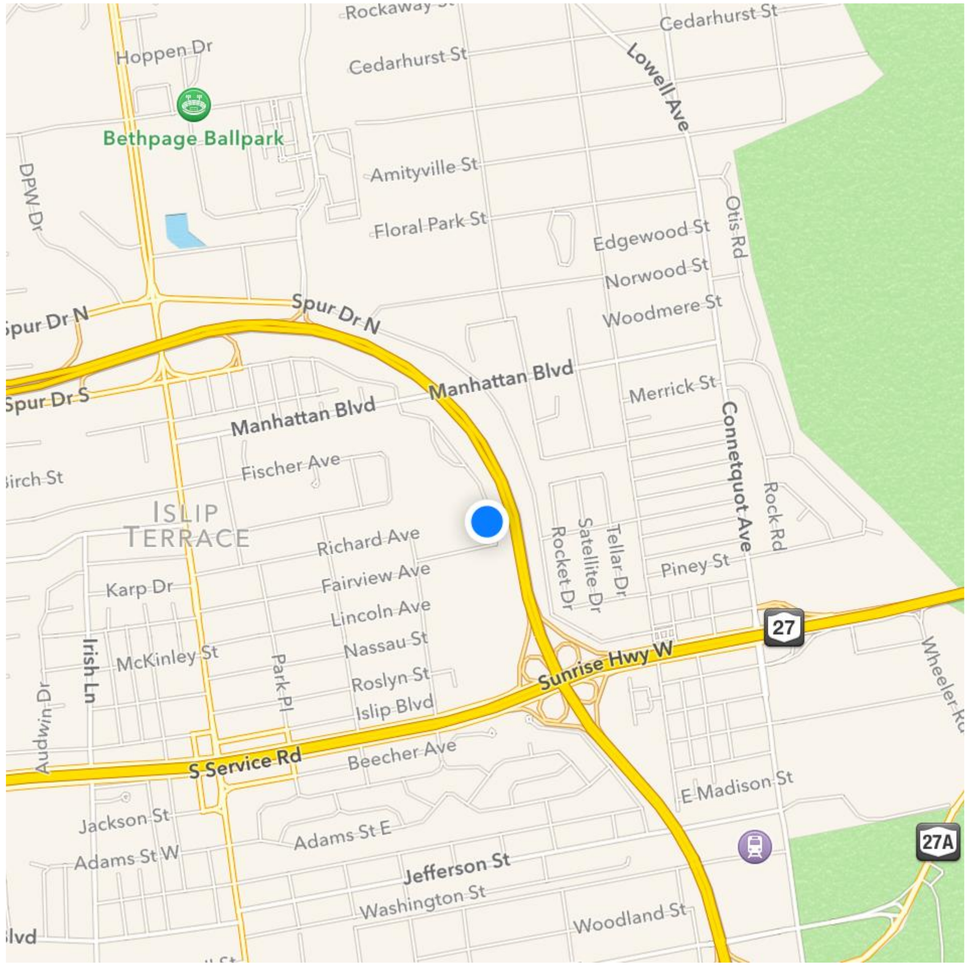
Latitude and Longitude

How do you find a location on the Earth?

Latitude and Longitude

- Map - representation of an area used to show physical features and exact locations

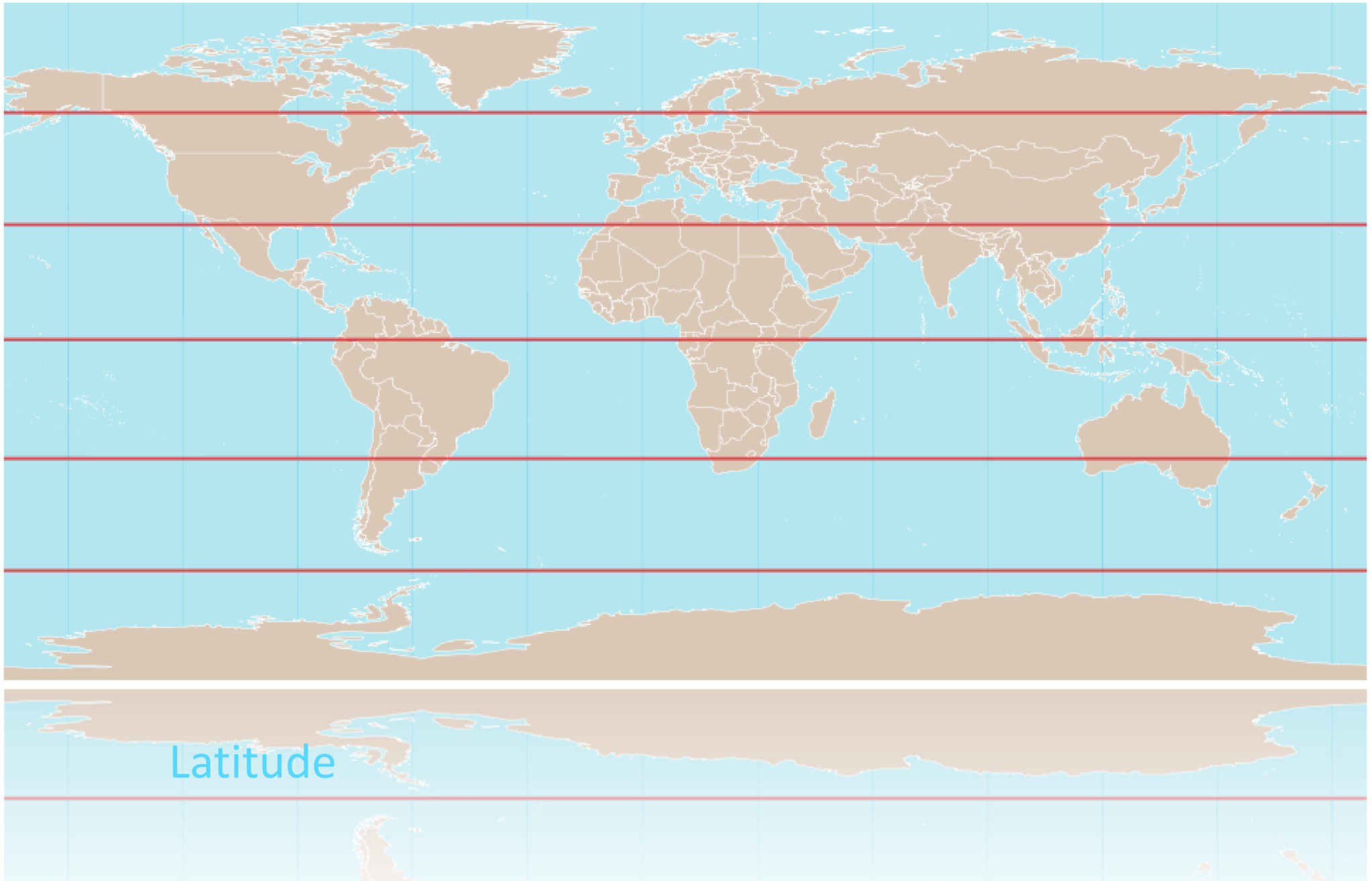


Latitude and Longitude

- Latitude - measuring lines running parallel to the equator
    - Also called parallels
    - These lines never intersect
- Equator - main reference line of Latitude (0° latitude)

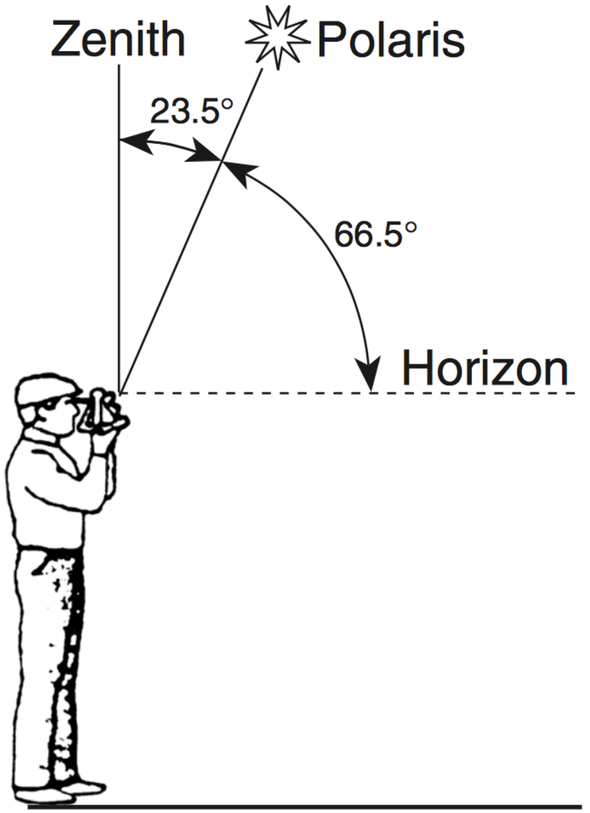
Latitude and Longitude

- The North Pole is 90º N latitude
- The South Pole is 90º S latitude


Latitude

Latitude and Longitude

- Finding your latitude:
  - The altitude (angle) of Polaris is equal to your latitude

