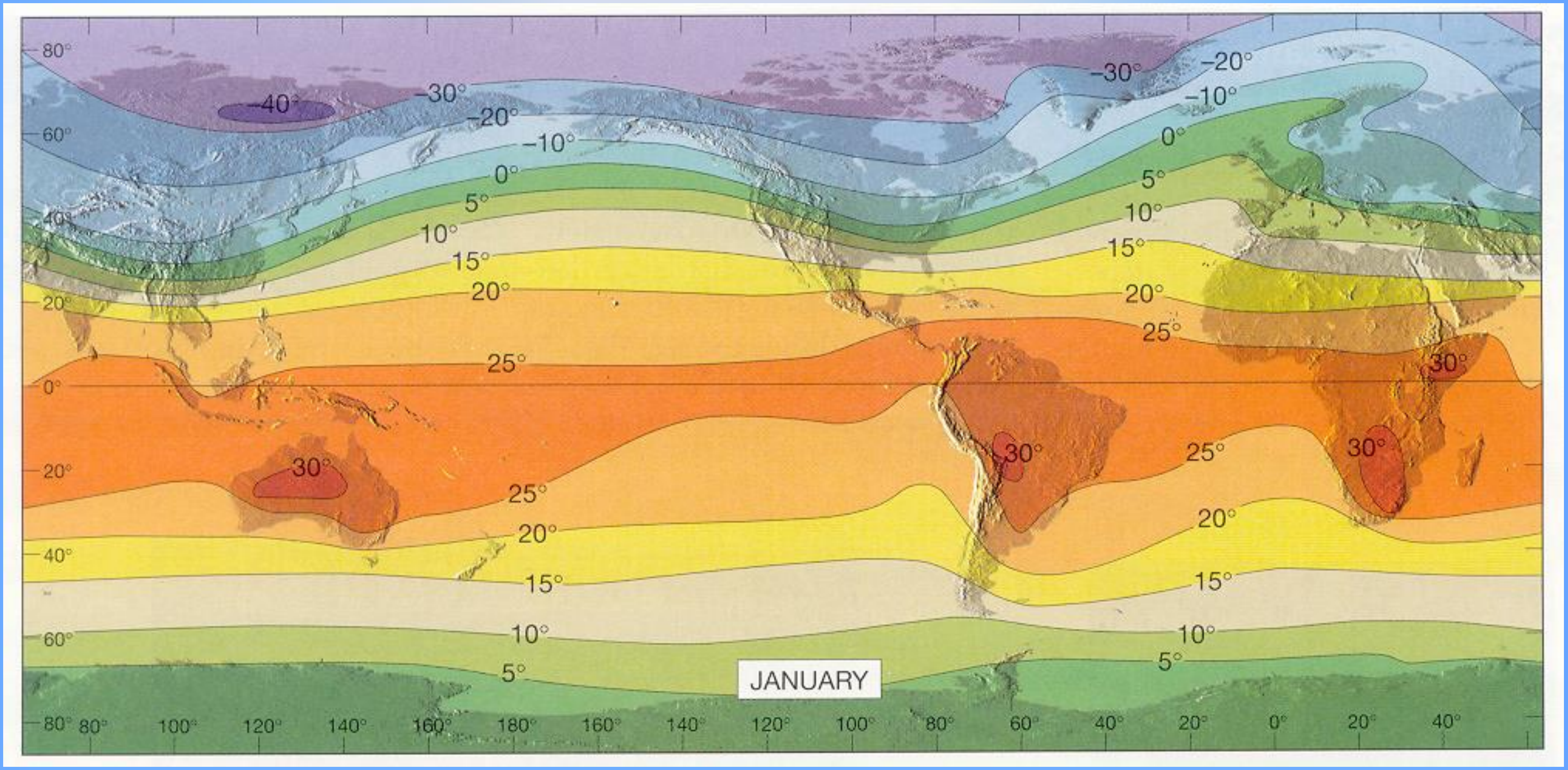
1. Earth's ___**magnetic**___ field – strength varies from place to place, depending on the distance from the Poles.

2. Earth's **gravity** field

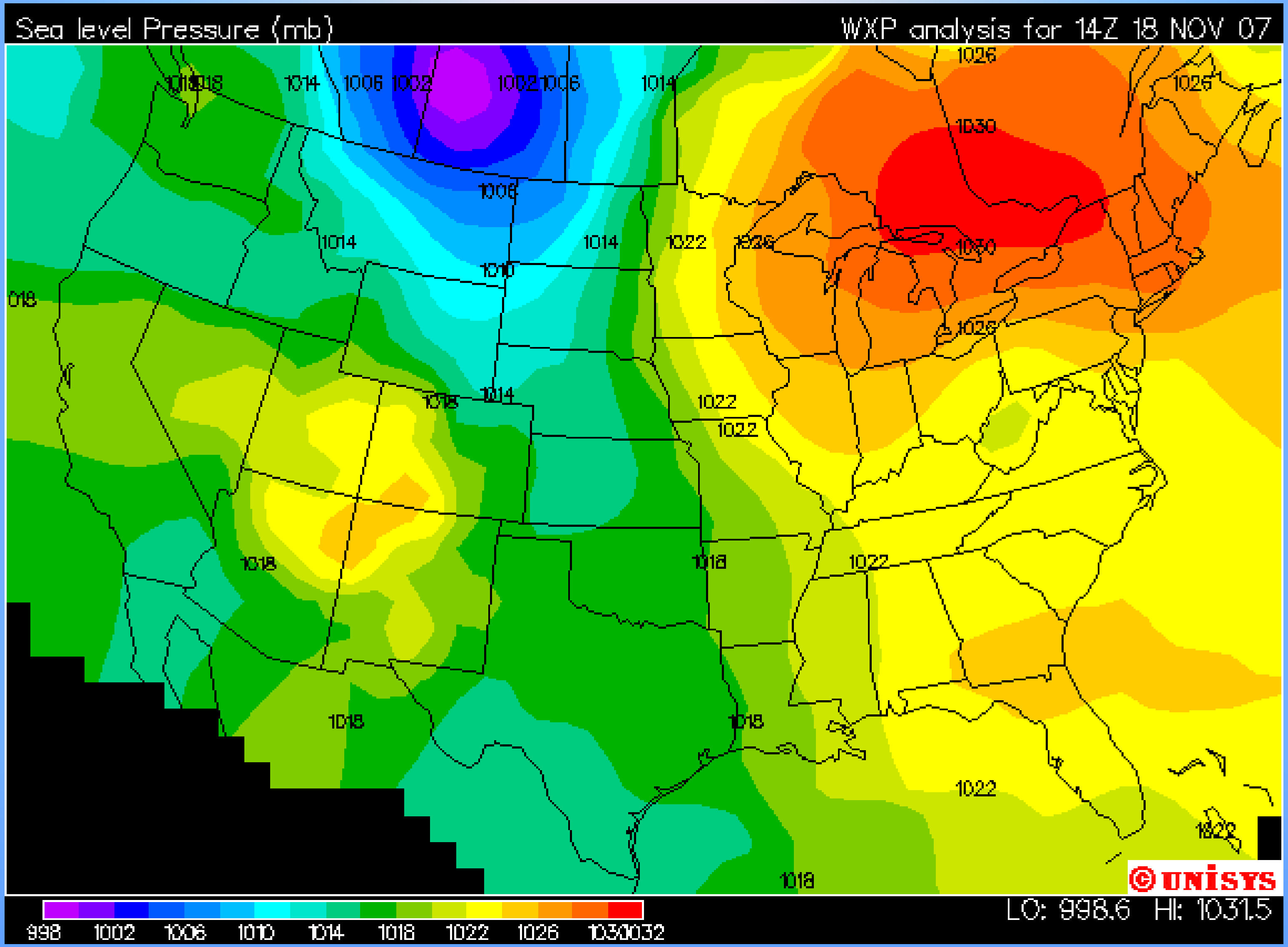


- Objects are attracted Earth with varying force, depending on the distance from the center of Earth

