5
Geographers' Tools:
Location Systems

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EXTRA CREDIT

Extra Credit Atlas Exercise for Exam I is available on the course home page.

Submit answers using the blue Scantron sheet by **Feb. 19, 2019**.

Once you have completed the exercise, transfer your answers to the blue Scantron sheet using a #2 pencil.
Completely erase all mistakes and stray marks.
LATE answer sheets will NOT be accepted.

2

Location Systems

❖ **Earth's Grid:** system of points on the surface connected by **intersecting lines of latitude and longitude.**

To portray data spatially, we need a way to accurately locate places on the earth's surface.

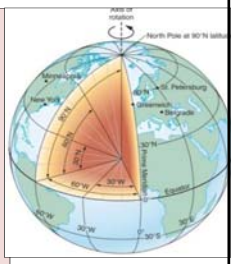
❖ This is the **GRID SYSTEM**.

➢ Composed of **lines of latitude and longitude.**

✓Allows us to **see locations, patterns, and interrelationships.**

✓Allows us to **measure distance.**

✓Allows us to **determine area.**



3

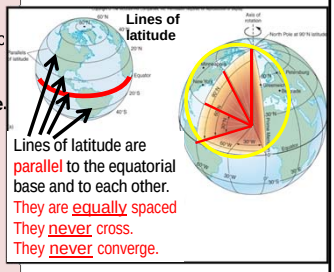
Latitude

❖ LATITUDE: **Distance** measured in degrees **NORTH** and **SOUTH** of the **EQUATOR**.

It is the result of geometric calculations **using the equatorial plane of the earth** (equator) **as its base.**

(*The equator is at the center point in the movement of the sun's vertical rays on the earth's surface.*)

The measured angle of the plumb line from the earth's surface to the center of the equatorial plane equals latitude.



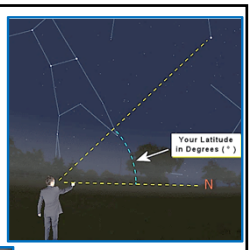
Lines of latitude are parallel to the equatorial base and to each other.
They are equally spaced
They never cross.
They never converge.

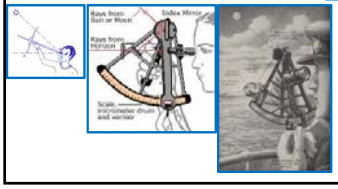
4

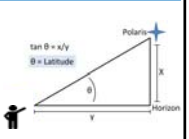
Latitude

❖ **Latitude is also astronomical.**

You can measure the angle of the sun above the horizon or the height of the North Star at night using a "sextant." The angle equals latitude.







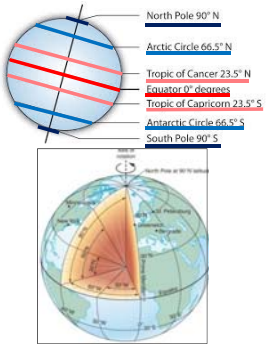
5

Latitude

❖ **There are seven lines of latitude we need to know**

All are based on astronomical observations.

90° N = North Pole
66.5° N = Arctic Circle
23.5° N = Tropic of Cancer
0° = Equator
23.5° S = Tropic of Capricorn
66.5° S = Antarctic Circle
90° S = South Pole



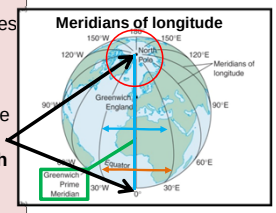
6

Longitude

Meridians are **man-made** phenomena based on the geometry of circles (360º)

❖ **LONGITUDE**: Distance measured in degrees **east** and **west** of the **0° line** which has been designated the "**Prime Meridian.**"

- All other lines of longitude are called **meridians** and **each one extends from the North Pole to the South Pole**.
- They all **converge** **(touch)** at the poles.
- Thus, the distance between meridians varies with latitude from the pole to the equator.



The 0° line of longitude is known as the "Greenwich Meridian."

Why Greenwich Meridian?

Greenwich Meridian

At one time, countries defined their prime meridian by the location of the observatory telescope that was used to gather the astronomical data.

1766 - Britain published the first nautical almanac. Its detailed maps, charts and tables, all based on the 0° meridian at London, became widely used.

1870s and 1880s – a series of international conferences was convened to the address prime meridian issue.

➢ **The result was a worldwide acceptance of the Greenwich Meridian as the Prime Meridian (0°).**

8

Drawing Longitude

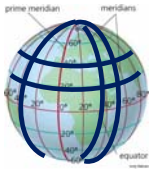
Meridians of longitude are marked by first dividing the equatorial circle into 360 segments, then dividing every circle of latitude into 360 segments and finally connecting all like-numbered degrees.