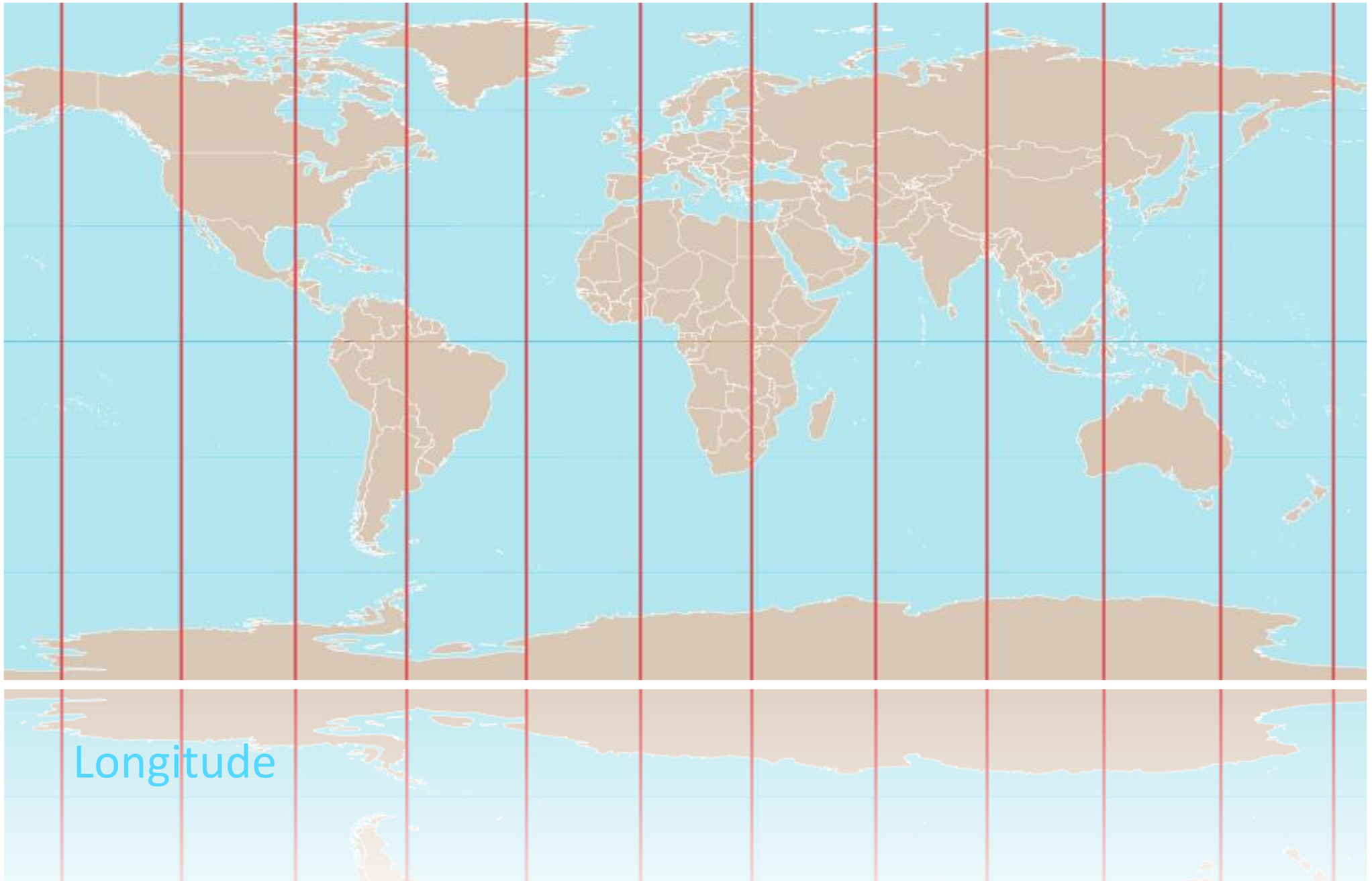


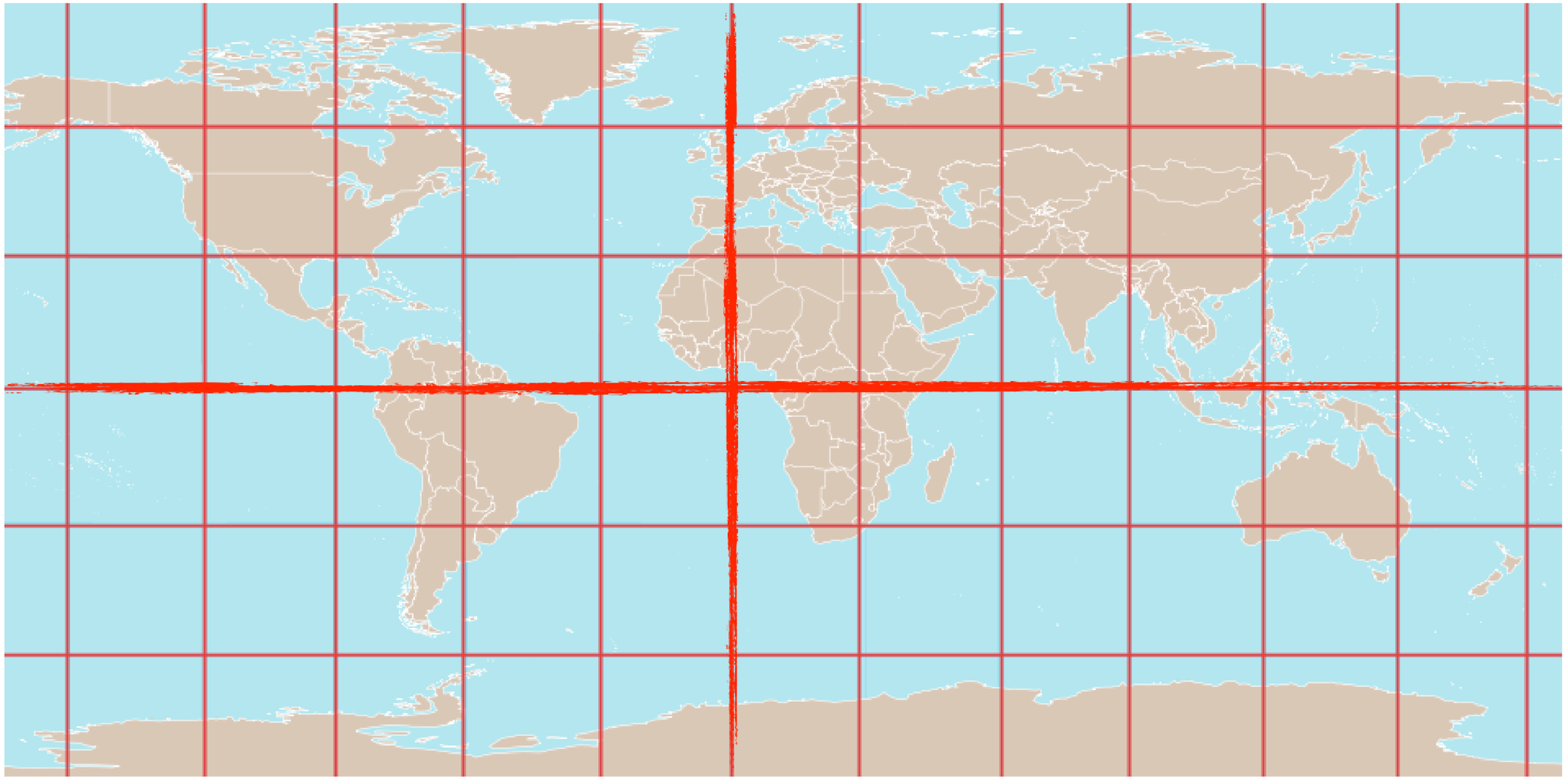
Latitude and Longitude

- Longitude - measuring lines that measure distance east and west from the prime meridian
    - Also called meridians
- Prime Meridian - main reference line of longitude (0° Longitude)

Latitude and Longitude

- The International Date Line is 180º east or west of the Prime Meridian


Longitude



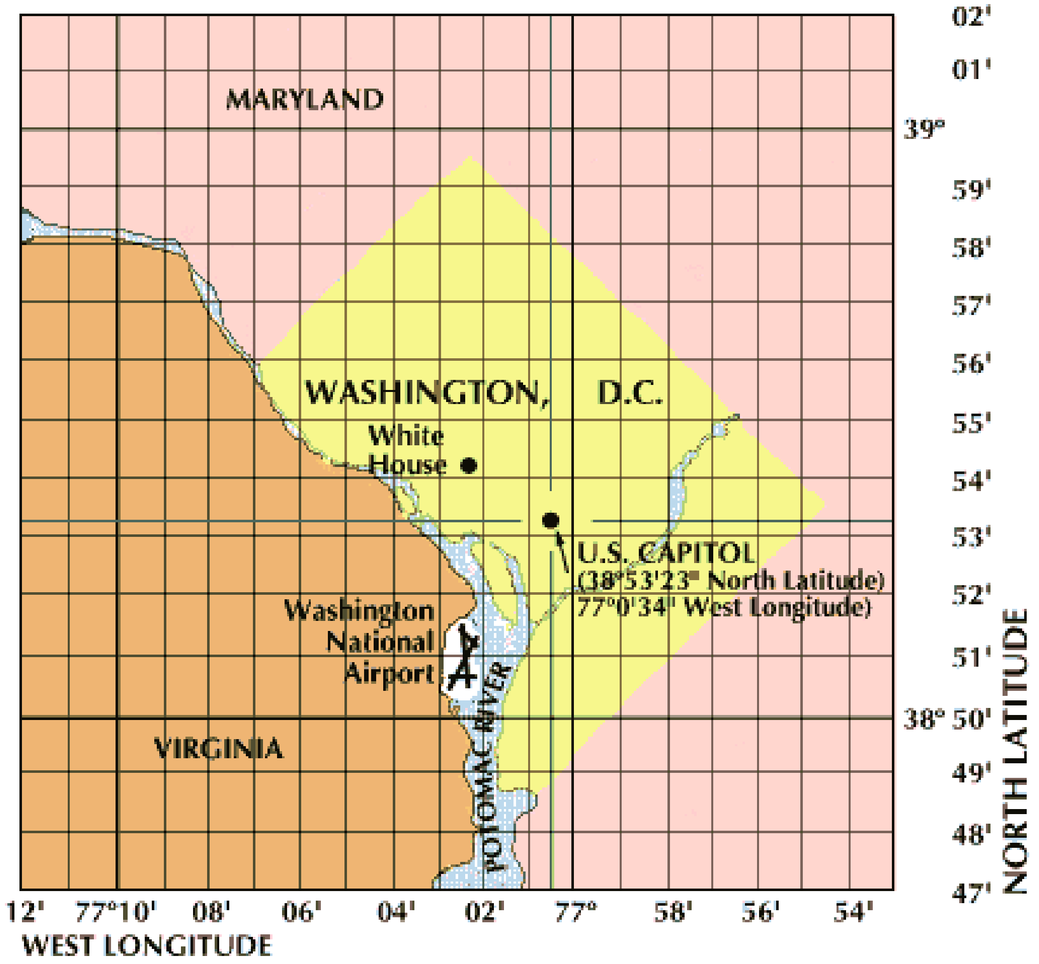
Combine latitude and longitude to get a coordinate

Latitude and Longitude

- Be sure you include direction with both latitude and longitude
    - Example: 20° 30’ N and 75° 30’ E