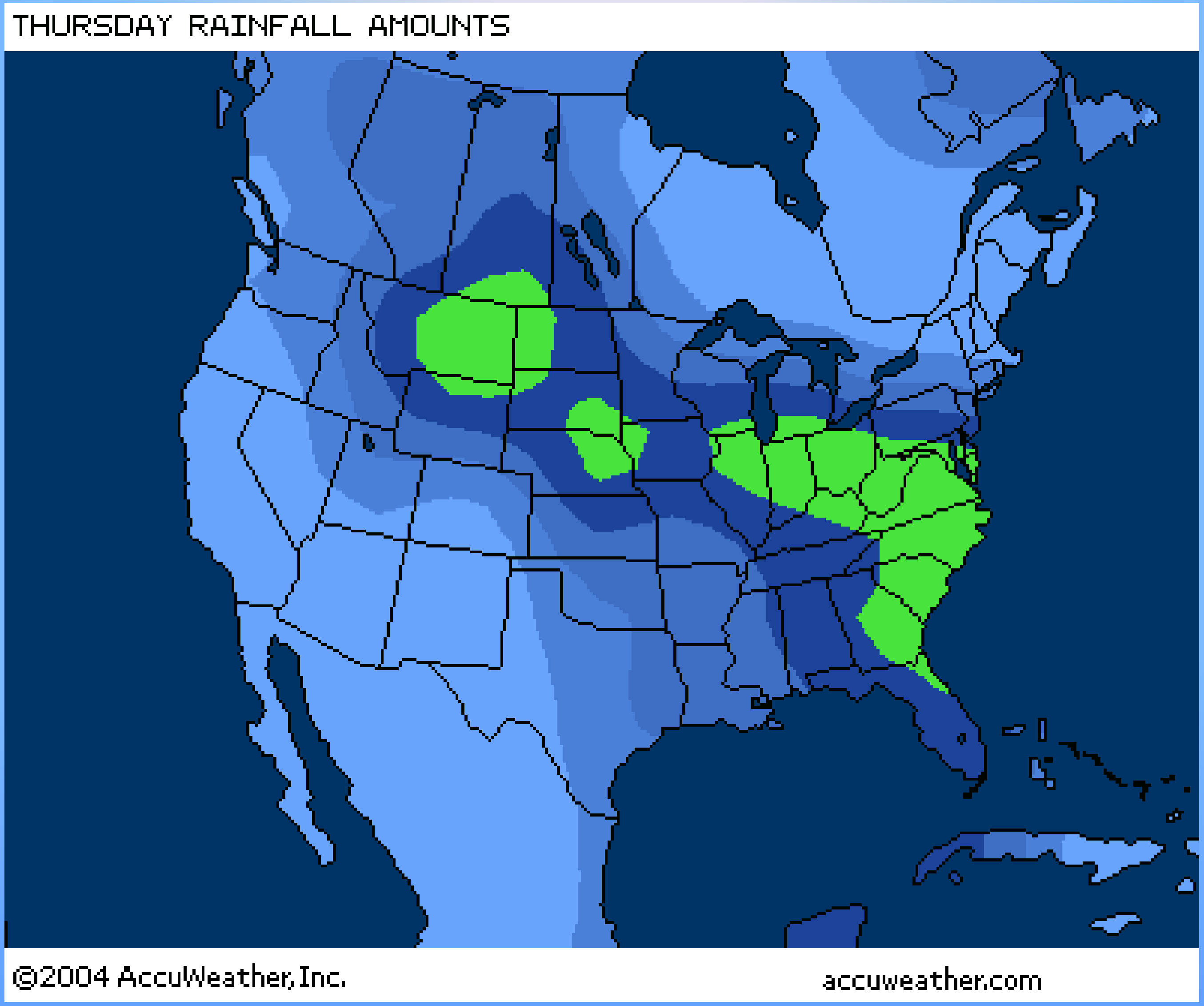
3. A _Temperature_ Field



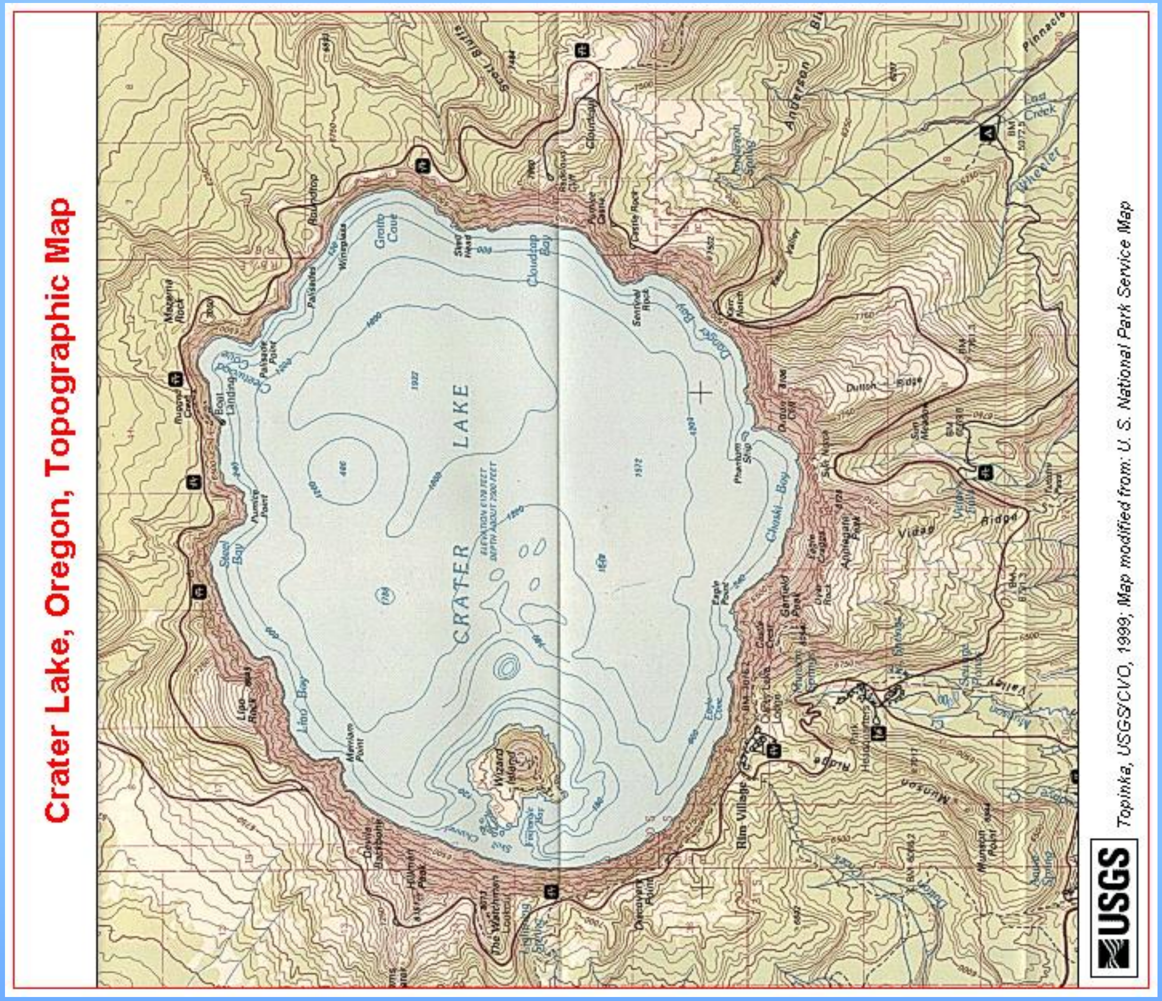
4. An Air Pressure Field



5. A Precipitation Field



6. Elevations of Earth’s surface with respect to sea level



B. Scalar and Vector Fields

1. **Scalar** field: measured completely in terms of AMOUNT, or MAGNITUDE.
   a. EXAMPLES: temperature, air pressure, elevation, rainfall, snowfall, insolation