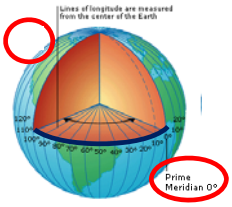
❖ There two meridians we need to know:

0° = **Prime Meridian**

180° = **International Date Line**
(IDL follows along **180°** but not exactly.)

FYI: 0° and 180° are neither E or W





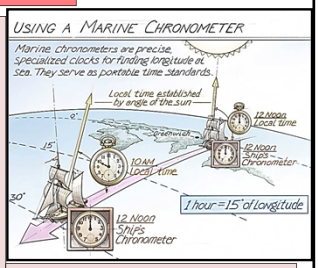
9

Finding Longitude

To determine your longitude on the earth's surface you need two accurate clocks.

One clock **(chronometer)** set for the time at **0°** (the Prime Meridian or GMT) and **one set locally by the angle of the sun.**

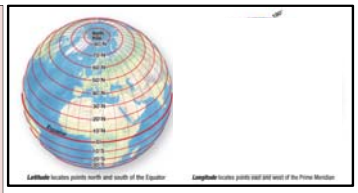
The difference in time between them indicates distance from the Prime Meridian.



Each 60 min = 15° of longitude.
Each 30 min = 7.5° of longitude.
Each 15 min = 3.75° of longitude.
Each 4 min = 1° of longitude.

Latitude and Longitude

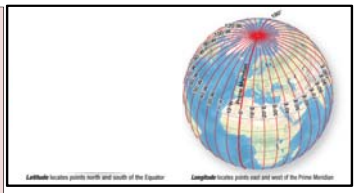
L A T I T U D E



11

Latitude and Longitude

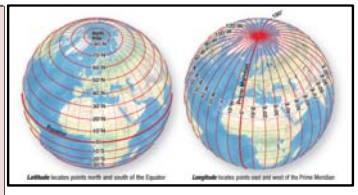
L O N G I T U D E



12

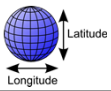
Latitude and Longitude

LONG
LATITUDE

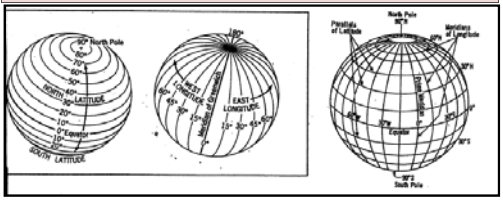


13

Latitude and Longitude



Latitude + Longitude = Earth's Grid



https://www.youtube.com/watch?v=swKBi6hHHMA – 3.5 min summary video

14

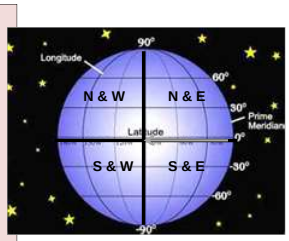
Latitude and Longitude

We can divide the earth's grid into four quadrants:

north+west | north+east
south+west | south+east

❖ **REMEMBER:**

- Latitude is only designated **NORTH** or **SOUTH.**
- Longitude is only designated **EAST** or **WEST.**



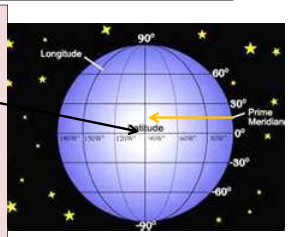
15

Reading Latitude and Longitude

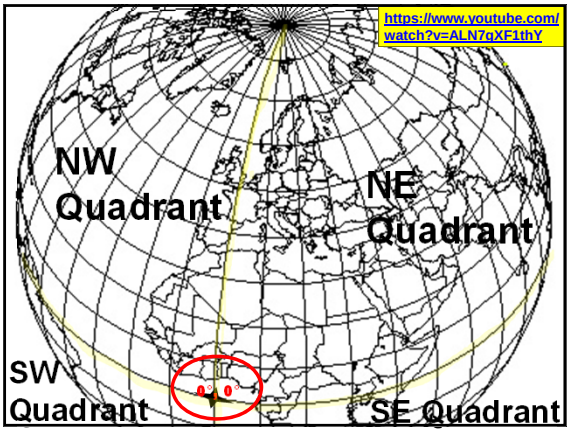
When locating places on the earth, we start where the base lines of latitude and longitude cross:

0°, 0°

- First we count lines north or south of the **equator**.
- Then we count lines east or west of the **prime meridian.**



16



TIME

❖**The longitude of a location is determined by time differential.**

You need to know the difference between "local" or "sun" time **and** "prime meridian time (GMT)."

NOTE: It is the **same time** (hour of the day) along any meridian from the North Pole to the South Pole.

18

TIME ZONES

❖ **Standard Time Zone:** an area of the earth that is **15° of longitude wide** (360° ÷ 24 hrs of one rotation = 15°/hr), where all clocks are set when **solar noon** occurs at the zone's central meridian.