Latitude and Longitude

- Subdivisions of Latitude and Longitude
    - One degree is divided into 60 minutes (60’)
    - One minute can be divided into 60 seconds (60”)



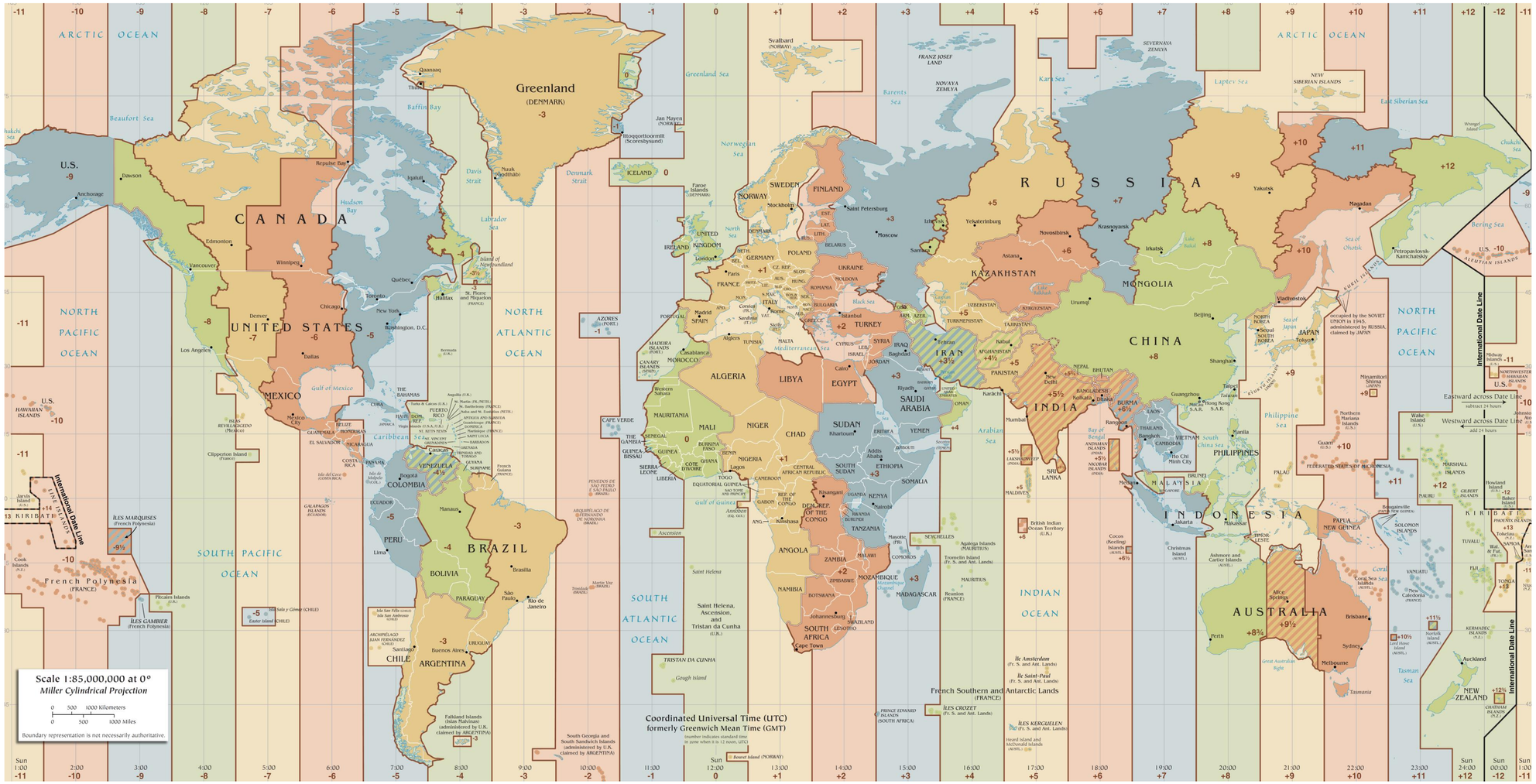
Subdivisions of Latitude and Longitude

Latitude and Longitude

- Time Zones:
  - Earth’s rotation is the basis for local time
  - The Earth rotates 360º in 24 hours
  - Earth rotates on an imaginary axis at 15º per hour
  - Earth is divided into 24 (15º) time zones

Latitude and Longitude

- Time Zones (continued):
    - Each time zone is one hour different
    - Each time zone covers 15º of longitude
    - There are 6 time zones in the United States

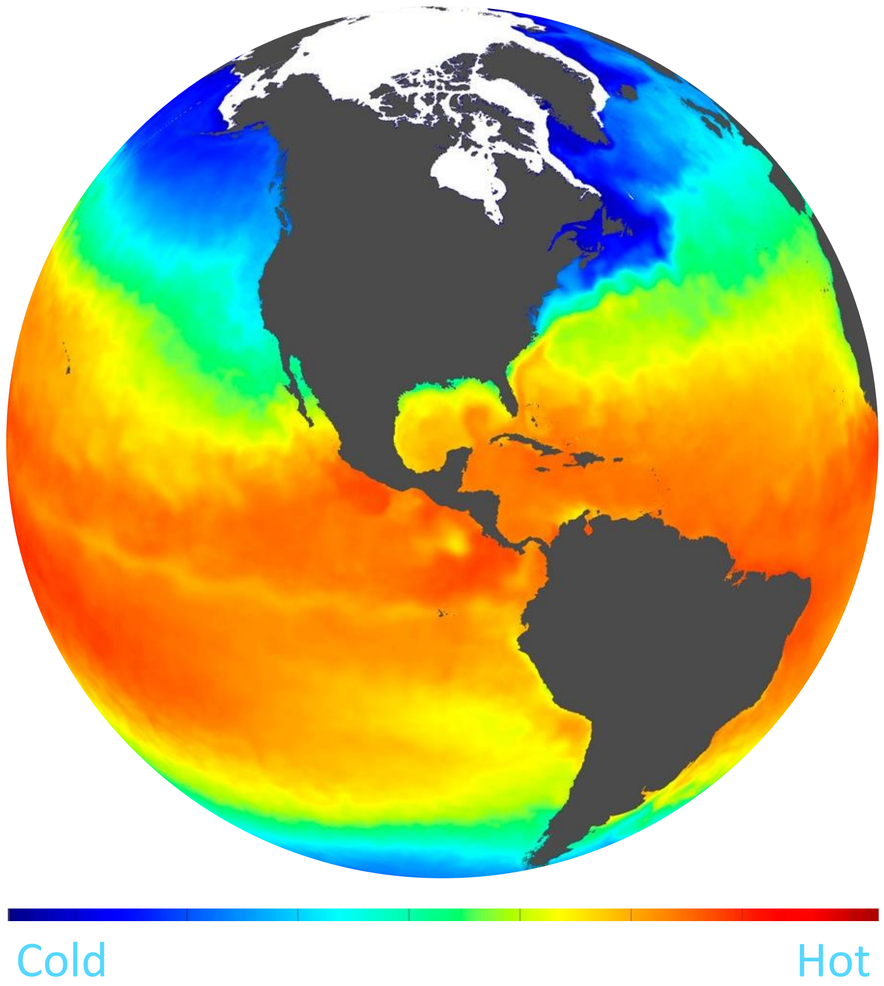

World Time Zones
Scale 1:85,000,000 at 0°
Miller Cylindrical Projection
0 500 1000 Kilometers
0 500 1000 Miles
Boundary representation is not necessarily authoritative.
Coordinated Universal Time (UTC)
formerly Greenwich Mean Time (GMT)
ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
Greenland (DENMARK)
CANADA
U.S.
UNITED STATES
MEXICO
RUSSIA
CHINA
MONGOLIA
KAZAKHSTAN
INDIA
BRAZIL
ARGENTINA
CHILE
PERU
COLOMBIA
VENEZUELA
BOLIVIA
PARAGUAY
URUGUAY
AUSTRALIA
INDONESIA
PHILIPPINES
JAPAN
NEW ZEALAND
PAPUA NEW GUINEA
ALGERIA
LIBYA
EGYPT
SUDAN
ETHIOPIA
NIGERIA
SOUTH AFRICA
ANGOLA
ZAMBIA
TANZANIA
KENYA
SOMALIA
MADAGASCAR
SAUDI ARABIA
IRAN
IRAQ
TURKEY
FRANCE
SPAIN
GERMANY
UNITED KINGDOM
SWEDEN
NORWAY
FINLAND
POLAND
UKRAINE
ITALY
International Date Line
Eastward across Date Line
subtract 24 hours
Westward across Date Line
add 24 hours

Field Maps

What are the different types of field maps?