2. ___**Vector**___ field: measured in terms of MAGNITUTDE and ___**direction**___.

a. EXAMPLES:

___Gravity, magnetic ,___

___wind on weather maps___

C. **Field Maps**: These are maps of a particular field on which the various readings for the property being studied are marked.

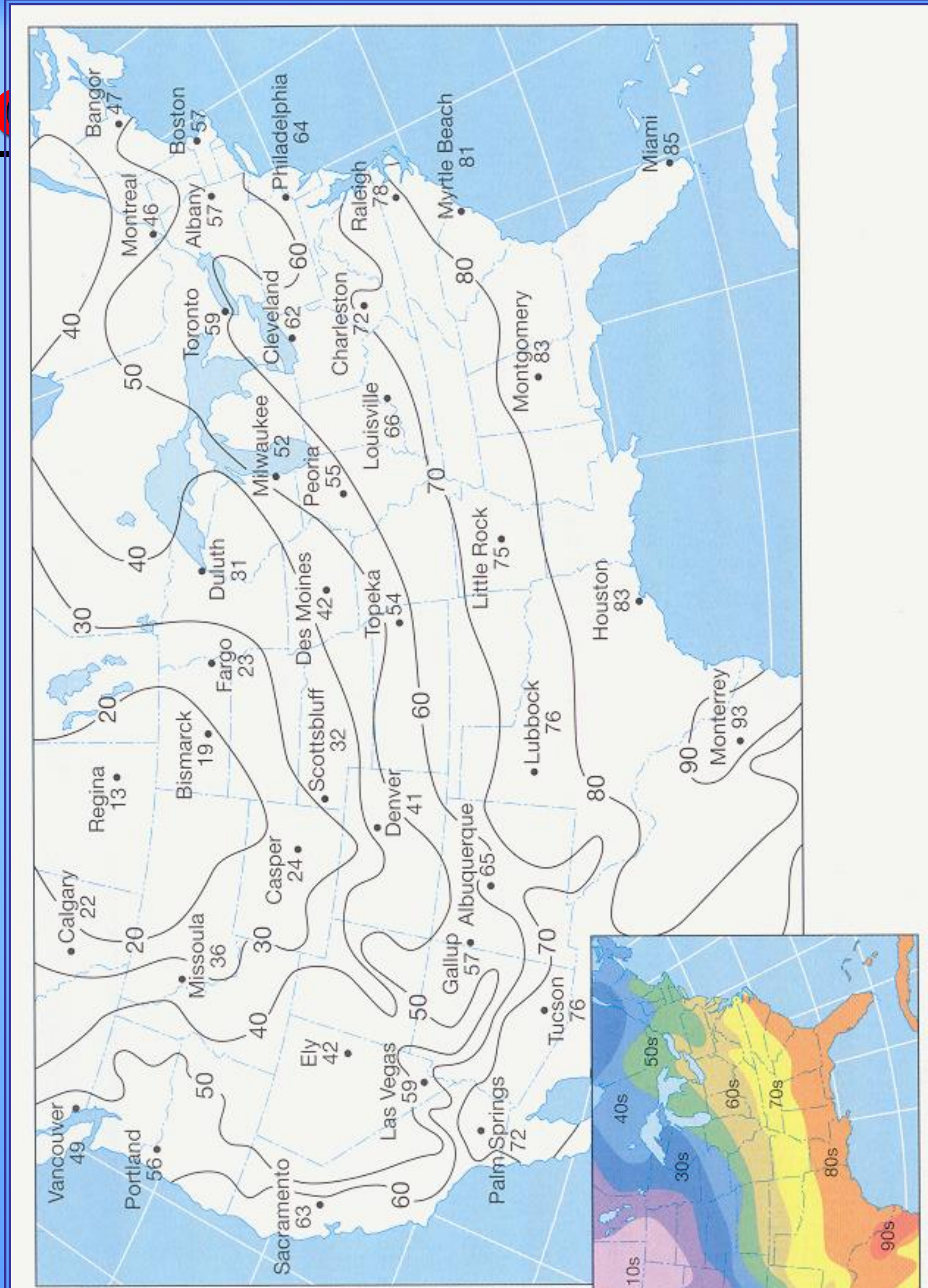
1. __**Isoline**__: a line connecting all points having the SAME field value.
2. Importance of isolines
   a. Provide a good idea of the SHAPE of a field.
   b. Show the pattern of change within the field.

