

Lineament Extraction from Digital Terrain Derivate Model: A Case Study in the Girón–Santa Isabel Basin, South Ecuador

PROBLEM

Geological lineaments are considered a superficial expression of discontinuities on the earth's surface. Automated extraction of lineaments generates results in less time and detects more structures than manual detection.

MAIN GOAL

This study aims to extract geological lineaments from the Santa Isabel–Girón Basin using remote sensing data and GIS technology, combined with statistical analysis and photogeological interpretation to understand the spatial concentration and orientation of the lineaments in the study area.

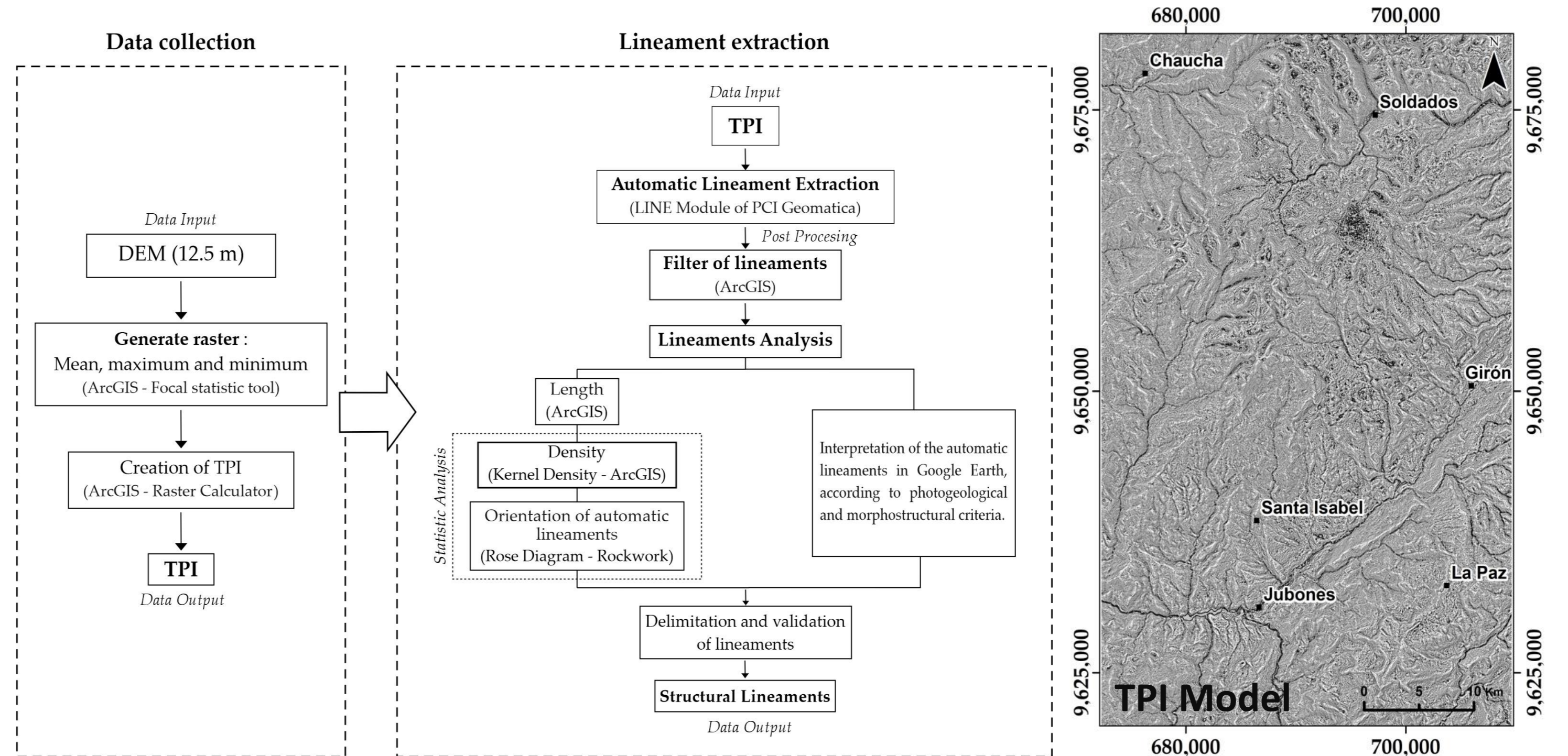
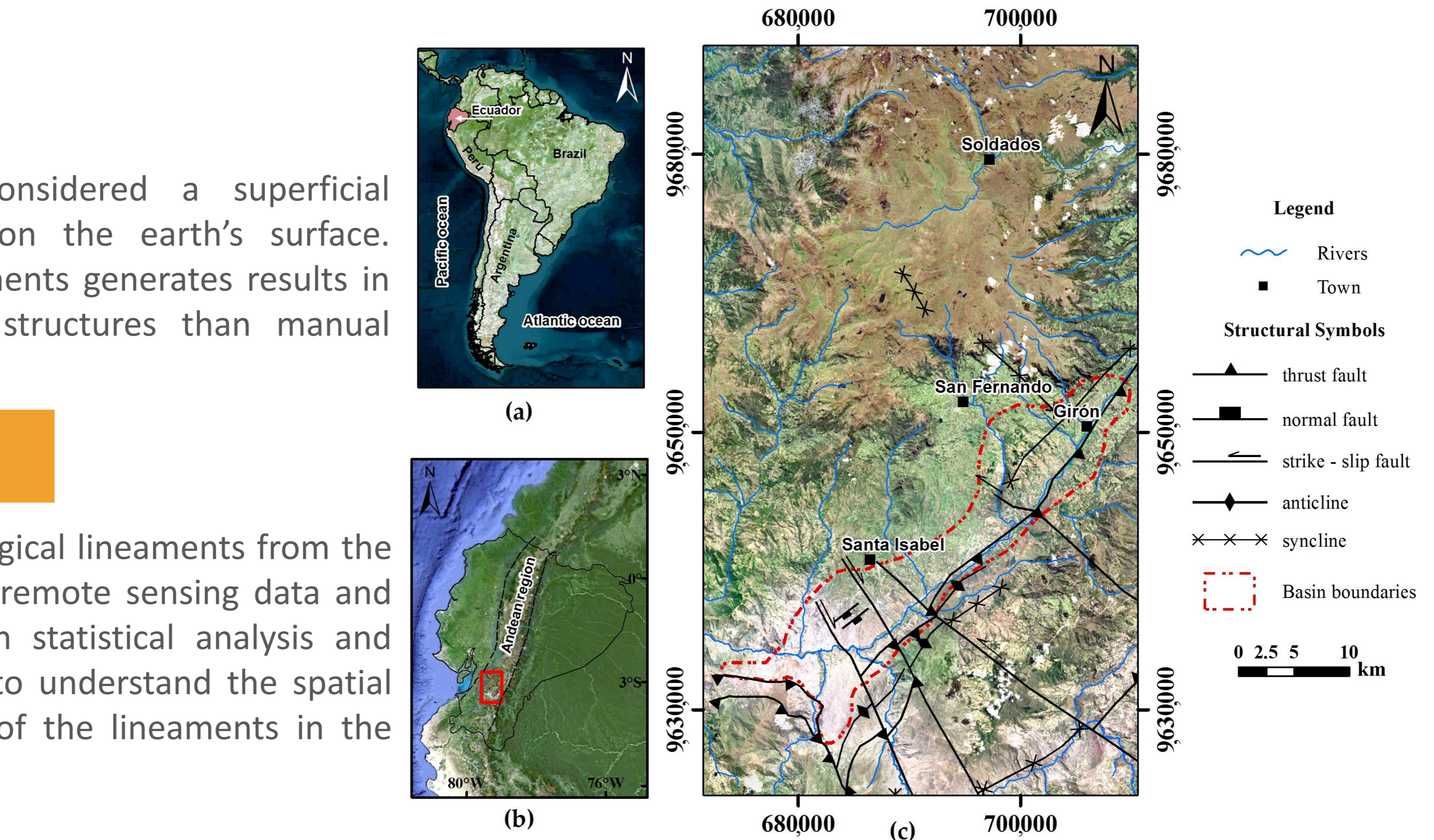
METHODOLOGY