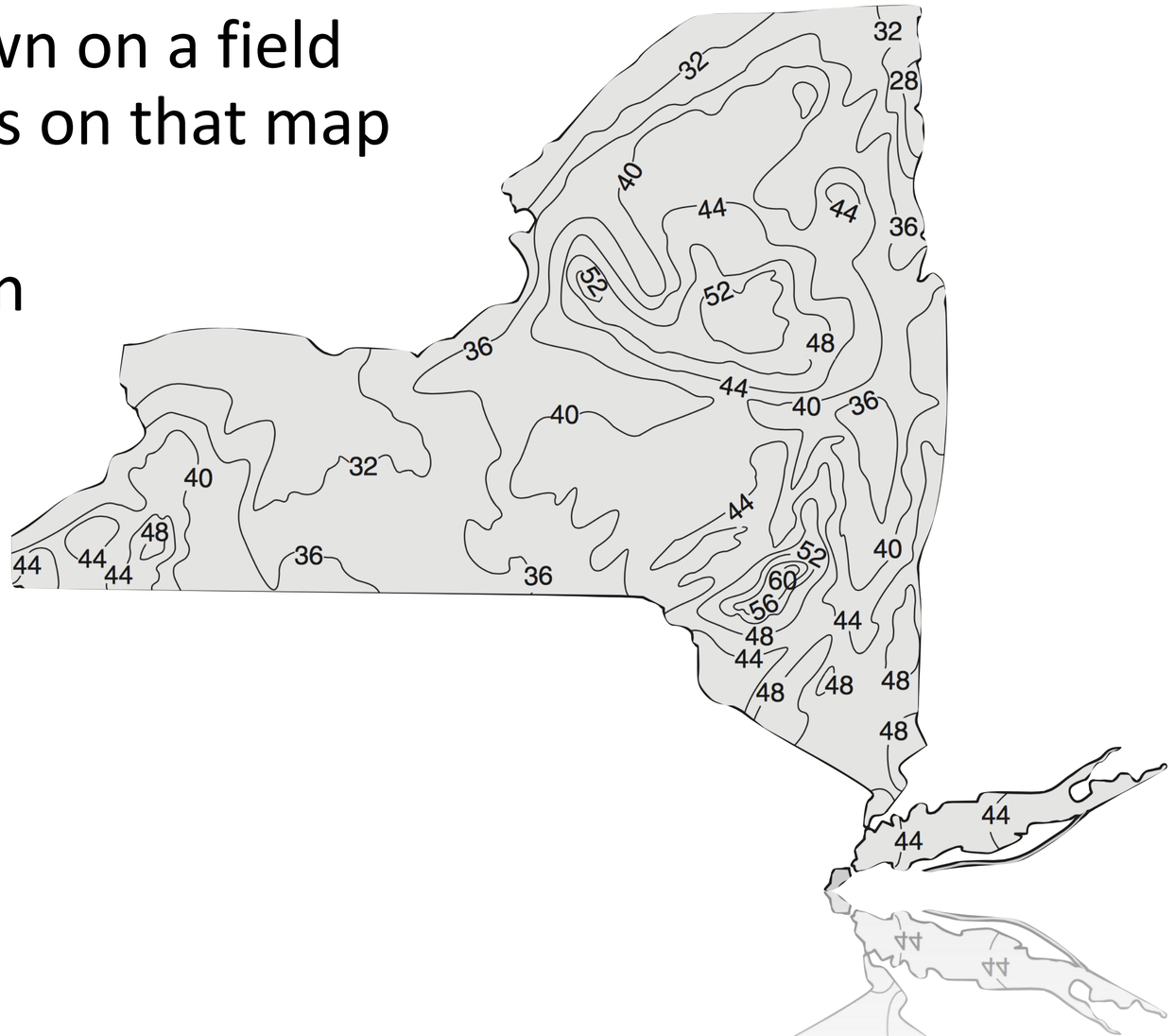
Field Maps

- Field - a region with a measurable quantity at every location
    - Example: ocean temperature



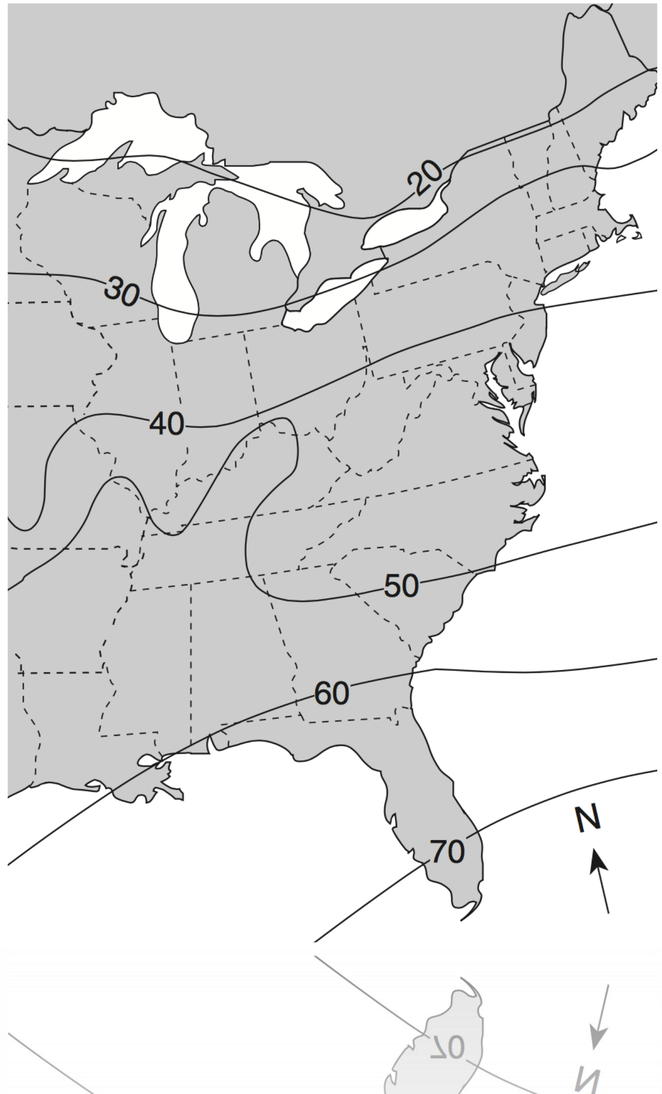
Field Maps

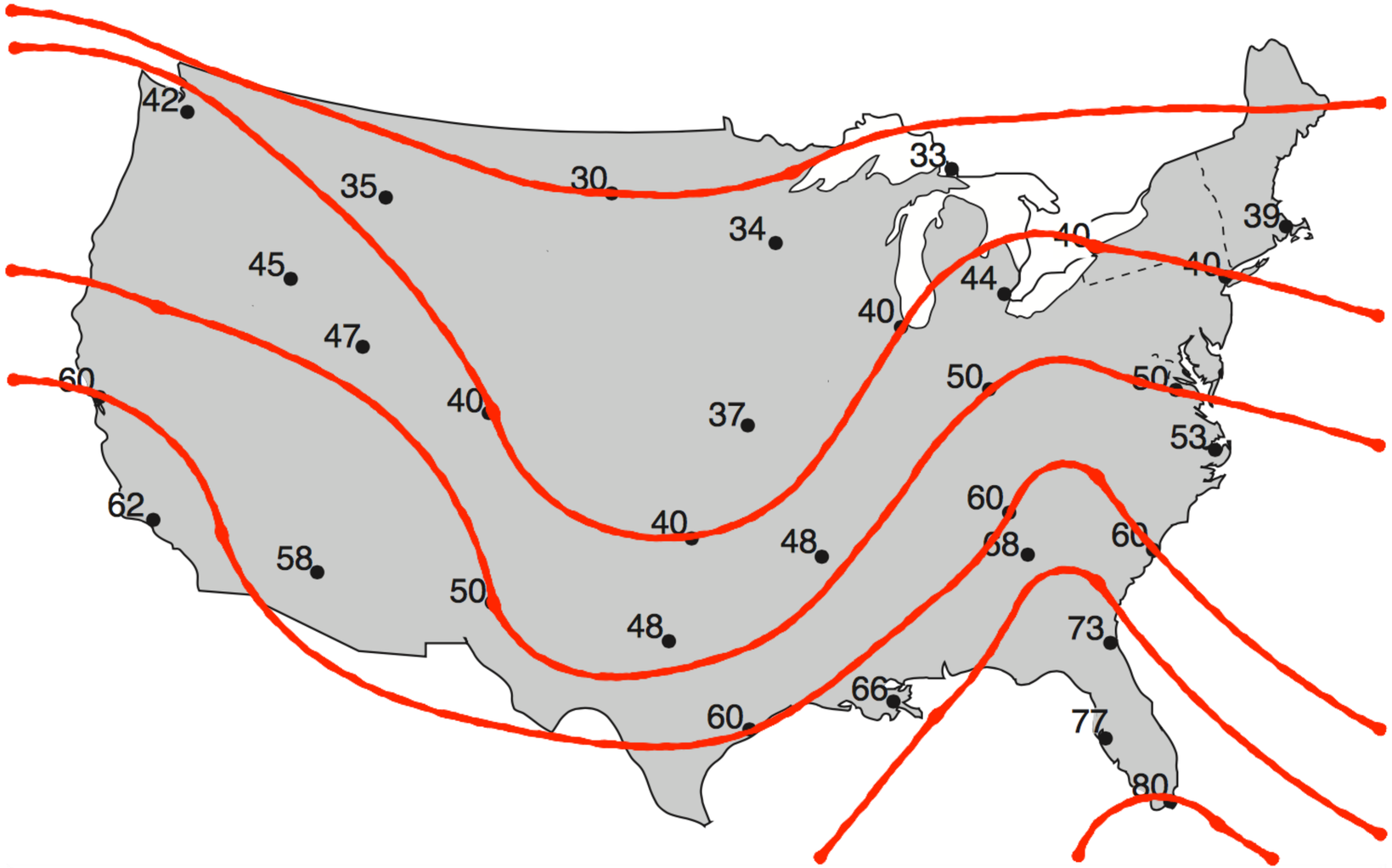
- Isolines - are lines that are drawn on a field map to connect all of the points on that map that have the same value
    - Example: precipitation amounts in inches



Field Maps

- Points represent values of data found at a specific location
- To construct a field map connect the points of equal data
    - Do not connect every value… just whole numbers
    - Isolines form complete circles or end at the edge of the map