3. Types of Isolines

a. __**Is**

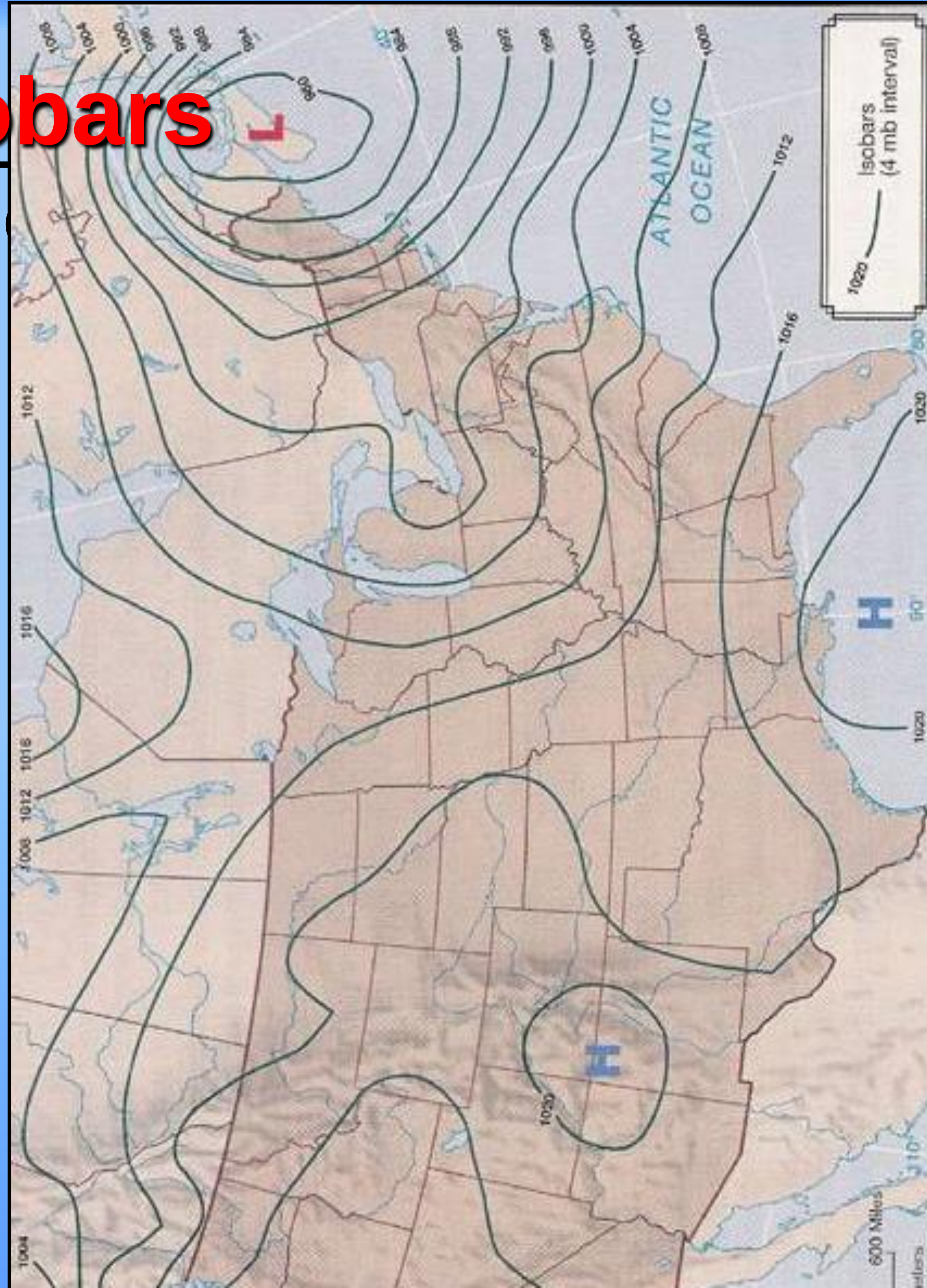
equal

ure



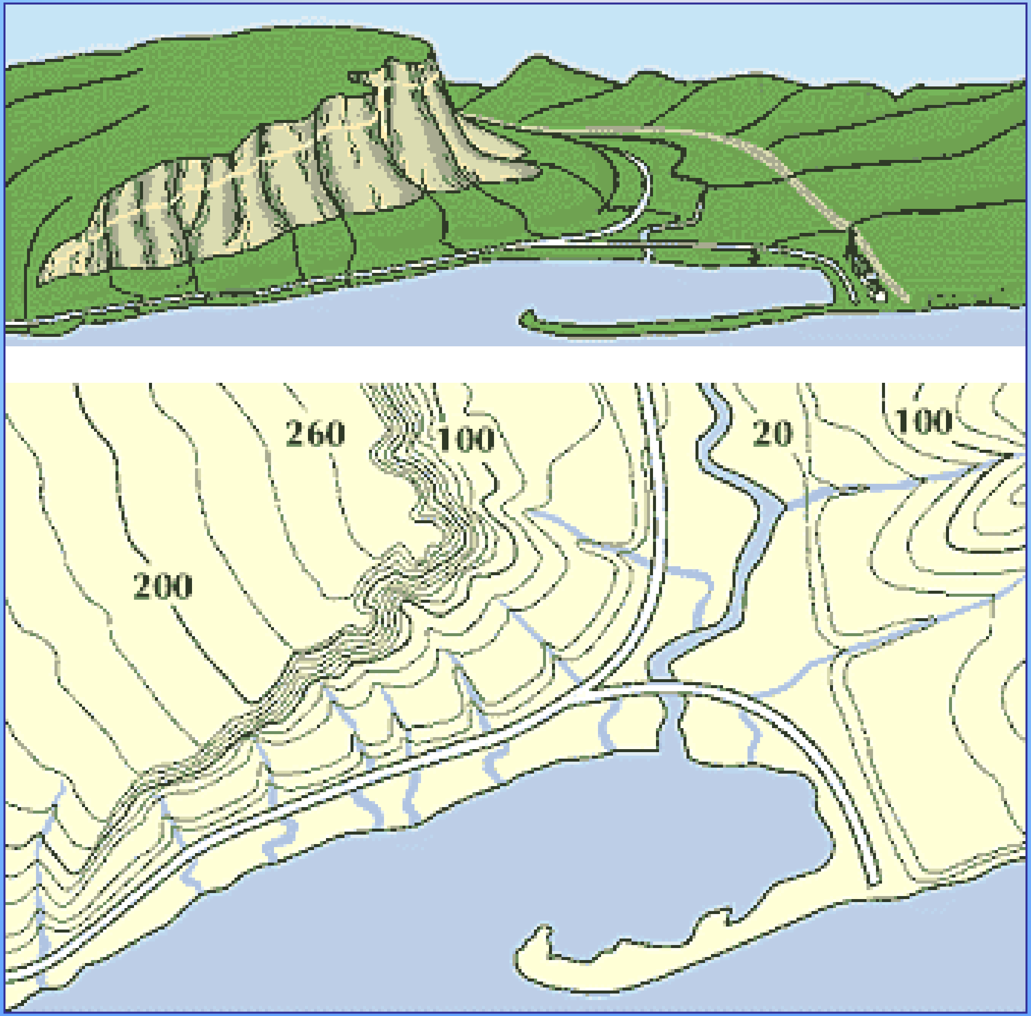
b. **Isobars**

atm

