Dirty REMOTE SENSING :
Lecture 8 *A mapping interlude..*

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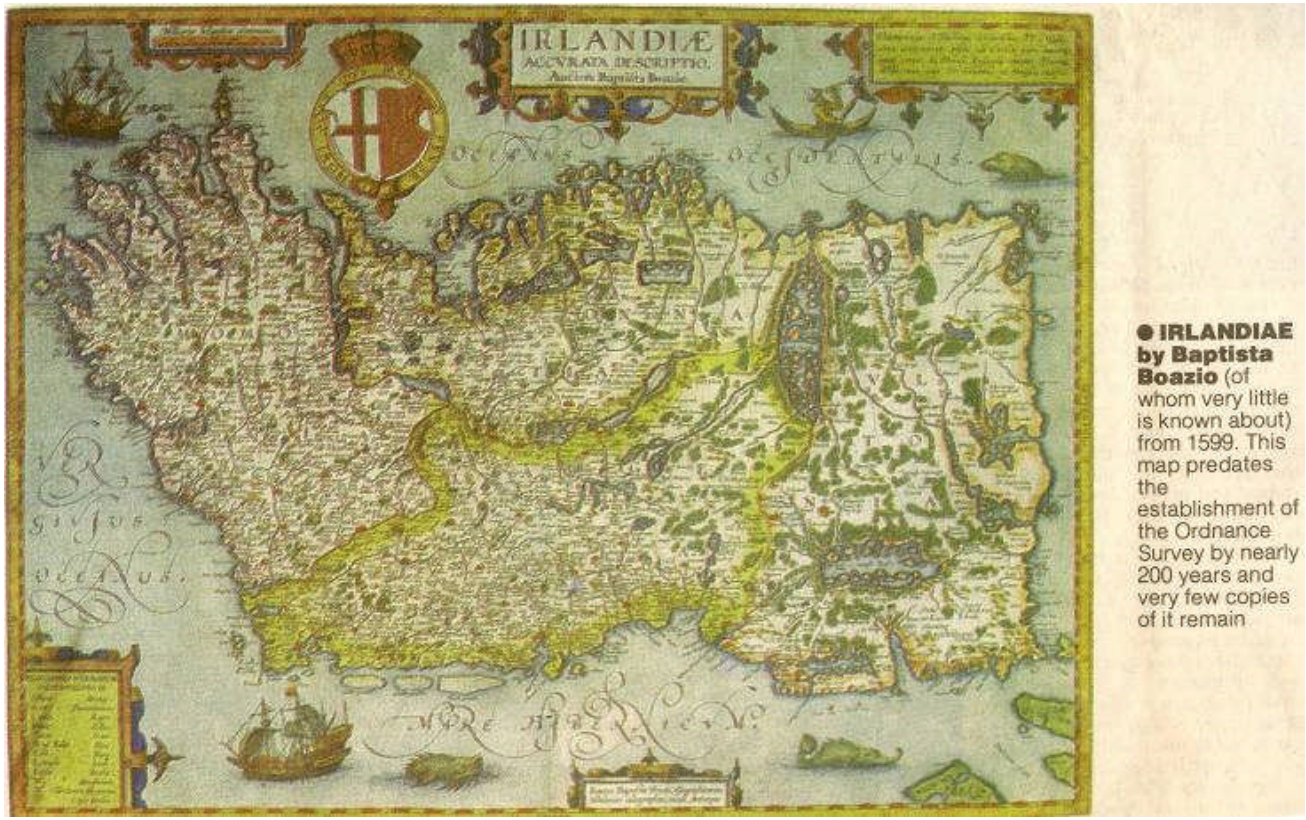
Web for the Week:
http://electronics.howstuffworks.com/gps.htm

http://www.cstars.ucdavis.edu/classes/ers186-w03/lecture17/lecture17.ppt

A mapping interlude..

