



# MIAN



## INTEGRATED NORTH ANDEAN MAP (MIAN)

### Technical Specifications

Consulting and Technical Coordination



With special contributions from the United States National Section of the PAIGH



U.S. DEPARTMENT OF THE INTERIOR  
INTERNATIONAL TECHNICAL ASSISTANCE PROGRAM



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## Specifications of the Integrated North Andean Map (MIAN)

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## 1. Introduction to the product

These technical specifications have been drafted in accordance with the ISO 19131:2007 standard “*Geographic Information Data Product Specifications*”. The Integrated North Andean Map (MIAN) is a geographic dataset covering the countries of Bolivia, Colombia, Ecuador, Panama and Peru with official, digital, standardized, continuous and fundamental (or reference) data in vector structure at 1: 250,000 resolution.

It contains six themes (Administrative boundaries, Hydrography, Populated sites, Transport networks, Terrain Morphology and Miscellaneous) that in turn contain 15 geographic objects as indicated in Table 1. The full description of these is included in the «Catálogo de objetos geográficos MIAN» (MIAN Catalogue of geographic objects). It should be noted that the boundaries included in the geographic object «País» (country) are there as an approximate reference and for guidance; they do not have any official nor probative validity, in accordance with Chapter I, article 1 of the Organic Statute of the PAIGH.

The aim of the MIAN is to provide a fundamental cartography for all kinds of users and all types of applications. It covers the spatial extent of the five countries mentioned above, but it is intended first of all to complement and give continuity to the Integrated Central America Map. Secondly, it is also intended to constitute, once Brazil and the rest of the countries of the subcontinent join, an Integrated Map of South America (MIAS).

As a general philosophy, the MIAN has been developed always keeping the family of ISO 19100 standards as a reference and always seeking to be in compliance with the applicable standards. The OGC standards have also been taken into account, especially when considering the publication of the MIAN through Web Map Services and possibly WMTS.

From the beginning, the MIAN will be available in the form of a 1.3.0 WMS service at the GeoSUR geoport under a CC BY 4.0 licence in this mode:

CC BY 4.0 CAF, PAIGH, GeoSUR Program, IGM Bolivia, IGAC Colombia, IGM Ecuador, IGNTG Panama, IGN Peru

The sources of the data used has been the official digital cartography closest to a resolution of 1:250,000 that the geographic institutes of the region have produced. These have been checked for errors and handled so as to form a continual digital map.

The MIAN has been put together under the auspices of the CAF, the PAIGH and the GeoSUR Program, and has had available the technical support of the USGS of the Unites States and of the CNIG of Spain. This has been a model project in terms of the institutional cooperation, because the IGM of Bolivia, the IGAC of Colombia, the IGM of Ecuador, the IGNTG of Panama and the IGN of

Peru have participated in the production process, in a very positive team-based working environment.

Work has been carried out jointly at five workshops:

- First Workshop (Bogota, 9th – 13th of February, 2015), at which the team was set up, the project was defined and work was begun.
- Intermediate Workshop (Lima, 7th – 8th of April, 2015), to incorporate the IGM of Bolivia, which had not been able to attend the First Workshop.
- Second Workshop (Quito, 13th – 17th of July, 2015), which was for making progress in the work and achieving the first project milestones.
- Third Workshop (Panama, 16th – 20th of November, 2015), dedicated to finalizing the data and metadata necessary for publishing a WMS server.
- Fourth Workshop (Rio de Janeiro, 16th – 20th of May, 2016), for starting work on the continuous transition towards Brazil, settling the remaining details and defining the future evolution of the project.

During the intervals between the workshops, work has proceeded by means of telephone conferences, electronic mail and the exchange of data and metadata files.

## **2. Field of application**

The MIAN covers the land area under the sovereignty of these countries: Bolivia (BO), Colombia (CO), Ecuador (EC), Panama (PA) and Peru (PE).

