MAP PROJECTIONS & GEOGRAPHICAL INFORMATION SYSTEMS

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A. MAP PROJECTIONS

Introduction

The most accurate way to represent the earth in terms of its SIZE, SHAPE, AREA, etc is in the form of a GLOBE.

However: for study purposes it has become necessary to 'convert' the earth from its 3-D Globe form to a more user-friendly 2-D flat form, like in an atlas map. [This would definitely be easier to carry around and refer to than a globe].

Different geographers have tried to 'flatten' the spherical globe on to a flat plane/surface to aid our study of the earth. They have attempted to project the earth into workable images like the atlas map.

Their efforts are called MAP PROJECTIONS.

The Problem

With the conversion from 3-D to a flat paper surface (A4 page), several DISTORTIONS became evident:

1. **Scale:** Depending on the type of projection, the scale was accurate only at certain points, e.g. along a specific latitude/longitude or near the equator. As one moves away from these points, maybe closer to the poles, the scale distorts from reality and is not reliable. This would affect distance calculations and present problems to navigators and others.

2. **Shape:** Imagine cutting a soccerball in half and attempting to flatten it. It does not flatten properly. The shape becomes distorted much like the earth.

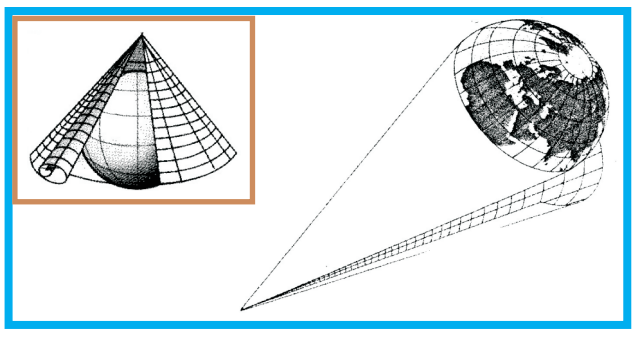
3. **Direction:** Take the same ball and before cutting it up, mark two points (maybe X and Y) on the surface. Now cut it up and spread it out. Check the two points you marked. Are they in the same place, have they moved in relation to their original positions? Comment on the movement. It will become even more distorted if we had to draw lines of latitudes and longitudes on the outside surface and compare them when we flatten the ball.

4. **Area:** In projecting the globe on to a 2-D format like an A4 page, places away from the work centres (i.e. the Equator or the middle latitudes) become more distorted from reality. Greenland appears almost the same size as China on a world map than it is in reality. [It really is about 4 times smaller.]. This is because the projected image (map projection) is not accurate with regards **to area** as we move away from the equator.

LET'S LOOK AT SOME MAP PROJECTIONS

Grade 10.

1. LAMBERT'S CONICAL PROJECTION



Prepare a large sheet of paper with grid lines (latitudes and meridians) and wrap it like a cone. Now place the cone of paper below the earth like a scoop of ice-cream. You can adjust the cone to fit along any latitude, more especially the middle latitudes (30 to 60 degrees). Map the details of the globe on to the cone this is referred to as a conical projection.

Advantages

Scale is accurate for most parts called CONFORMAL. This means that distances will relate accurately with distances on the earth's surface.

Greater accuracy occurs along the middle latitudes latitudes and longitudes match with the globe and can be transferred on to the cone paper accurately.

Suitable for study of certain latitudinal regions of the earth, e.g. climate of 40 degrees south (region of temperate cyclones).

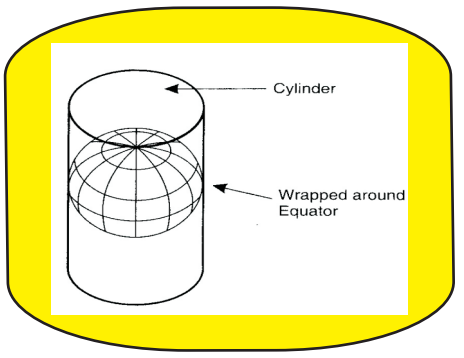
Disadvantages

Because the cone tapers downwards this affects an accurate representation of the globe towards the poles making it distorted. [you will find that the latitudes and longitudes on the cone will be badly out of alignment towards the bottom].

This causes a misrepresentation of shape and area towards the bottom of the map.

Grade 11.

2. MERCATOR'S CYLINDERICAL PROJECTION



Fold a large sheet of paper like a cylinder around the earth in a north-south direction. It will touch at the equator only. The paper will move increasingly away from the globe's surface as you go towards the poles in both hemispheres. [Remember: the earth is a spherical body.] On the paper you have marked lines of latitudes and longitudes intersecting at right angles (rectangles). Now transfer the globe's image onto the cylindrical paper. What do you notice?

Advantages

Shapes are accurate within a short distance from the equator. Islands and small countries are accurately represented.

Therefore CONFORMAL.