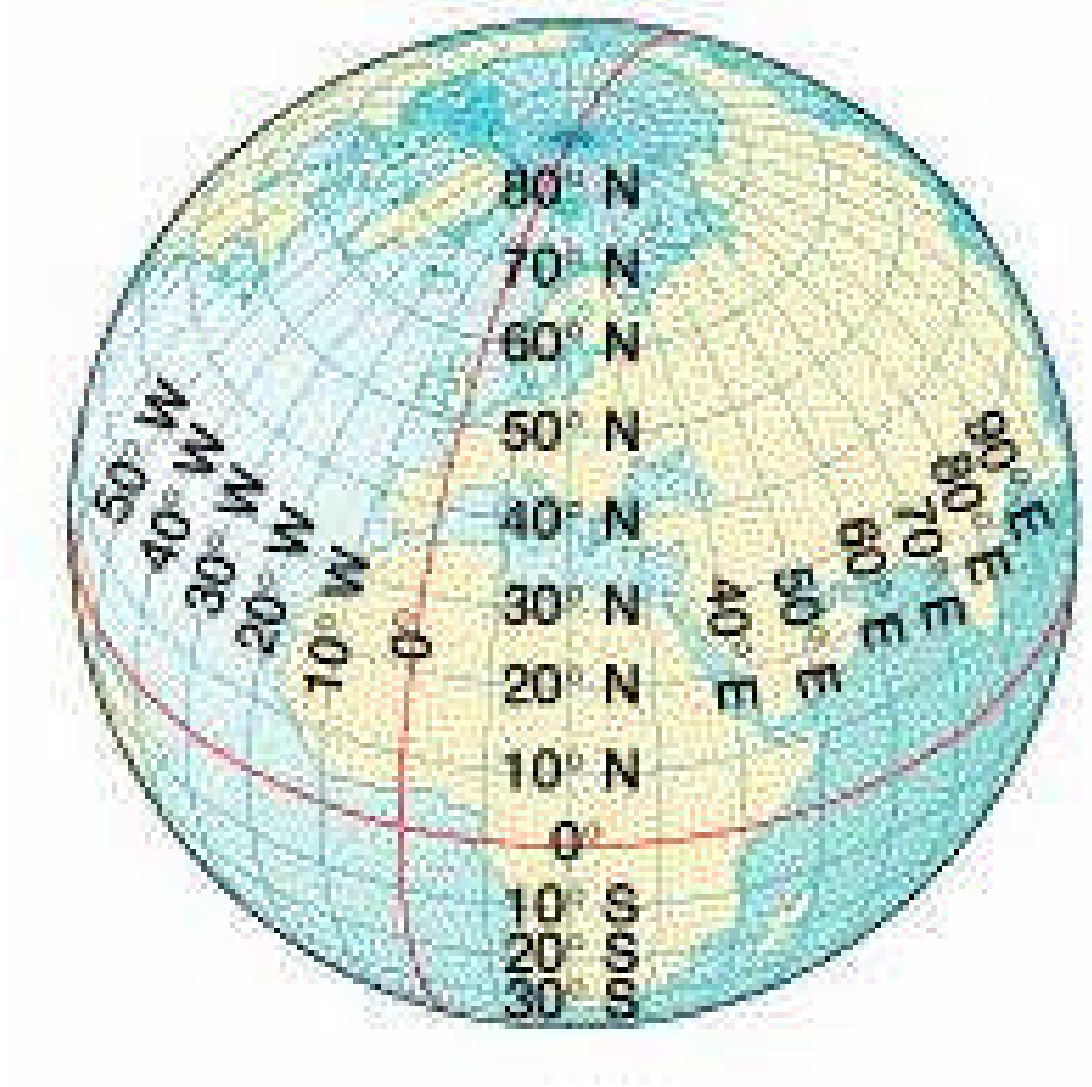


● IRLANDIAE by Baptista Boazio (of whom very little is known about) from 1599. This map predates the establishment of the Ordnance Survey by nearly 200 years and very few copies of it remain

www.ghosttowns.com/topotmaps.html

www.progonos.com/furuti/MapProj/Normal/TOC/cartTOC.html

Latitude and Longitude.



Latitude.

- Halfway between the poles, at the earth's fattest we imagine a line round the earth, the equator, which divides it exactly into two halves.

- A series of equidistant circles drawn round the globe with the poles as centre decreasing in size from the largest circle (equator) towards the pole, provide a system of reference lines to establish the distance of any point north or south of the equator.

- These **lines** are parallel to each other and to the equator; they are, therefore, called **parallels**.