The geological lineaments were extracted in the PCI Geomatics 2016 software using a Topographic Position Index (TPI).

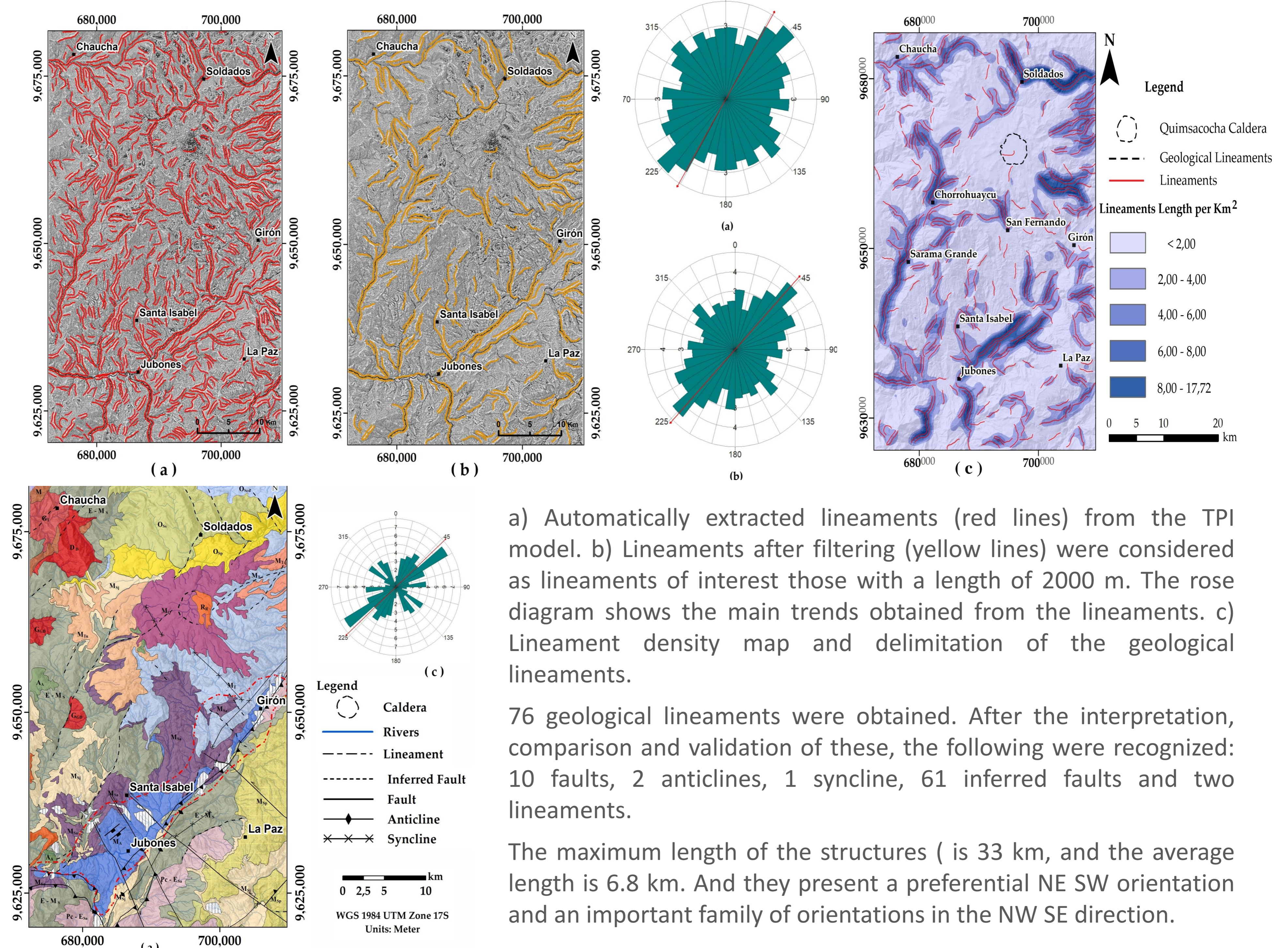
The TPI model was obtained using the following equation:

$$TPI = \frac{DEM_{mean} - DEM_{min}}{DEM_{max} - DEM_{min}}$$

DEM = Digital Elevation Model



RESULTS



a) Automatically extracted lineaments (red lines) from the TPI model. b) Lineaments after filtering (yellow lines) were considered as lineaments of interest those with a length of 2000 m. The rose diagram shows the main trends obtained from the lineaments. c) Lineament density map and delimitation of the geological lineaments.

76 geological lineaments were obtained. After the interpretation, comparison and validation of these, the following were recognized: 10 faults, 2 anticlines, 1 syncline, 61 inferred faults and two lineaments.

The maximum length of the structures (is 33 km, and the average length is 6.8 km. And they present a preferential NE SW orientation and an important family of orientations in the NW SE direction.

CONCLUSIONS

- The automated extraction of the linear features of an area will depend on the resolution and the satellite image used. DEM, DTM, and, in this case, TPI represent important tools for mapping morphostructural lineaments in difficult-to-access areas, tropical areas, and areas of high cloud cover, where the application of optical images can be difficult.
- 76 geological lineaments were obtained, and 71 faults (10 faults and 61 inferred faults) were defined from them. In general, they had an orientation and magnitude in accordance with the structures of the existing geological maps.
- The present study provides a new database of lineaments for the Girón–Santa Isabel basin area that could be useful for developing management and development plans.