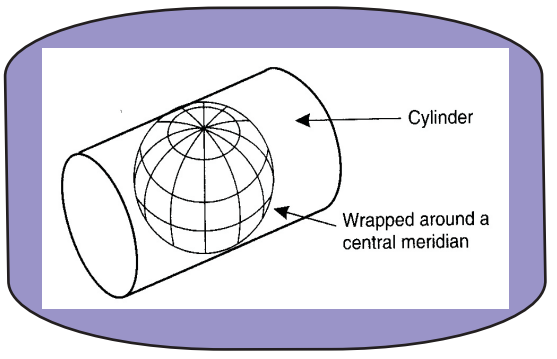
Good for navigation, accurate true bearing and direction along any straight line (called a Rhumbline).

Disadvantages

Becomes increasingly distorted away from the equator nearer the poles. Poor correlation between the size of the cylindrical paper and the earth's surface. Therefore places nearer the poles have to be 'stretched' out to fill the extra map space, making places like Greenland larger than they are in reality.

Grade 12.

3. The TRANSVERSE MERCATOR PROJECTION



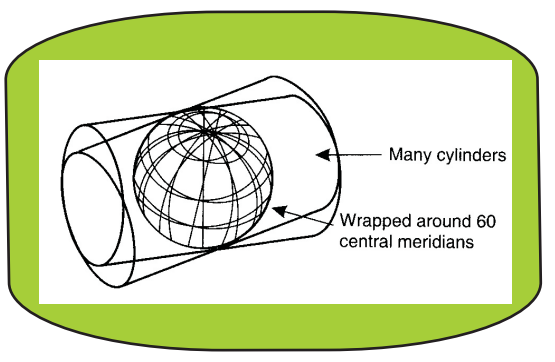
Gauss Conformal a cylindrical projection)

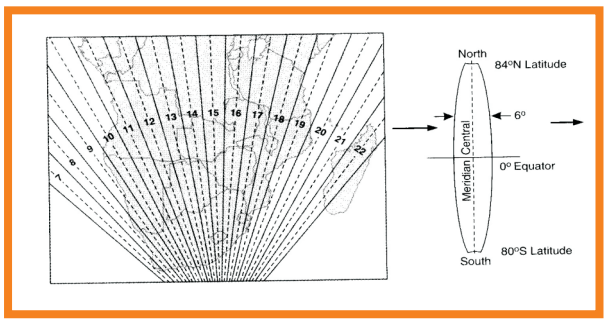
Characteristics/Advantages/Disadvantages

Wrap the cylindrical paper around the central meridians in an east-west direction.

Accuracy in scale (CONFORMAL), direction, distance (EQUIDISTANT), area (EQUAVALENT) and shape are true only within about 3 degrees of the meridian used. Beyond this they become heavily distorted and inaccurate.

4. UNIVERSE TRANSVERSE MERCATOR (UTM)





Characteristics and advantages

Attempts to map the world in 6 degree zones along 60 central meridians 6 X 60 = 360 degrees(globe).

This is done by using many cylinders wrapped around the earth along different meridians each mapping a specific area.

[Sometimes a country can have many meridians passing through it mapped by this method].

Ideal for the mapping of different areas of Earth along certain Longitudes.

Accurate study of a specific zone (meridian).

Can be very effective in Global Positioning (GPS) and use of spatial data (GIS to study the effect of changing climate patterns in certain areas of the world). [GPS Tracker systems use such accurate projections to find hijacked vehicles].

Disadvantage

Cannot joins maps from two different zones.

Can only use map from one zone.

B. GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

Refers to the **technology** used to make our world and environment more meaningful, e.g. computers, maps, photographs, satellites, etc.

A thorough study of the earth via such technology provides us with detailed information and enables us arrive at definite conclusions.

Managing such information involves manipulation and analysis of data, encoding, displaying of info, printing and presentation of geographic info… modern computers are an invaluable tool in GIS.

Uses

Instead of visiting an area to find out about it, we can zoom in with a satellite and gather info.

GIS tools can store huge amounts of info easily.

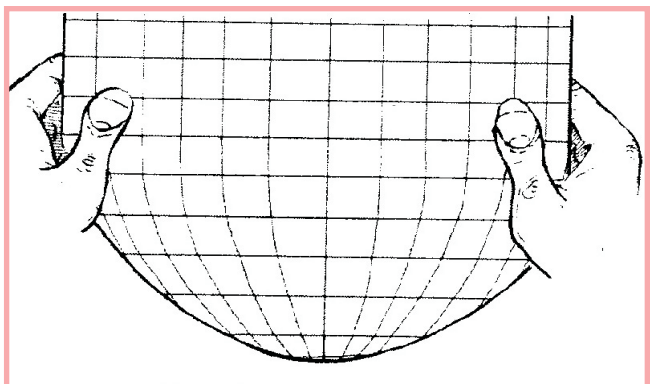
Data can be manipulated to test for a desired effect, e.g. recent power outages by Eskom could have been averted with proper GIS studies on the expanding population and our growing needs in SA.

Understanding and addressing spatial relationships e.g. best place to build a clinic in a rural area.

Provides a wide range of possible solutions to a variety of problems with research that is global in proportions.

Saves money with unnecessary expenses being avoided by manipulating data for a more workable solution.

Use of various symbols (lines, points and polygons) allow for tremendous amounts of info to be collected and analysed at the same time, e.g. topo maps.



Stretching out the graticule

GOOD LUCK FOR THE JUNE EXAMS!!