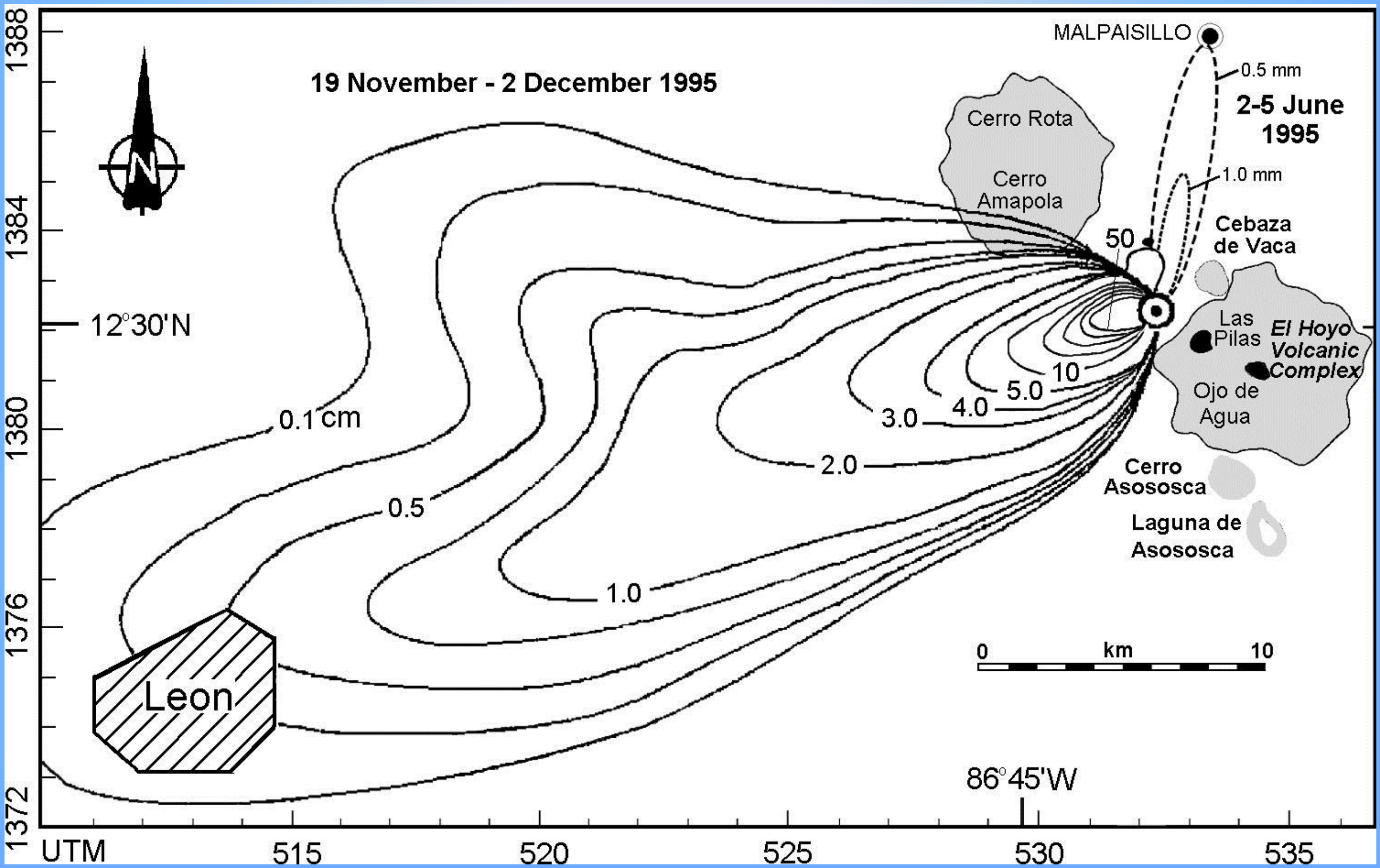


ure.

c. ___**Contour Lines**___: lines of equal land elevation

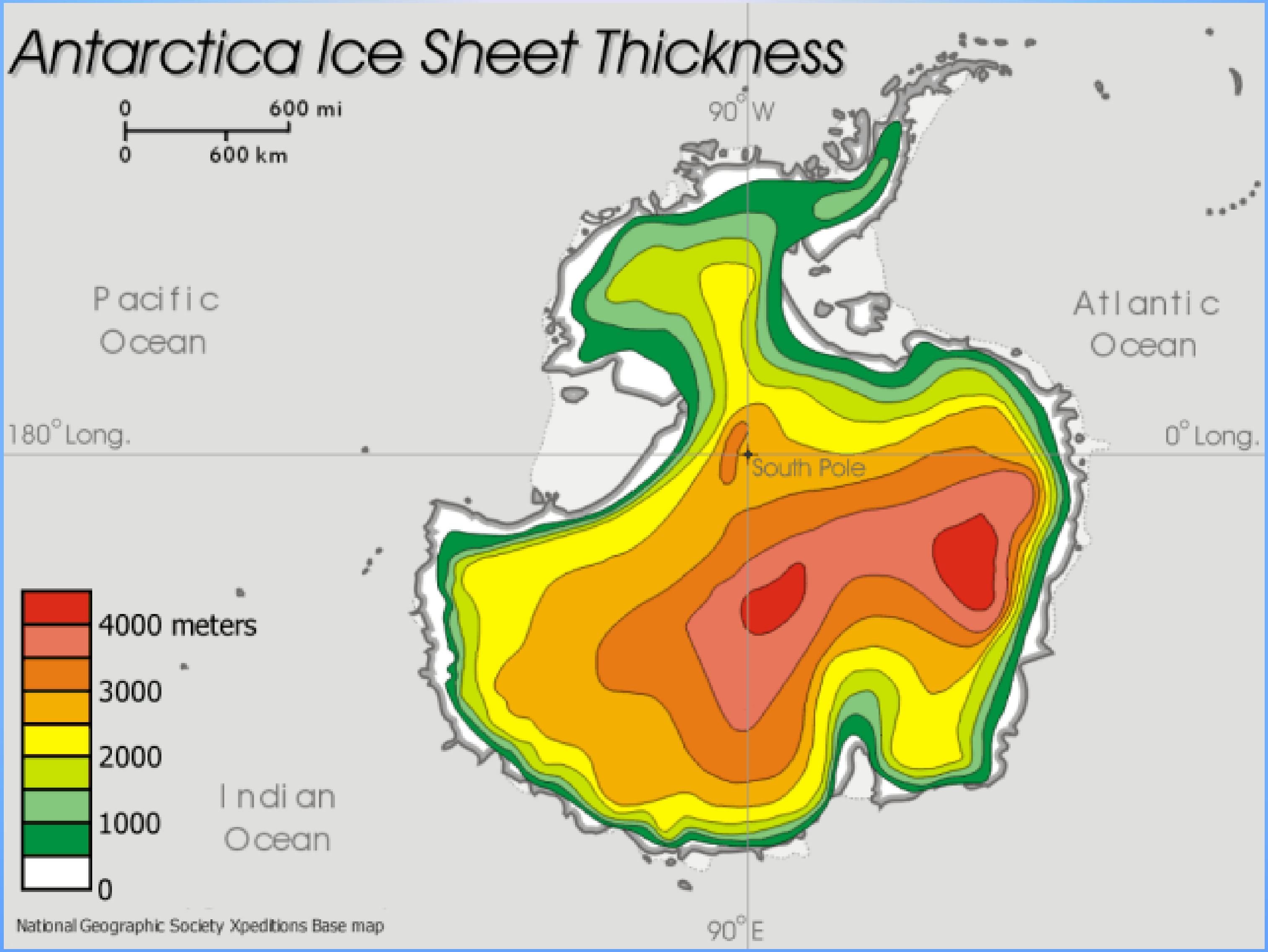


d. **Isopachs**: lines of equal thickness.