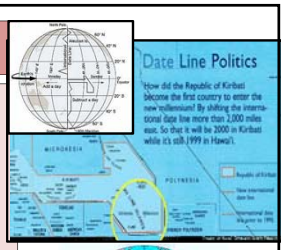
❖ **Each 15° of longitude = 1 hour** (60 min) **of time.**
- Each 7.5° of longitude = 30 minutes.
- Each 3.75° of longitude = 15 minutes.
- Each 1° of longitude = 4 minutes.

✓ **Time zones are based on calculating longitude.**
✓ Concept created in 1883 by US railroad companies for scheduling purposes.
✓ Linked to International Meridian Conference of 1884
✓ Officially adopted by countries starting in the 1920s.

19

TIME ZONES

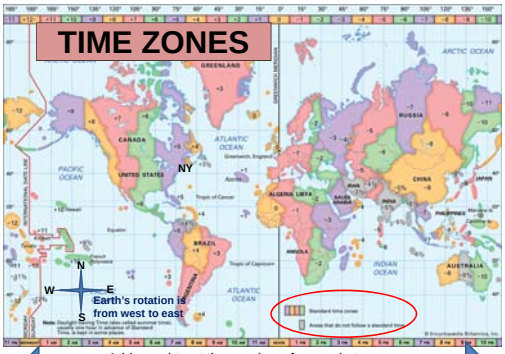
❖ **There are 24 world standard time zones, each 15° wide and equal to one hour**.
- Numerous off-standard zones (half hour, multi-hour, sun) created by governments.
- Over 30 irregular-shaped zones due to political borders.



❖ **The International Date Line generally follows the 180° meridian** – but not exactly in order to keep political units in the same date. **When the line is crossed the date changes, e.g., 3 PM Tuesday becomes 3 PM Wednesday, or vice versa, depending on direction of movement.**

20

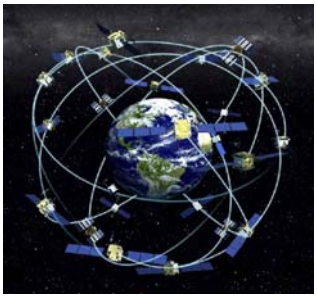
TIME ZONES



EARLIER — Add or subtract the number of zones between current location and area in question. — LATER

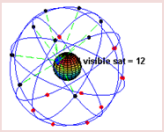
21

Global Positioning System



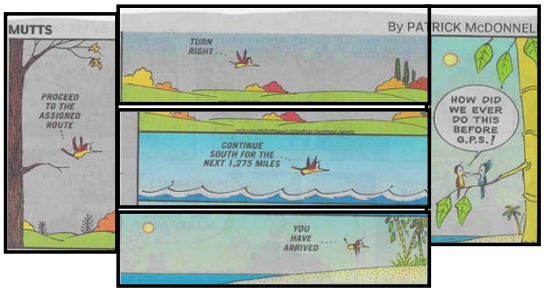
❖ **An array of 29** (24 active) **satellites orbits 12,500 miles above the earth.**

➢ **Need to be in contact with 3 to 4 satellites to get a fix on a location: latitude, longitude and elevation.**



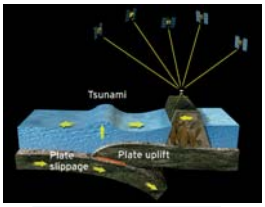
22

GPS Dependence



23

Using GPS



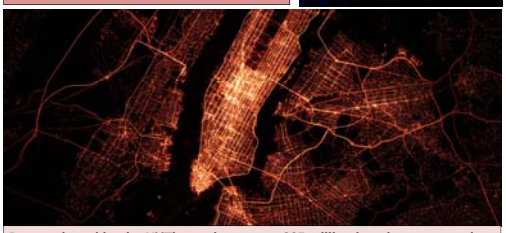
- Location – positioning things in space
- Navigation – getting from point a to point b
- Tracking - monitoring movements
- Mapping – creating maps based on those positions
- Timing – precision global timing

https://www.novatel.com/industries/agriculture/ 2 min GPS ad

24

Using GPS-enabled Apps to Track Your Location

- Location – positioning things in space
- Navigation – getting from point a to point b
- Tracking - monitoring movements
- Mapping – creating maps based on those positions
- Timing – precision global timing



Data reviewed by the NYTimes shows over 235 million locations captured from more than 1.2 million unique devices during a three-day period in 2017.

https://www.nytimes.com/interactive/2018/12/10/business/location-data-privacy-apps.html?module=inline

25

Tracking GPS-enabled Devices:
aka, Tracking People

In about four months' of data reviewed by The Times, her location was recorded over 8,600 times -- on average, once every 21 minutes.

26

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27

N E X T

Parts of Maps

28