NATIONAL UNIVERSITY OF CATAMARCA, ARGENTINA
SCHOOL OF TECHNOLOGY AND APPLIED SCIENCES

ISSUES ABOUT SATELLITE IMAGES GEOREFERENCING IN ARGENTINA

Dra. ANALÍA ARGERICH

To analyze:

-The georeferencing process of satellite images.

- The implications that have for the georeferencing of satellite images the two reference systems that coexist in Argentina, one local and the other global, keeping in both the same system of projection and coordinates Gauss-Krüger.

DISTORTIONS IN SATELLITE IMAGES

GEOMETRIC

- The configuration of the satellite
- The geometry view of the sensor
- The topography of the land observed

RADIOMETRIC

- The action of the atmosphere
- The time of the year in which the image is detected
- The defects this sensor may have

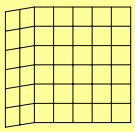
GEOMETRIC CORRECTIONS

to minimize or eliminate the distortions that are present in the geometry of images

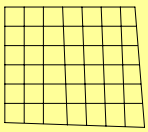
THE DISTORTIONS ARE ORIGINATED:

- In the same capture system
- By the Earth curvature

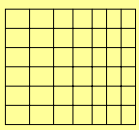
COMMON DISTORTIONS ORIGINATED IN THE CAPTURE SYSTEM



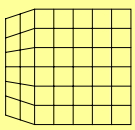
transverse inclination



turn

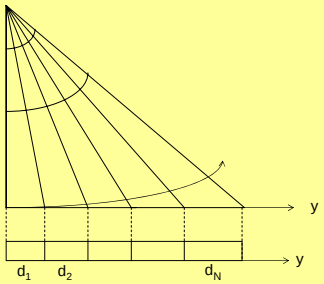


longitudinal inclination



change in the orbital height of the sensor

PANORAMIC DISTORTION



THE CORRECTION PROCESS

TWO LEVELS

ACCORDING TO THE ORBITAL PARAMETERS OF THE SATELLITE

ADJUSTING THE IMAGE TO A MAP OR TO ANOTHER IMAGE

GEOREFERENCING

GEOREFERENCING:
A process of change of space of reference

the original image is defined in a local system -the location of each pixel is determined by its situation in rows and columns-

Georeferencing adjusts this image to a new space of reference -each pixel has its equivalent value X,Y in a cartographic projection system-

the space image

the space projection

REFERENCE SYSTEM

REFERENCE FRAME

IMPLIES THE CONSIDERATION

Earth as an ellipsoid – mathematical model -

a projection system of the ellipsoid

a system of plane coordinates associated to the projection

ARGENTINE GEODESIC SYSTEM

CAMPO INCHAUSPE 69

POSGAR 94

International Ellipsoid of 1924

World Geodetic System WGS 84

semi-major axis a = 6,378,388 m

a = 6,378,137.00 meters

semi-minor axis b = 6,356,911.95 m

b = 6,356,752.31 meters

MATERIALIZATION
OF THE REFERENCE SYSTEM

- Cartographic representation of the land

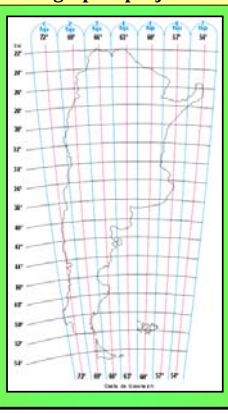
Kind of projection used to represent the ellipsoid in the drawing

Gauss-Krüger System

7 meridian bands

3º of longitude wide and 34º long – latitude –

Division of the Argentine Republic in 7 meridian bands of cartographic projection