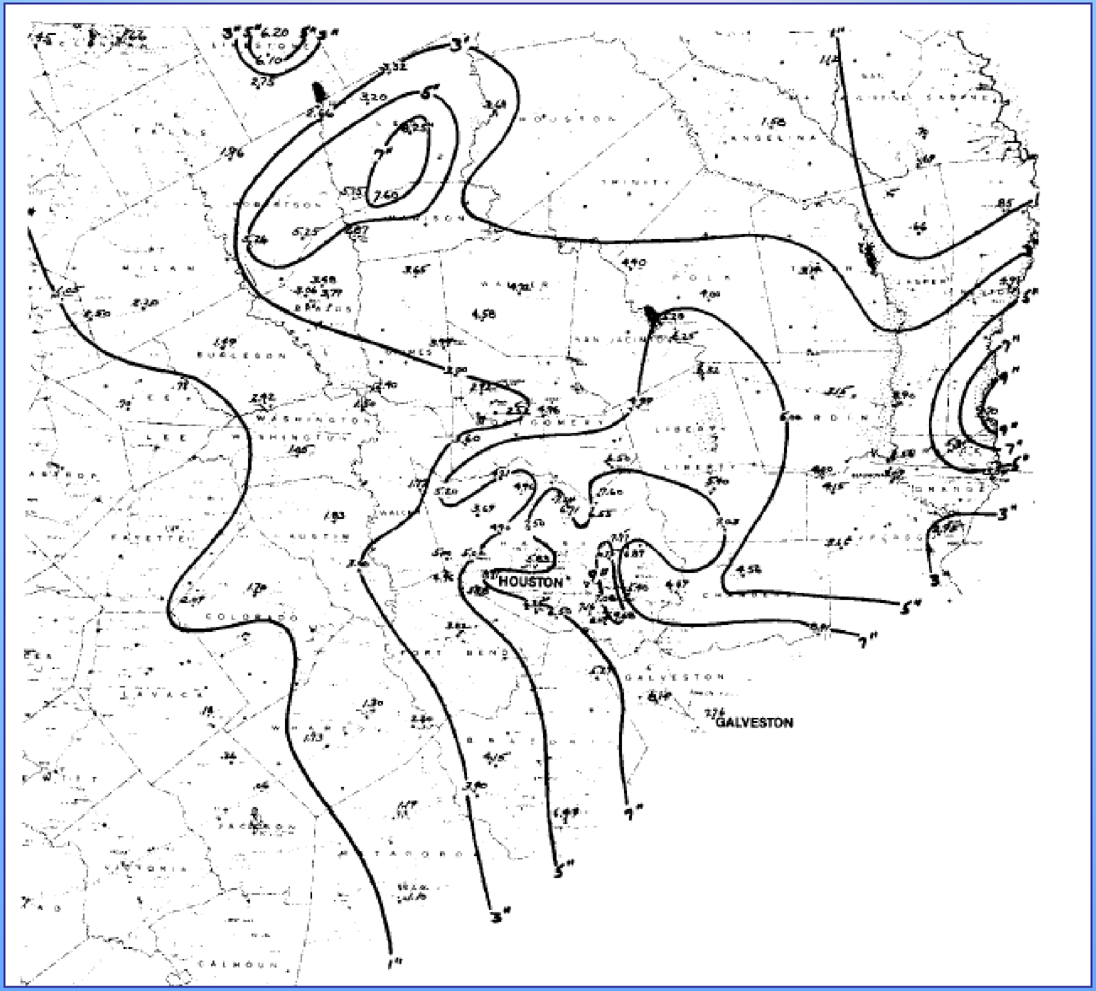


Volcanic ash depth map of a volcanic eruption in Nicaragua

Isopachs


Antarctica Ice Sheet Thickness
0
600 mi
0
600 km
90° W
Pacific Ocean
Atlantic Ocean
180° Long.
0° Long.
South Pole
4000 meters
3000
2000
1000
0
Indian Ocean
National Geographic Society Xpeditions Base map
90° E

e. **Isohyets** : lines of equal amounts of rainfall

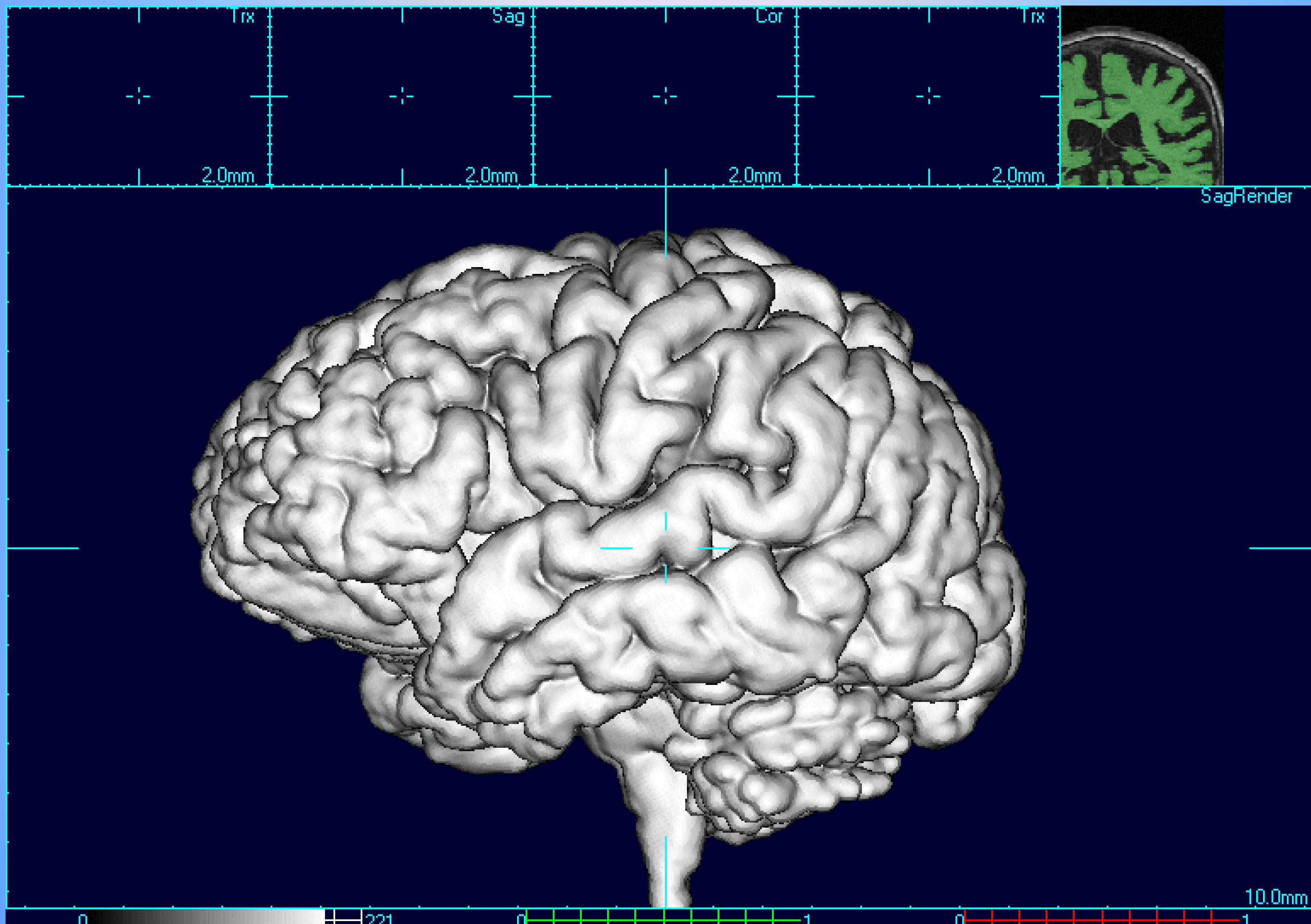


Hurricane Alicia, August 18-19, 1983

D. Isolines

1. Show field conditions on a **two-dimensional surface**
2. ISOSURFACE – NOT a line, but a **surface** passing through all points of 3-dimensional space with the same field value.
   - This gives a **three-dimensional** picture of the field.