It includes the archipelago of the Galapagos Islands (Ecuador) and all the islands that can be shown at the 1:250,000 scale, both the maritime and riverine islands.

The bounding box at the WGS84/SIRGAS coordinates for latitude and longitude that defines the zone is:

12° 30' N	57° 30' W
23° 00' S	83° 45' W

## **3. Identification of the product**

The name of the digital data product is «Mapa Integrado Andino del Norte» (Integrated North Andean Map) v1.0 and its acronym is «MIAN». Both terms

may be used in a generic way, without specifying the version or with a specific version.

Examples: MIAN refers to the generic product and all that is said about it applies to all the versions.

MIAN v1.0 refers only to the first version.

The Integrated North Andean Map (MIAN) is a geographic dataset covering the countries of Bolivia, Colombia, Ecuador, Panama and Peru with official, digital, standardized, continuous and fundamental (or reference) data in vector structure at 1: 250,000 resolution.

The purpose of the MIAN is to provide a fundamental cartography for all kinds of users and all types of applications. It covers the spatial extent of the five countries mentioned above, but it is intended first of all to complement and give continuity to the Integrated Map of Central America Map. Secondly, it is also intended to constitute, once Brazil and the rest of the countries of the subcontinent join, an Integrated Map of South America (MIAS).

The thematic category of the MIAN data, in accordance with the classification of themes covered by the ISO 19115, standard is that of «imageryBaseMapEarthCover», code 010.

As has already been mentioned, the MIAN covers the land area under the sovereignty of the countries of Bolivia (BO), Colombia (CO), Ecuador (EC), Panama (PA) and Peru (PE). The bounding box that defines the zone with WGS84 latitude and longitude coordinates is:

12° 30' N	57° 30' W
23° 00' S	83° 45' W

The spatial portrayal is in vector structure and the spatial resolution is 1:250,000.

#### **4. Structure and content**

The language of the data is Spanish (esp) and the character set is the utf8.

##### **4.1 UML Model**

The UML v2.0 model can be seen in Figure 1; this covers the following geometric primitives in conformance with the ISO 19107:2003 standard:

- GM\_Point
- GM\_Curve
- GM\_Surface



Figure 1. MIAN v2.0 model

## 4.2 Catalogue of geographic objects

The MIAN Catalogue is structured around 6 themes and 15 objects, just as is shown in Table 1:

Table 1 Summary of the MIAN Catalogue

Theme	Geographic object
Administrative boundaries	Country, Level 1, Level 2 and Level 3
Hydrography	River, Coast line, Body of water, Hydrographic forms
Populated sites	Settlement, Urbanized zone
Transport networks	Railway, Road
Morphology	Spot height, Island
Miscellaneous	Toponym

It should be noted that the boundaries included in the geographic object «País» (country) are as a reference and for guidance; they do not have any official nor probative validity, in accordance with Chapter I, article 1 of the Organic Statute of the PAIGH [1]. The intention is not to portray the official boundaries of each country, rather it is to serve as a cartographic reference, lacking precision at large scales, so that the user can find the way spatially in an approximate manner.

The full description of the themes, the geographic objects and the attributes that each one of those objects has, can be seen in Annex I.

The MIAN v2016 catalogue of geographic objects is available in digital version at the GeoSUR Program geoportal: <http://www.geosur.info/>.

Its title is «Catálogo de objetos geográficos MIAN v2016» (MIAN v2016 catalogue of geographic objects). Its scope is formed by the geographic objects included in Table 1, and both the authorship and the responsibility for setting it up are shared, cooperatively, by the technicians participating in the project.

## 5. Reference Systems

The Coordinate Reference System (SRC) of the MIAN is that corresponding to EPSG: 4326, that is, WGS84 for latitude and longitude.

There is no specific system based on geographic identifiers.



## 6. Data Quality

The MIAN, as a set of fundamental reference data for the region, should have the quality of data that would be expected in an official cartographic series at the reference scale, just as is described as follows, in accordance with the ISO 19157:2013 standard for data quality.