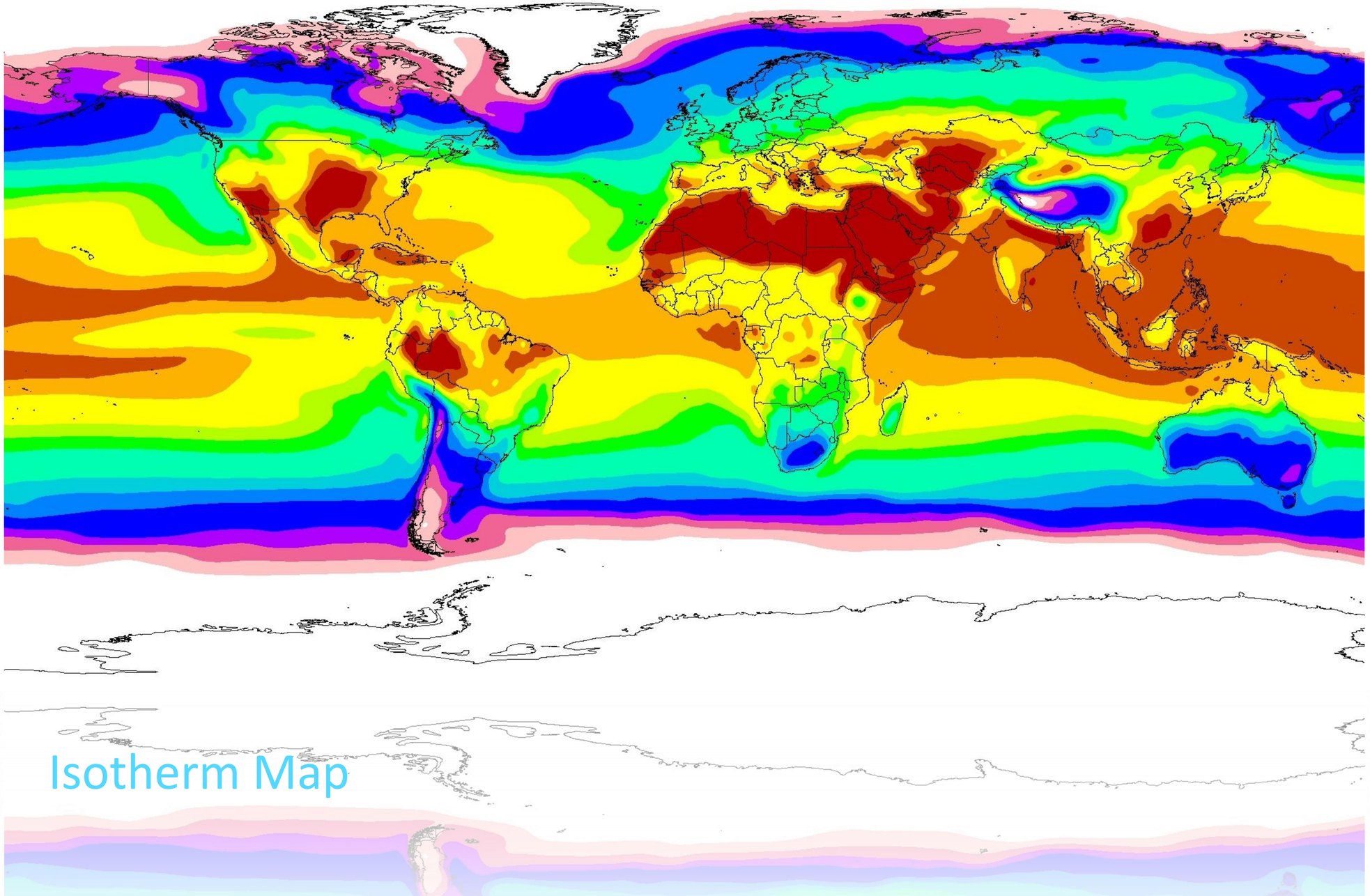




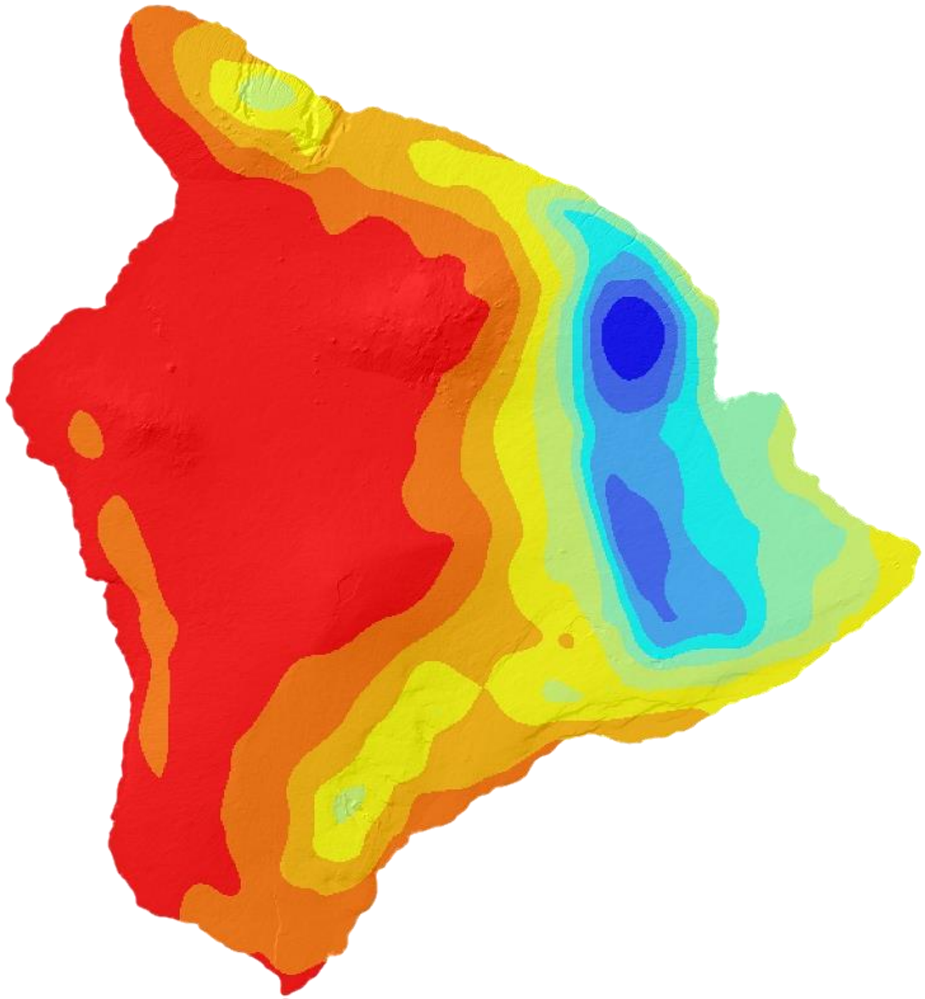
Temperature Values in the United States

Field Maps

- Different Types of Isolines:
    - Isotherm - lines that connect equal points of temperature
    - Isohyet - lines that connect equal points of rainfall
    - Isobar - lines that connect equal points of air pressure
    - Contour Line - lines that connect equal points of elevation



