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
longitudinal inclination

turn
change in the orbital height of the sensor

PANORAMIC DISTORTION
THE CORRECTION PROCESS

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

Earth as an ellipsoid – mathematical model -

a projection system of the ellipsoid

a system of plane coordinates associated to the projection

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

International Ellipsoid of 1924

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

POSGAR 94

World Geodetic System WGS 84

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
- 3° of longitude wide and 34° 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

SATELLITE IMAGES GEOREFERENCING

Satellite Image
Xmax, Ymax
X, Y min

Topographic Chart
Georeferenced image

Image coordinates and coordinates of the reference frame

THE TRANSFORMATION OF A COORDINATES’ SYSTEM

two-dimensional functions

\[ \begin{align*}
  x &= a_0 + a_1 c_i + a_2 l_i \\
  y &= b_0 + b_1 c_i + b_2 l_i
\end{align*} \]

multiple linear regression

POSITION ERROR

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

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

MEDIUM POSITION ERROR

\[ EMP = \frac{\sum EP_i}{n} \]

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

**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.