- Absolute positional precision

ECM  $\leq$  50 m

- Thematic accuracy
  - o Correction of the classification  
Errors < 2%
  - o Correction of the names of the geographic objects  
Errors < 4%
  - o Correction of other qualitative attributes  
Errors < 2%

- Completeness
  - o Omission of geographic objects

Rate at which objects are omitted, in all themes except the Miscellaneous theme, in relation to objects in the real world < 2%

- o Commission of geographic objects

Rate at which objects are included (commission), in all the themes except the miscellaneous theme, in relation to objects in the MIAN < 1%

- Logical consistency
  - o Conceptual consistency

Repeated geographic objects 0%

Repeated vertices 0%

Loop 0%

Erroneous loose ends 0%

Open surfaces 0%

- o Consistency in the domain

Rate of attributes with values outside the expected range of values 0%

The related data quality elements listed in Table 2 are not taken into account.

**Table 2 Data Quality elements not taken into account**

<b>Aspect of quality</b>	<b>Data quality element</b>
Positional accuracy	Relative positional accuracy
	Positional accuracy of grid data
Thematic accuracy	Qualitative accuracy of attributes
Logical Consistency	Topological consistency
	Consistency in format
Temporal quality	No elements
Usability	No elements

## **7. Data Capture**

### **7.1 Sources of data**

The sources of data used have been the official cartography produced by each one of the geographic institutes participating:

- Map of Bolivia at 1:100,000 scale from the Military Geographic Institute of Bolivia.
- Topographic Map at 1:100,000 scale from the 'Agustín Codazzi' Geographic Institute of Colombia.
- Official base cartography at 1:250,000 scale from the Military Geographic Institute of Ecuador.
- General Map at 1:250,000 scale from the 'Tommy Guardia' National Geographic Institute of Panama.
- National Map in digital media at 1:100,000 scale from the National Geographic Institute of Peru.

### **7.2 Production process**

- 1) Interactive consolidation, agreed by consensus, of the «País» (country) object boundaries, using as supporting reference the Landsat 7 satellite images and the binational cartography available at larger scales from other projects.
- 2) Interactive geometric matching up, agreed by consensus, of each separate theme in this order: Hydrography, Transport networks, Populated sites, Morphology and Miscellaneous. Landsat 7 satellite images and the binational cartography available at larger scales from other projects have also been used as supporting reference.
- 3) Partial harmonization of the density of the data in each country.

- 4) Loading the data into a single Database.
- 5) Automatic checks on logical consistency and interactive correction of the errors detected in various iterative processes.
- 6) Creating the legend, and publication of the WMS service

## **8. Maintenance**

The frequency for updating the information in the Integrated North Andean Map (MIAN) is set at every 5 years, when a complete and new version will be distributed.

## **9. Portrayal**

The MIAN portrayal catalogue gathers together the portrayal specified in the «Production Specifications for topographic maps at 1:250.000 scale» of the Pan American Institute for Geography and History (PAIGH), provisional edition, 1978, just as is put together and stated in Reference document [2].

The detailed description of this is available at the geoportal of the GeoSUR Program (<http://www.geosur.info/>) in the «*Catálogo de representación MIAN v2016*» (MIAN portrayal catalogue, v2016). This will soon be published in XML format also and in accordance with the OGC Symbology Encoding standard [3].

## **10. Distribution**

The MIAN information will be distributed, initially, through a Web Map Server, version 1.3.0, in accordance with the OGC standard [4] and consistent with its nature and the aim of a digital reference map intended to serve as a base for all types of applications and uses.

The MIAN WMS will be available at the SDI node of the CAF/PAIGH Geosur Program, and the conditions of use are the following:

CC BY 4.0, CAF, PAIGH, GeoSUR Program, IGM-Bolivia, IGAC-Colombia, IGM-Ecuador, IGNTG Panama, and IGN-Peru.