An Isosurface



3. RULES FOR DRAWING ISOLINES

a. EVERY point on an isoline will have the **SAME field value.**

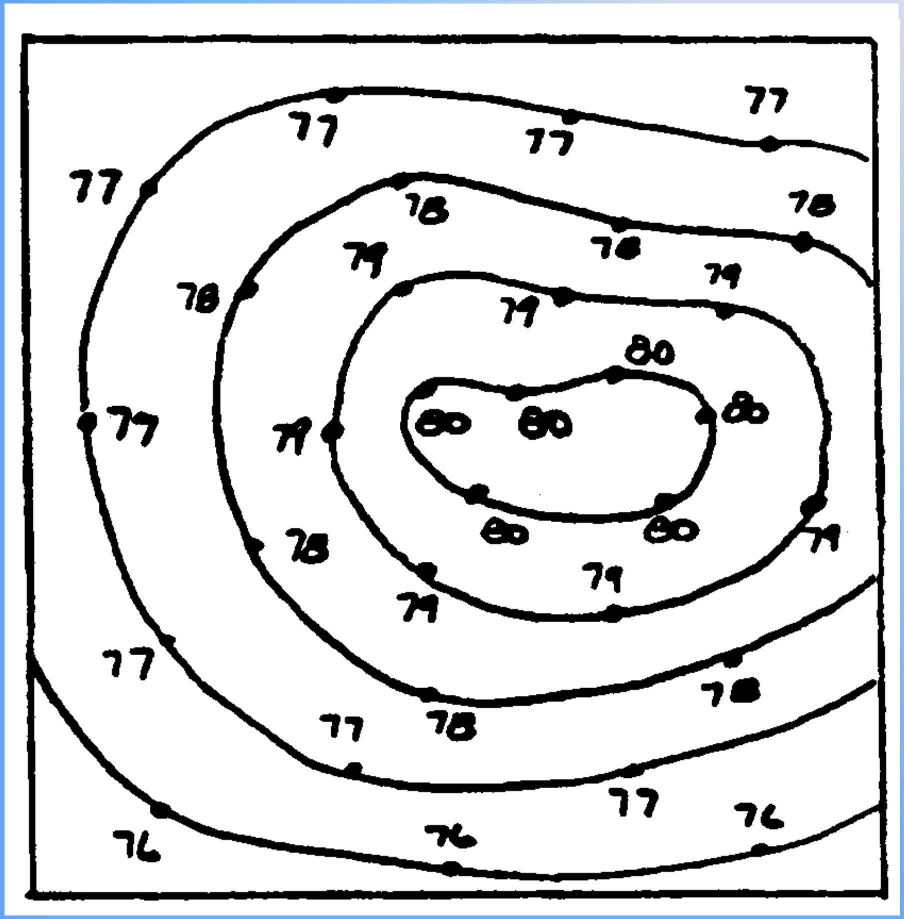
b. Isolines **CANNOT touch or cross** other isolines

c. Isolines MUST form **closed loops or extend to the edges of the map**. Isolines NEVER begin or end on the map!

d. Isolines tend to form **smooth curves** (no sharp points).

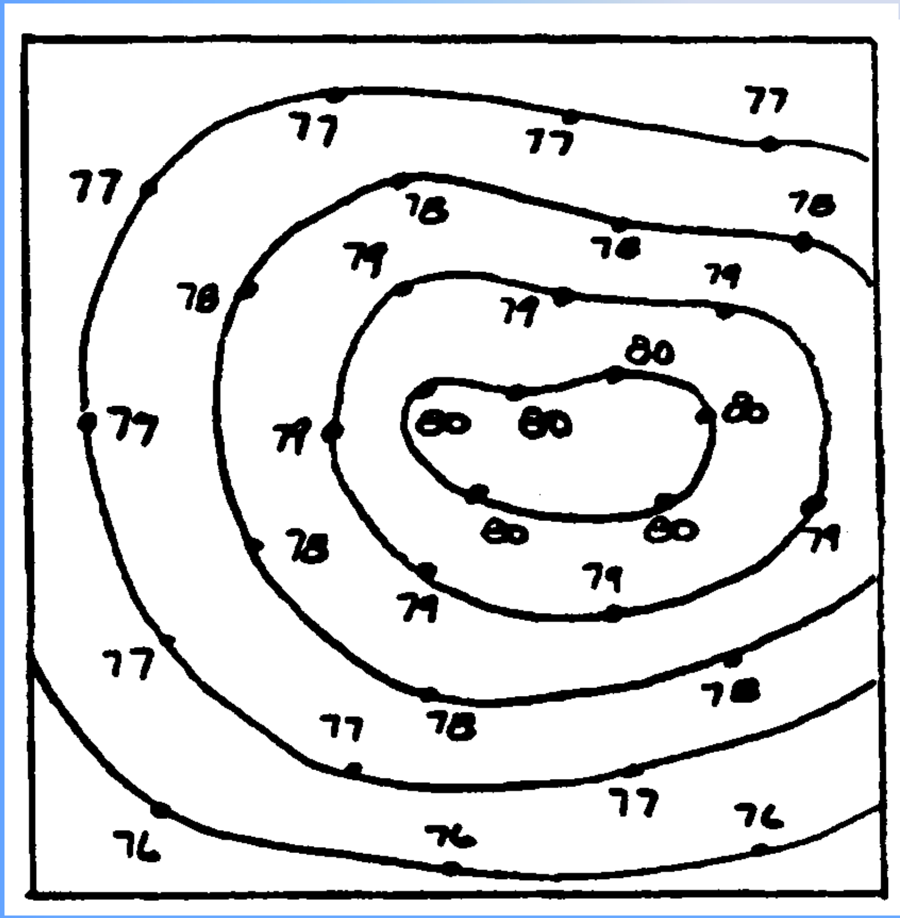
e. Isolines tend to be **paralle**l to one another.

EXAMPLE



- The field values on the first map show the amount of snow that fell during a snowstorm.
- The numbers seem scattered and jumbled.
- Just looking at the map would not tell you much.

EXAMPLE

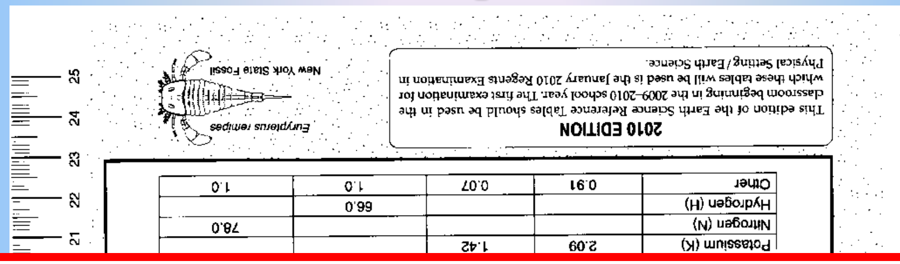


- The pattern of the isolines makes it much easier to see
  - Where the snow was deepest
  - How it gets thinner as you travel away from the deepest place.

E. Gradient – the change in a field quantity as we go from one point to another

1. Average Gradient = $\dfrac{\textbf{Amount of change in field quantity}}{\textbf{Distance over which the change occurs}}$

You can find the equation in the ESRT



Equations

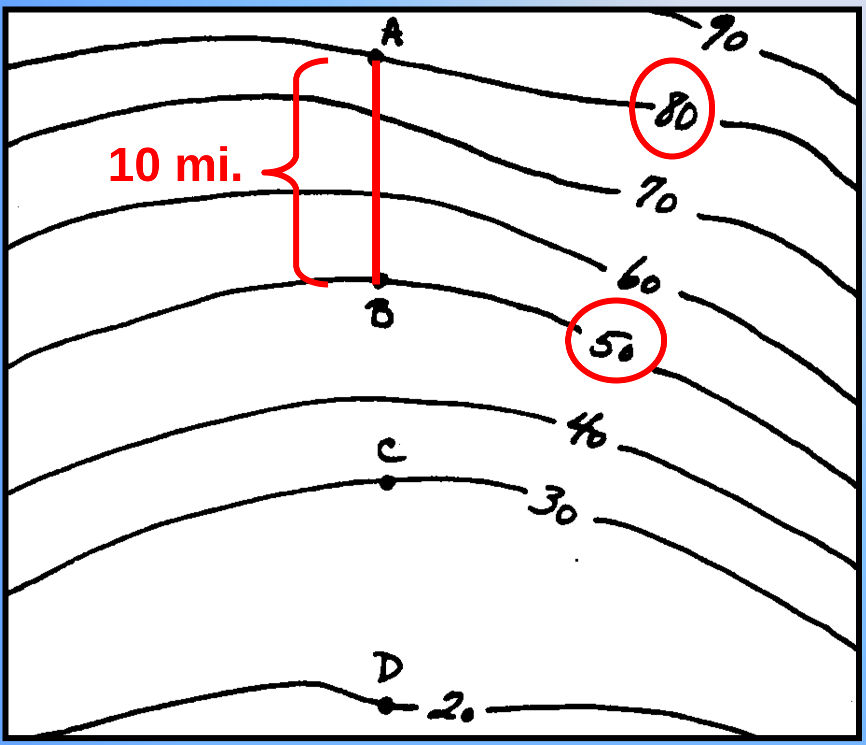
$$\text{Eccentricity} = \frac{\text{distance between foci}}{\text{length of major axis}}$$