- **Angular distance** north or south of the equator is called **latitude**. For reference the parallels of latitude are numbered from 0-90 on each side of the equator, the equator being 0 and the poles being 90 on each side.

Longitude.

- Another set of lines around the globe can be constructed to intersect the parallels of latitude at right angles; these lines run north and south.

- They are semi-circles, all of them the same size, with the centre of the earth as their centres.

- These semi-circles converge at the poles and divide up the earth rather like the segments of an orange. These **lines** are called **meridians**. If we look down on the globe from the poles, they appear to radiate out from each pole to the equator.

- If one meridian is chosen and numbered zero, and the others are then consecutively to the left and right (west and east), it is possible to determine how round the world a place is from the zero meridian by quoting the meridian reference. **Angular distance east and west** of the zero meridian is called **longitude**.

Latitude and Longitude.

- Before considering how this system of reference works, the units of measurement must be understood.

- We are dealing with a globe and distance along the circumference of circles, we use angular measurement, the basic unit of which is the degree. A circle is made up of 360 degrees; a degree is divided into 60 minutes (‘) each minute into 60 seconds (“).

- Parallels of latitude are numbered according to their angular distance from a line drawn from the centre of the globe to the equator. Thus a parallel of 40° latitude means that a line drawn from that parallel (north or south of the equator) to the centre of the earth will form an angle of 40° with the line from the centre of the earth to the equator.

- As the distance from either pole to the equator is one quarter of a full circle, the angular distance from equator to pole is nowhere greater than 90°. The parallels of latitude are, therefore numbered from 0-90 both north and south. The north pole is 90° north latitude, the south pole is 90 ° south latitude. Because latitude can have the same value north and south of the equator, the direction N or S must be given with the degree of latitude, viz: 45 ° N or 45 °S.

Latitude and Longitude.

- A full reference to the location of any place in the world can be given by stating the degree values of the parallel and the meridian which intersect at that point; in other words, by giving the latitude and longitude of the place. The map reference for each place on the earth's surface is unique. The indexes of most atlases give the location of places shown in the maps by latitude and longitude references.
- .

That’s all well and good when dealing with a globe

Transforming this 3D object into 2D **ALWAYS** introduces errors. Imagine trying to tear and squash a tennis ball so that it lies perfectly flat - cant be done. And all our images are Flat! .

- To go from Lumpy Bumpy 3d reality to a nice flat surface a series of mathemetical steps are taken.
- WE first need an approximate mathematical model of the shape of the world this is the **DATUM** (the datum is based a **Spheroid** model)
- When we have the DATUM we need to select a **PROJECTION** to turn the DATUM coordinates into flat 2d grid coordinates