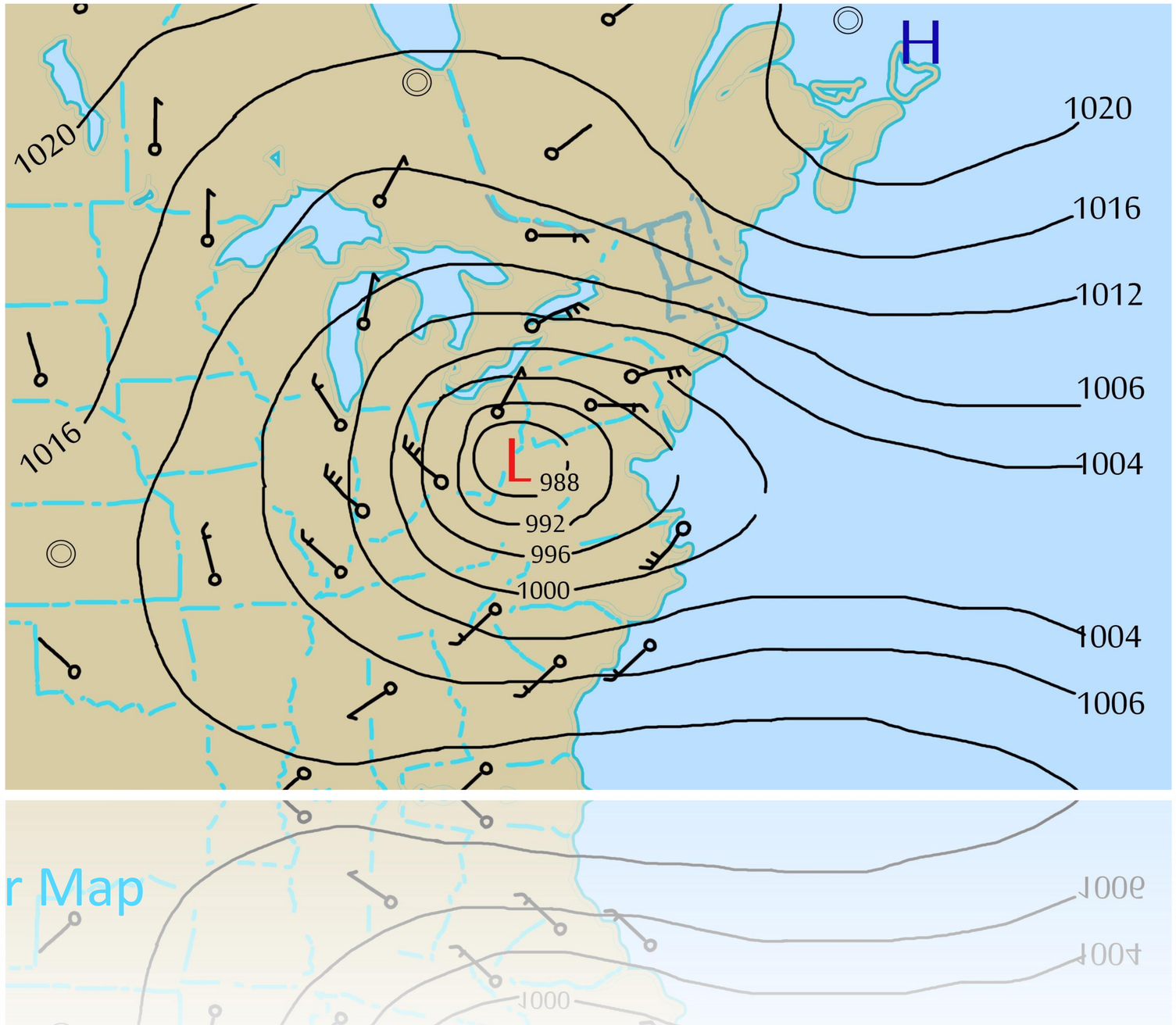
Isotherm Map



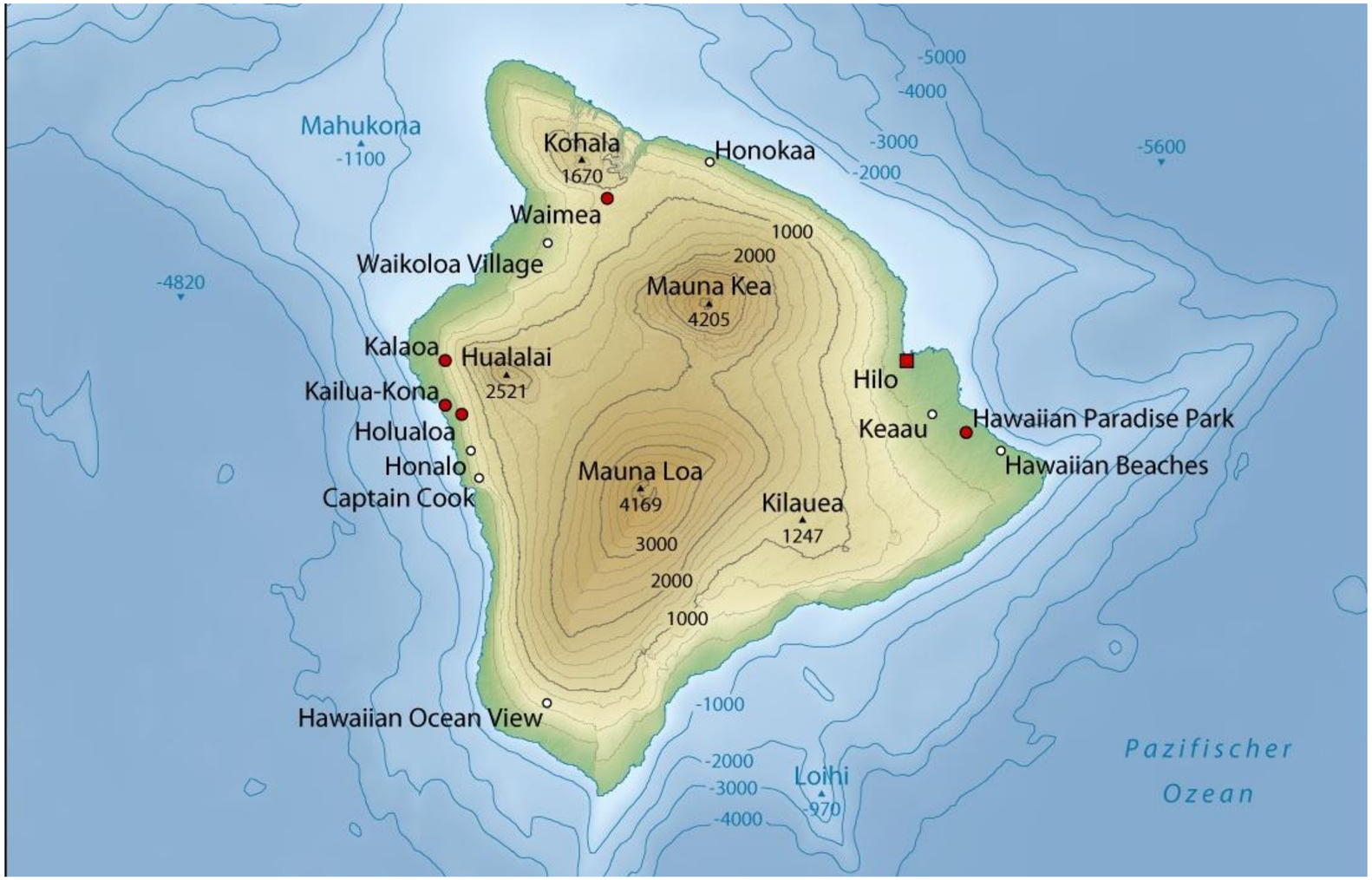
Inches of Precipitation

- 0.7 - 3.0
- 3.1 - 6.0
- 6.1 - 9.0
- 9.1 - 12.0
- 12.1 - 15.0
- 15.1 - 18.0
- 18.1 - 21.0
- 21.1 - 24.0
- 24.1 - 28.0
- 28.1 - 35.4

Isohyet Map


H
1020
1016
1012
1006
1004
1020
1016
L
988
992
996
1000
1004
1006

Isobar Map


Mahukona
-1100
Kohala
1670
Honokaa
-5000
-4000
-3000
-2000
-5600
Waimea
Waikoloa Village
1000
2000
-4820
Mauna Kea
4205
Kalaoa
Hualalai
2521
Hilo
Kailua-Kona
Holualoa
Honalo
Captain Cook
Keaau
Hawaiian Paradise Park
Hawaiian Beaches
Mauna Loa
4169
Kilauea
1247
3000
2000
1000
-1000
Hawaiian Ocean View
-2000
-3000
-4000
Loihi
-970
Pazifischer
Ozean

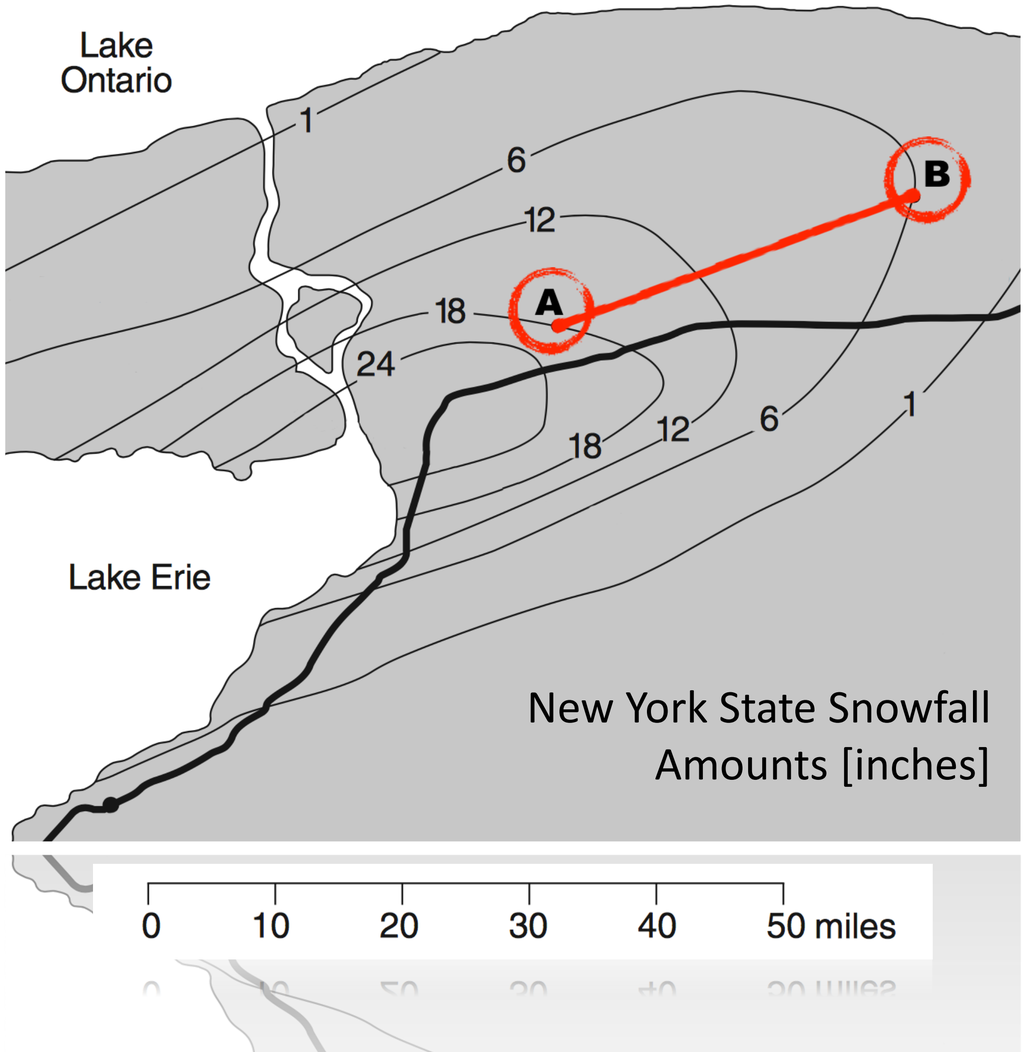
Contour Map

Field Maps

- Gradient (slope) - rate of change from one place to another

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

Field Maps



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

Gradient = $\frac{18 \text{ inches} - 6 \text{ inches}}{30 \text{ miles}}$

Gradient = $\frac{12 \text{ inches}}{30 \text{ miles}}$

Gradient = 0.4 $^{\text{inches}}/_{\text{mile}}$

Topographic Maps

How do topographic maps help us interpret our planet?

Topographic Maps

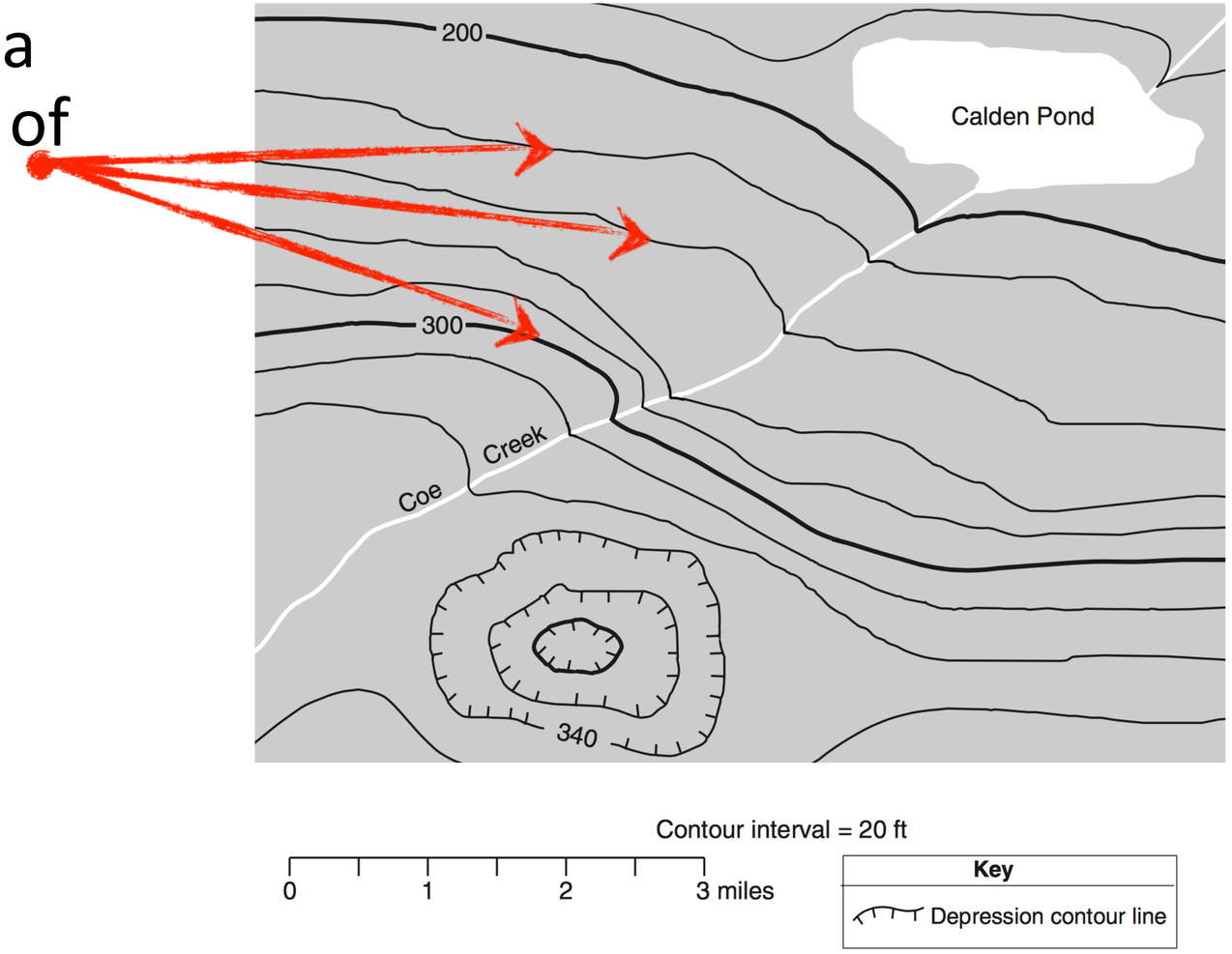
- Topographic Maps (contour map) - commonly used model of the elevation field of the surface of Earth
    - Topographic maps show three-dimensional shapes in two dimensions
- Elevation - height above or below sea level