$$\boxed{\text{Gradient} = \frac{\text{change in field value}}{\text{distance}}}$$

$$\text{Rate of change} = \frac{\text{change in value}}{\text{time}}$$

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

2. EXAMPLES

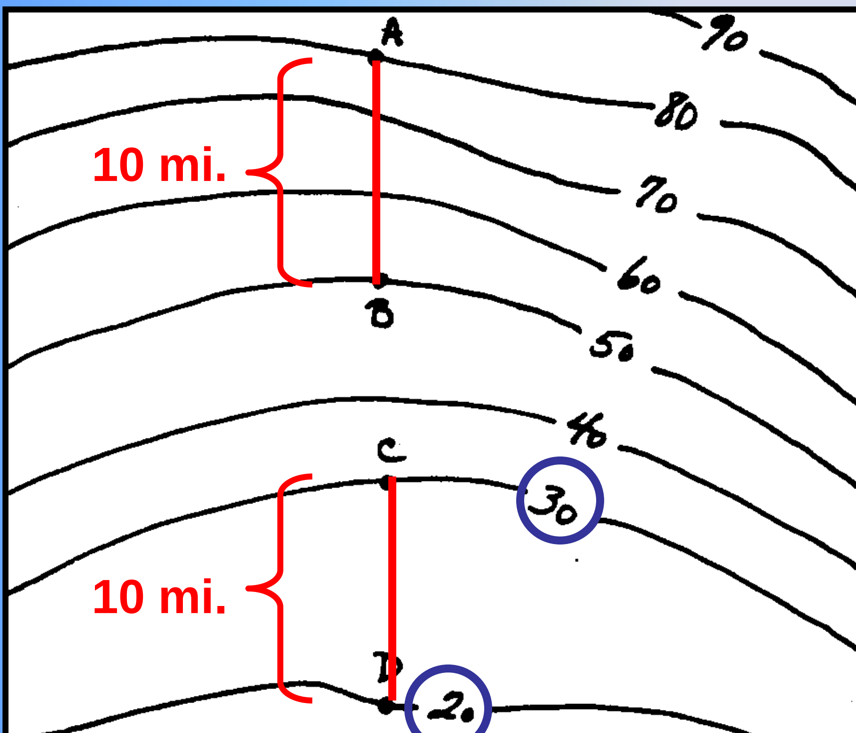


Temperature Interval = 10^{o} F

$A \longrightarrow B$ **Gradient** $= \dfrac{30^{o}\ F}{10\ mi} = 3^{o}\ F/mi$

10 miles

EXAMPLES



Temperature Interval = 10^{o} F

A $\longrightarrow$ **B**
Gradient $= \dfrac{30^{o}\ \mathrm{F}}{10\ \mathrm{mi}} = 3^{o}\ \mathrm{F/mi}$

C $\longrightarrow$ **D**
Gradient $= \dfrac{10^{o}\ \mathrm{F}}{10\ \mathrm{mi}} = 1^{o}\ \mathrm{F/mi}$

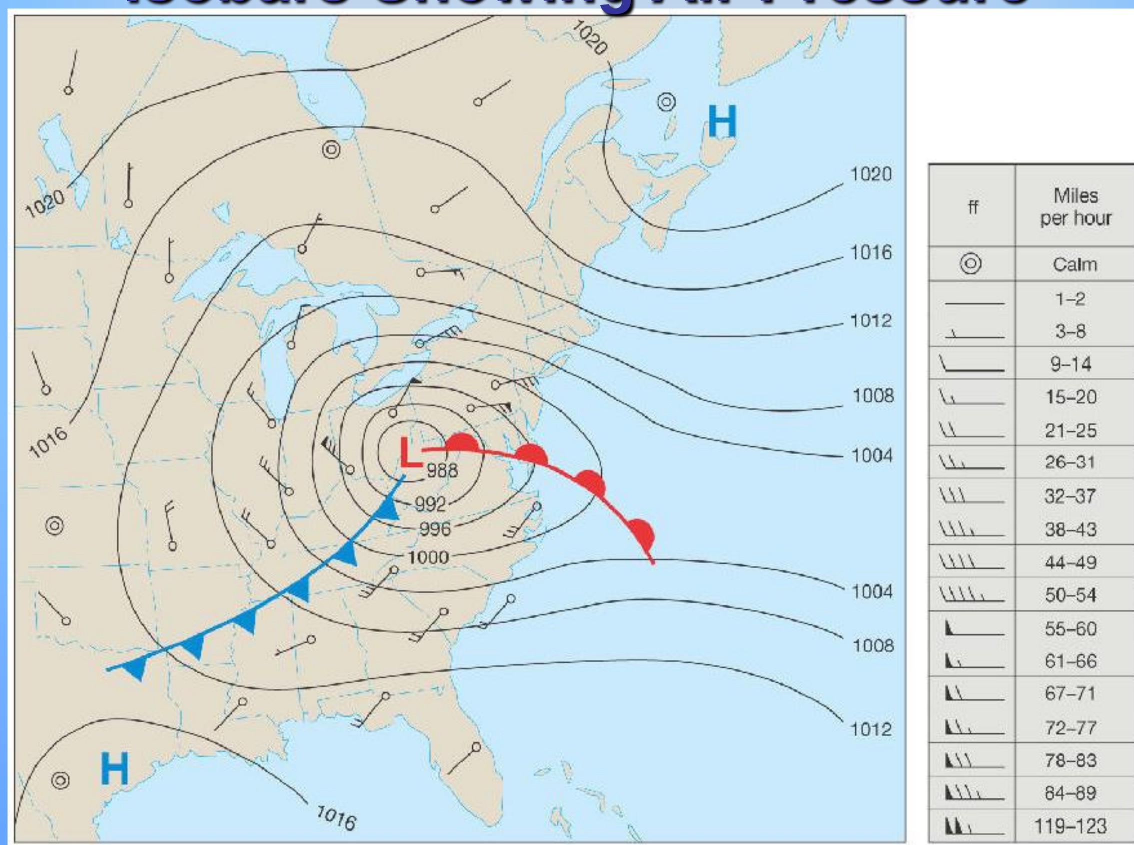
10 miles

3. Gradient and the Spacing of Isolines

a. Closer spacing means there is __**higher**__ gradient.

b. Farther spacing means there is a __**lower**__ gradient.

Isobars Showing Air Pressure



F. Fields and Time

1. Some field values may change with time (DYNAMIC FIELD). Others may not (STATIC FIELD). A field map may be accurate for only the *time at which it was made*.
2. Fields that undergo slow change with time include: **elevation of Earth's surface, gravity, magnetism**
3. Fields that undergo fast change with time include: **temperature, air pressure, humidity, wind precipitation, insolation**

- Try UPCO RB page 46 …. # 19, 20, 21.
  - (for # 21 use ESRT pg. 13)
- Try Worksheets
- Start Lab 1-4 Proc. B first