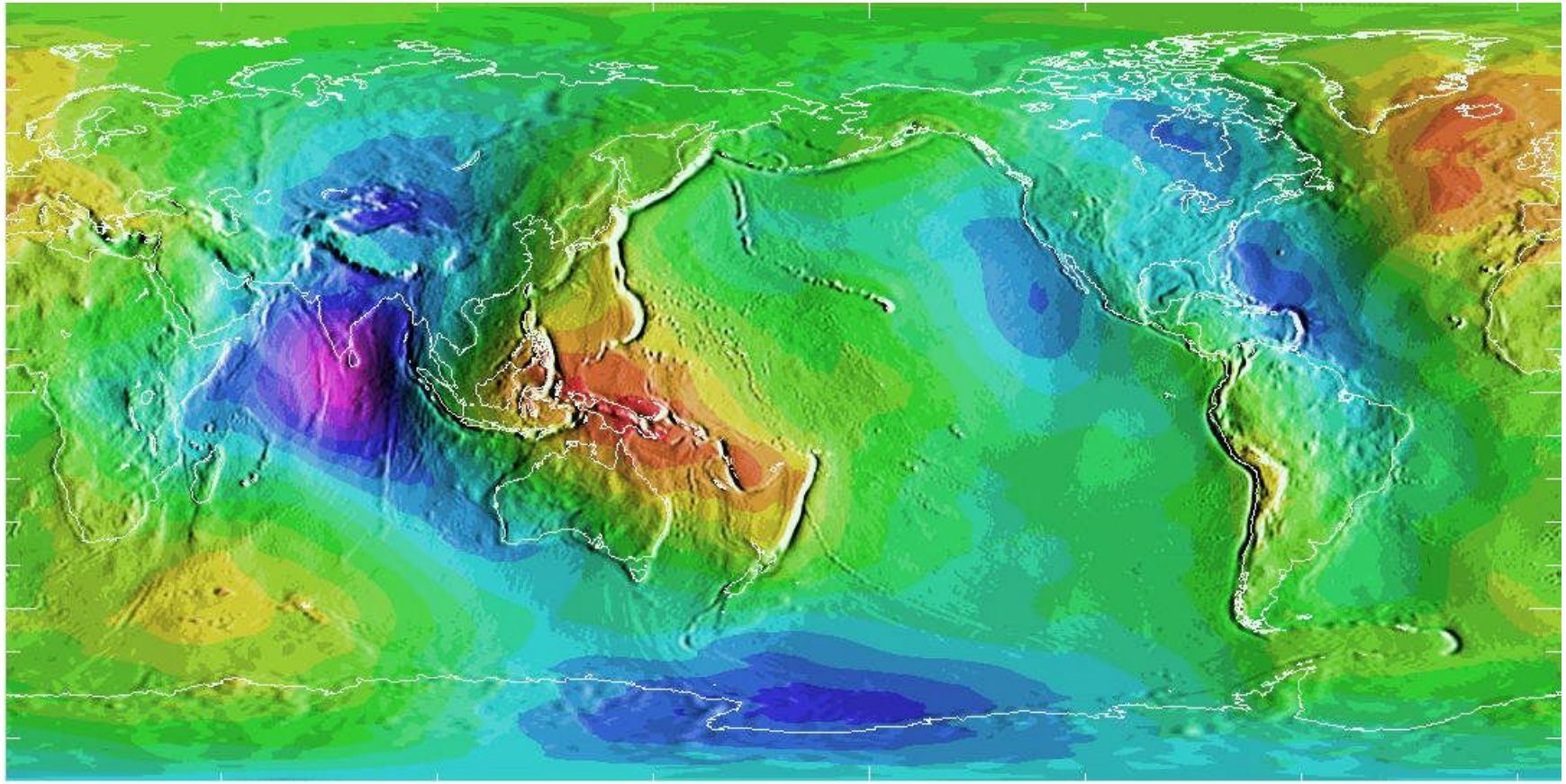
The Earth is often thought of as a ***sphere***. In reality, there is a slight flattening of the Earth at the poles, and a slight bulging of the Earth at the Equator. Technically, the Earth is an ***ellipsoid***.

Ellipsoids which approximate a sphere, such as the Earth, are also called *spheriods*.

Datums are simply a reference for modeling the Earth's surface based on some definition of the spheroid.

http://www.icsm.gov.au/mapping/datums2.html

The true shape of the world: Geoid



Projections

A method by which the curved surface of the earth is portrayed on a flat surface. This generally requires a systematic mathematical *transformation* of the earth's graticule of lines of longitude and latitude onto a plane.

It can be visualized as a transparent globe with a light bulb at its center (though not all projections emanate from the globe's center) casting lines of latitude and longitude onto a sheet of paper. Generally, the paper is either flat and placed tangent to the globe (a planar or azimuthal projection) or formed into a cone or cylinder and placed over the globe (cylindrical and conical projections).

Every map projection distorts distance, area, shape, direction, or some combination thereof. This is sort of like taking a tennis ball and cutting it up so it will lay flat on a table. There are many different ways to this and all will leave some distortion as they will not all lay perfectly flat and still align up with each other

http://www.city-sheridan-wy.com/info/pwd-pd-gis/intro.php

The new national mapping system: ITM

	IG	ITM
Reference Ellipsoid	Airy (modified)	GRS80
Central Meridian	8° West	8° West
Scale on CM	1.000 035	0.999 820
True Origin ø λ	53° 30' North 8° West	53° 30' North 8° West
False Origin	200 000 W 250 000 S	600 000 West 750 000 South

ITM & Irish Grid

- 400,000 / 500,000 coordinate difference
- Relationship defined via official OSi / OSNI polynomial transformation
  - between ETRF89 and Ireland 1975 (accuracy better than 1m everywhere in Ireland)