Topographic Maps

- Natural Features - features that are created by nature
    - Examples: mountains, hills, lakes, and rivers
- Cultural Features - features that are created by mankind
    - Examples: roads, cities, buildings and dams

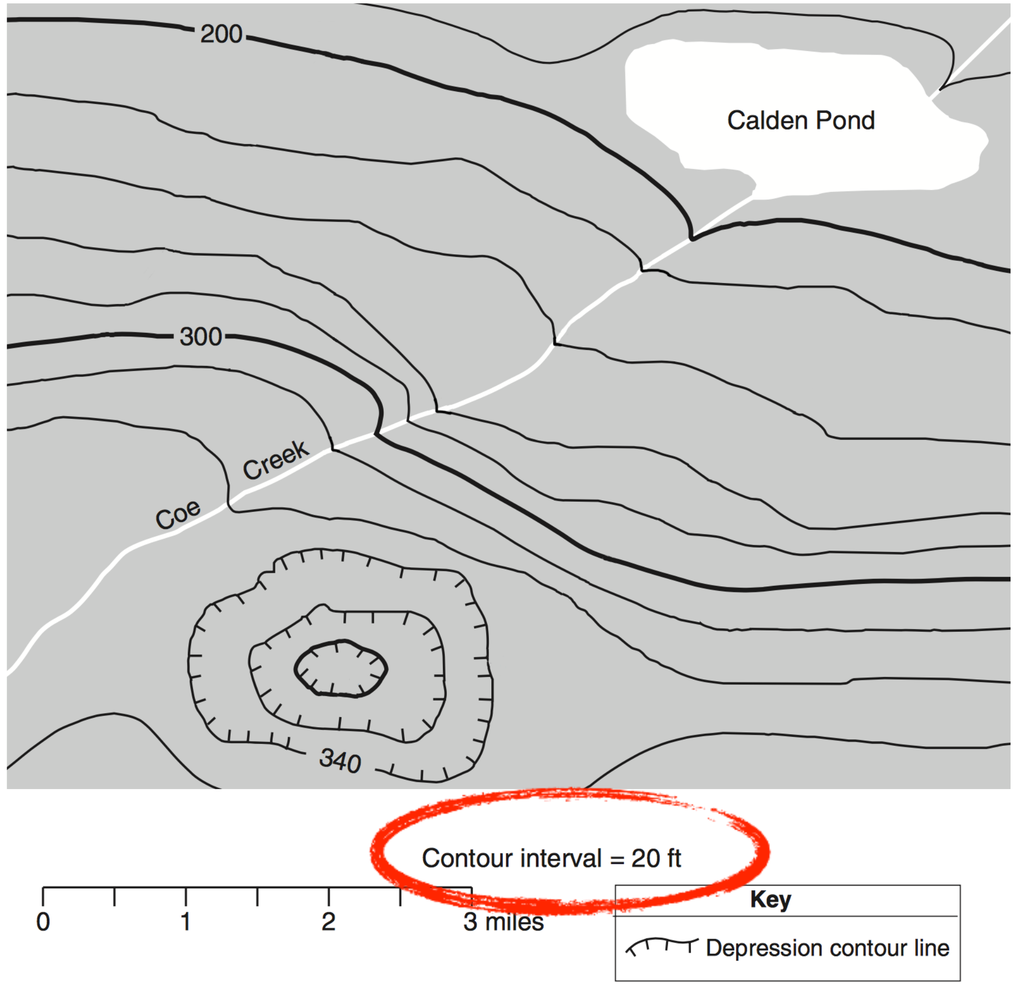
Topographic Maps

- Contour Lines - lines drawn on a map that connect equal points of elevation



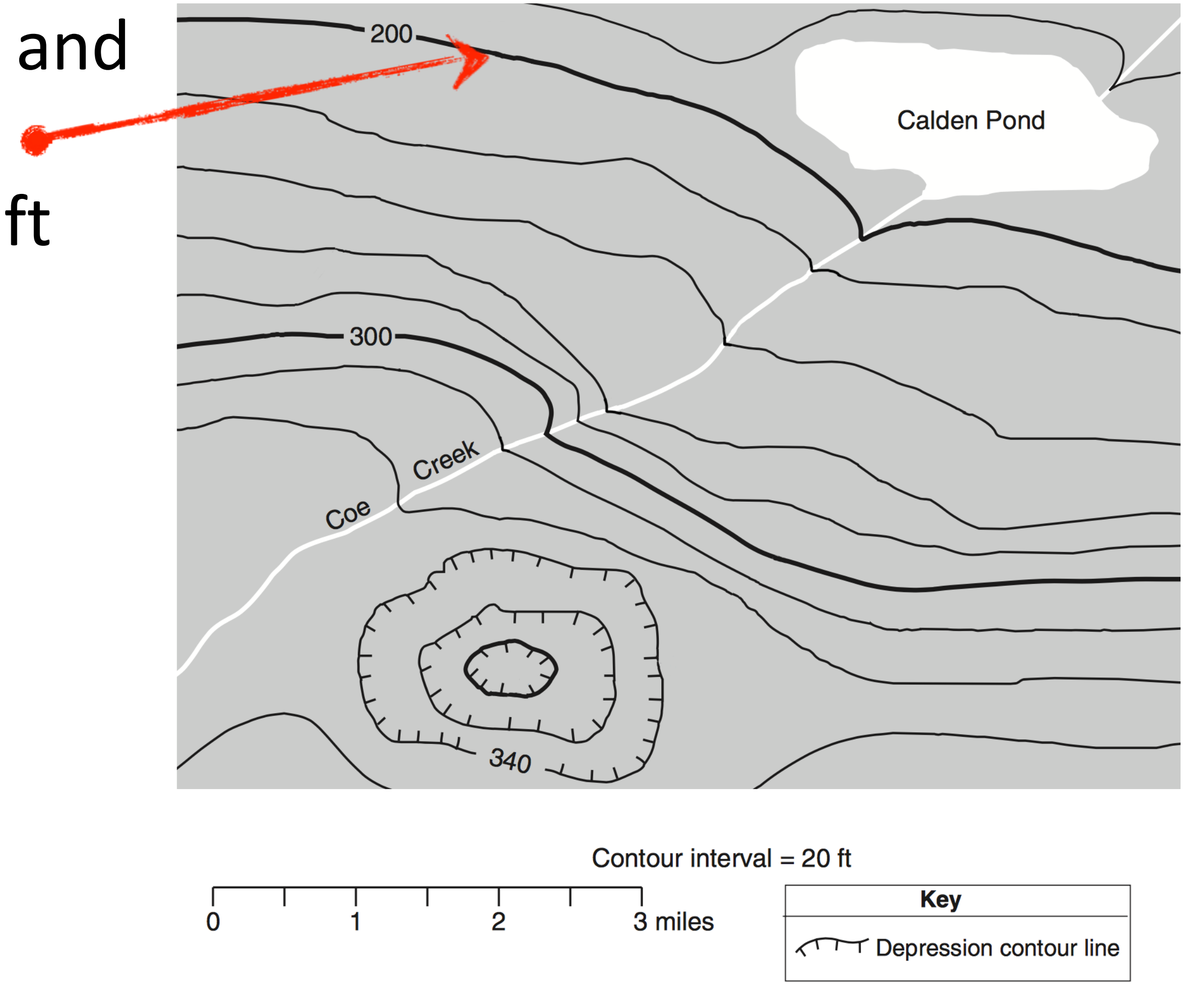
Topographic Maps

- Contour Interval - the difference in elevation between two side by side contour lines
    - The contour interval is usually found on the map key or legend