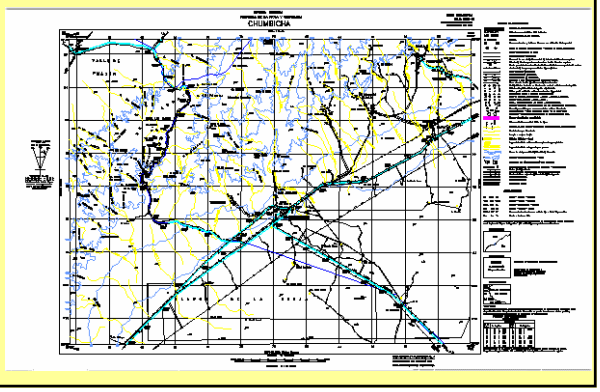
Two reference systems coexist in Argentina

projection and coordinates Gauss-Krüger

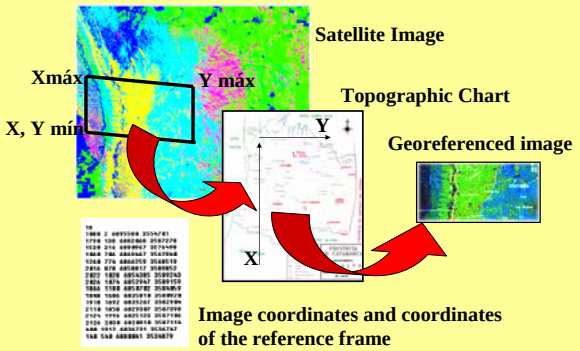
plane coordinates calculated from WGS 84

plane coordinates calculated from Inchauspe 69

Topographic Chart 2966-15 "Chumbicha" with plane coordinates Gauss-Krüger calculated from Inchauspe 69



SATELLITE IMAGES GEOREFERENCING



THE TRANSFORMATION OF A COORDINATES' SYSTEM

two-dimensional functions

dimension *x* — dimension *y*

multiple linear regression

$$x_i = a_0 + a_1 c_i + a_2 l_i$$
$$y_i = b_0 + b_1 c_i + b_2 l_i$$

$$EP_i = \sqrt{(\bar{c}_i - c_i)^2 + (\bar{l}_i - l_i)^2}$$

POSITION ERROR

Where the correct coordinates are: $\bar{c}_i ; \bar{l}_i$

MEDIUM POSITION ERROR

$$EMP = \frac{\Sigma EP_i}{n}$$

The procedure for satellite images georeferencing with Idrisi software

To digitalise the control points in the image

To record these points in a vector file

To create a correspondence file

To select the reference system

To edit the Gauss Krüger system

Band	Georeferencing Files for Idrisi Kilimanjaro
1	ref. system : Gauss-Kruger, Zone 1, Campo Inchauspe projection : Gauss-Kruger datum : Campo Inchauspe delta WGS84 : -148 136 90 ellipsoid : International 1924 major s-ax : 6378388 minor s-ax : 6356911.9 origin long : -72 origin lat : -90 origin X : 1500000 origin Y : 0 scale fac : 1.0 units : m parameters : 0
2	ref.system : Gauss-Kruger, Zone 2, Campo Inchauspe projection : Gauss-Kruger datum : Campo Inchauspe delta WGS84 : -148 136 90 ellipsoid : International 1924 major s-ax : 6378388 minor s-ax : 6356912 origin long : -69 origin lat : -90 origin X : 2500000 origin Y : 0 scale fac : 1.0 units : m parameters : 0
3	ref.system : Gauss-Kruger, Zone 3, Campo Inchauspe projection : Gauss-Kruger datum : Campo Inchauspe delta WGS84 : -148 136 90 ellipsoid : International 1924 major s-ax : 6378388 minor s-ax : 6356912 origin long : -66 origin lat : -90 origin X : 3500000 origin Y : 0 scale fac : 1.0 units : m parameters : 0

LANDSAT TM FULL SCENE GEOREFERENCED

FINAL REMARKS

- **Adjustments do not guarantee – in the strict sense – that the image will adapt totally to the new reference system: The correction of the transformation is only guaranteed in the support points, not in every image point.**
- **It is better to use a more numerous set of support points in order to make the transformation equations.**
- **Georeferencing quality can only be estimated from a set of control points different from the support points.**
- **In countries where different reference systems coexist, there has to be taken special care when using different data sources because they are not always compatible.**