It will therefore be under a Version 4.0 Attribution *Creative Commons* License that, just as is defined in [5], allows all kinds of uses, including commercial ones, the only condition being that the authorship and intellectual property be recognized under the above-mentioned conditions.

This authorship will be recognized in the products potentially derived from it (publications, illustrations, etc.) and in the case of applications, geoportals,

client applications and viewers on the page in which the information is viewed or on another accessed with just one click from the first page.

## **11. Metadata**

The metadata of the MIAN data has been drafted in accordance with the Latin American Metadata Profile (LAMP) v1, so it thus conforms to the ISO 19115:2003 standard.

When version 2 of the Latin American Metadata Profile (LAMP v2) is available, the necessary modifications will be made so that it conforms to that profile, and therefore, also with the ISO 19115-1 standard.

The metadata for both the MIAN data and the WMS MIAN server are available in the metadata catalogue of the GeoSUR Program.

## **12. Additional Information**

The following additional descriptive information is included here because it is not covered in the ISO 19131 standard nor in any of the previous paragraphs.

- The units of the coordinates are in sexagesimal degrees.
- The dates are stated in the Gregorian calendar.
- The elevations of the points are in meters and have as their origin, the origin of altitudes just as each participating country defines it.
- The data is two-dimensional.
- The MIAN is conceived as a series made up of one unit (equivalent to the sheets of a standard map coverage) for each country participating in the project.
- On the edges of a country there may be geographic objects that are repeated or double, because each one of the units (one per country) making up the MIAN should be whole in itself. Thus, the mountains, rivers and other geographic objects that are on the boundary between two or more countries are present twice, each one having the name given to it in the respective country.
- The MIAN Catalogue of geographic objects does not include contour/elevation lines because the participating institutions agreed to adopt the SRTM Digital Terrain Model as a digital portrayal of the relief because it is continuous, uniform and homogeneous, and it has sufficient

resolution and accuracy. The SRTM (Shuttle Radar Topography Mission) DTM of the NASA, from the year 2000, has a resolution of 30 m.

- Nevertheless, if a participating country wishes to provide a DTM of better quality or resolution, this can be done so long as the continuity and compatibility with the above-mentioned SRTM model is guaranteed.

### 13. Acronyms and abbreviations

CAF	Latin America Development Bank
CNIG	National Center for Geographic Information (Spain)
MSE	Mean Squared Error
EPSG	European Petroleum Survey Group
IGAC	Agustín Codazzi Geographic Institute of Colombia
IGM	Military Geographic Institute of Bolivia
IGM	Military Geographic Institute of Ecuador
IGN	National Geographic Institute of Spain
IGN	National Geographic Institute of Peru
IGNTG	Tommy Guardia National Geographic Institute of Panama
IPGH	Pan American Institute for Geography and History
ISO	International Standardization Organization
LAMP	Latin American Metadata Profile
MIAN	Integrated North Andean Map
NASA	National Aeronautic and Space Administration
OGC	Open Geospatial Consortium
SRTM	Shuttle Radar Topography Mission
WMS	Web Map Service
WMTS	Web Map Tile Service

### 14. References

- [1] «Organic Statutes of the Pan American Institute for Geography and History»: [https://www.ipgh.org/documentos/ipgh/Estatuto-Organico\\_2013-2017.pdf](https://www.ipgh.org/documentos/ipgh/Estatuto-Organico_2013-2017.pdf)
- [2] «Technical Specifications for designing and placing symbols in 1:500,000., 1:1,000,000., and 1:2,000,000 scale maps», IGM of Ecuador, First edition, 2013: <http://www.geoportaligm.gob.ec/portal/index.php/especificaciones-tecnicas-para-el-diseno-y-simbolizacion-de-mapas/>
- [3] OGC *Symbology Encoding*  
1.1.0: <http://www.opengeospatial.org/standards/se>.
- [4] OGC *Web Map Service*  
1.3.0: <http://www.opengeospatial.org/standards/wms>.

[5] CC BY 4.0 License: <https://creativecommons.org/licenses/by/4.0/>.