Topographic Maps

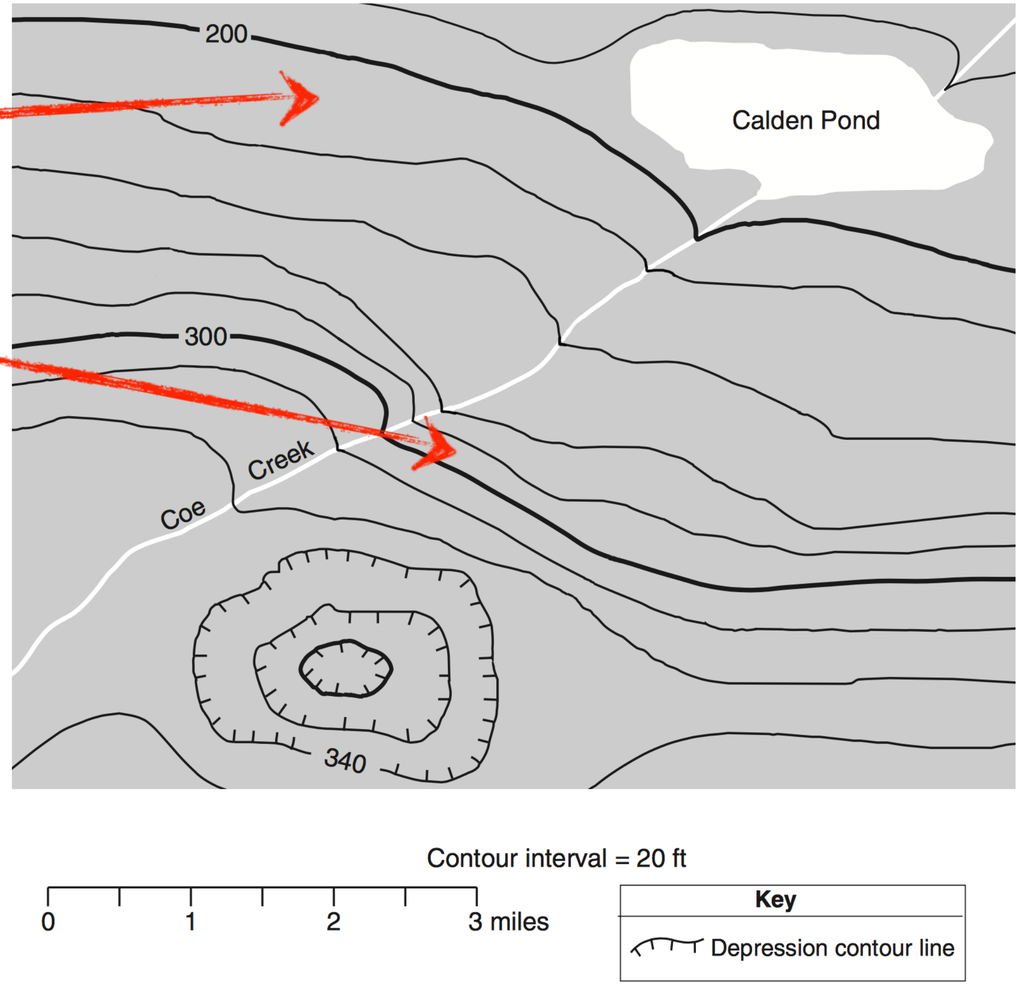
- Index Contour - lines that are bold and have an elevation labeled
    - Example: 200 ft and 300 ft



Topographic Maps

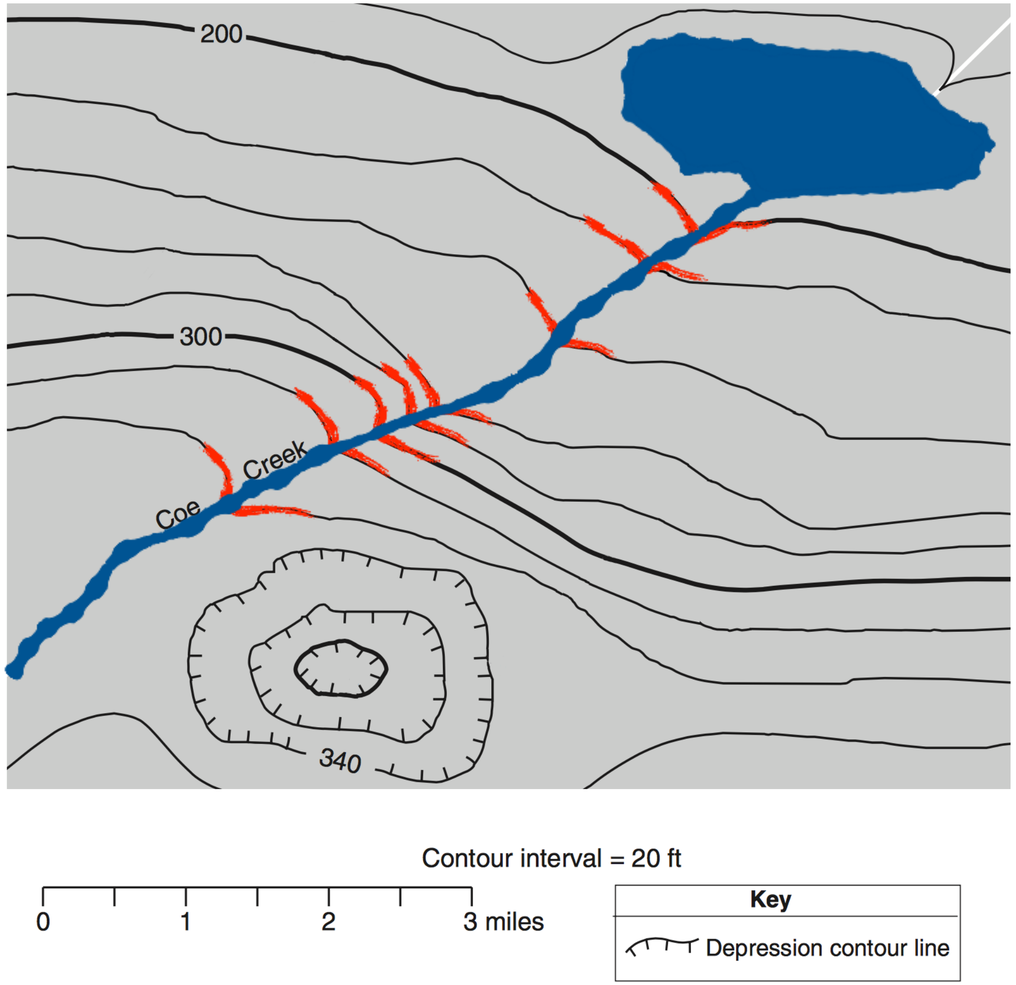
- Gentle Slope - when contour lines are spaced far apart

- Steep Slope - when contour lines are spaced close together



Topographic Maps

- When contour lines cross a river they bend upstream
    - Note: rivers flows the opposite direction the contour lines point

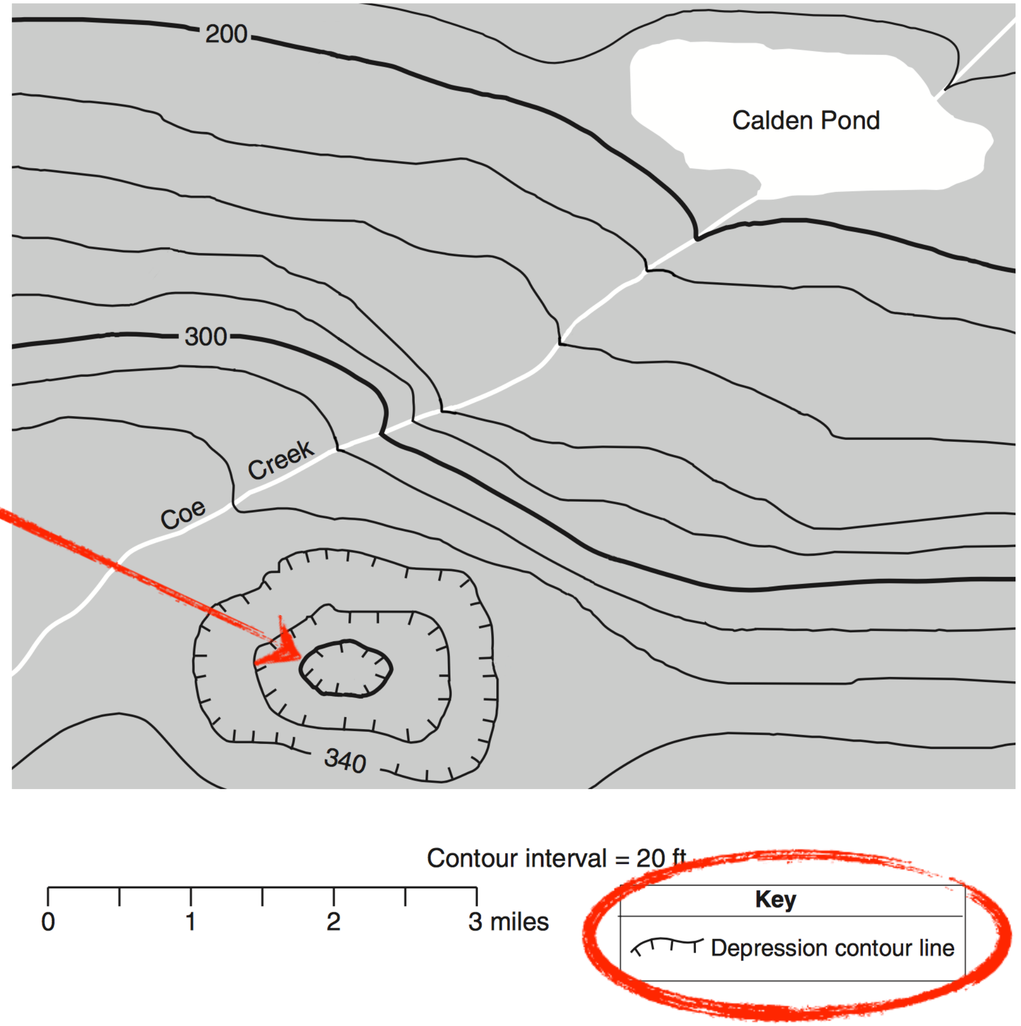


Topographic Maps

- Benchmark - a marker that has the exact latitude, longitude, and elevation of that position
    - Labeled on a map as BM. X.

Topographic Maps

- Depression Contour Lines - are marked with small lines called hachured lines that are pointed toward the center of a depression
    - Allows you to distinguish a hill from a hole



Topographic Maps

- Calculating the Highest Point:
  1. Finding the last (highest) contour line on that hill
  2. Imagine you drew another line
  3. Subtract one from the imaginary line

Topographic Maps

- Contour Line Rules:
  1. Contour lines close around hills, basins, and depressions or extend to the edge of the map
  2. Contour lines never ever cross
  3. Contour lines form V’s that point upstream whenever crossing a stream

Topographic Maps

- Topographic Profile - the side view of a geologic feature

Topographic Maps

Creating a Topographic Profile:

1. You need two points on a contour map and a horizontal grid between the two points
2. Transfer the points from the map to the horizontal grid
3. Connect the points with a smooth line to draw the profile