

ADDING VLBI TO THE MEXICAN GEODETICAL NETWORK

I. V. Krilov¹, D. Mendoza² and N. T. Kokina²

RESUMEN

Este trabajo propone el plan de usar radiotelescopios actualmente presentes en México, y agregar la técnica VLBI a la actual red geodésica nacional del país, para poder hacer mediciones de cambios en la superficie terrestre rápidamente tras la ocurrencia de un terremoto. Esta red así mejorada puede ser el inicio de la implementación de una Red Fundamental Geodésica Astrométrica en el país.

ABSTRACT

This work proposes a plan to use currently installed radiotelescopes in México, to add VLBI in the country's current national geodetic network, so that measures of changes in Earth's surface after earthquakes can be quickly done. This improved network could serve as a base to build the Fundamental Geodetic Astrometry Network in Mexico.

Key Words: Geodesy

1. INTRODUCTION

México's National Geodetic Network (RGN, Red Geodésica Nacional) serves as a unique analytical reference framework, that coordinates scientific and technical measurements of Earth's changing surface in the area of the country (see Figure 1). It determines México's dimensions and with other countries networks provide data for the reference ellipsoid parameters. It helps in the control of artificial satellites and it is essential to study the deformation of the Earth's crust in the country. It is also used for supporting cartographic works and tectonic plates studies.

The RGN was developed in roughly three periods: First, in 1915-1965, it relied on optomechanical methods of triangulation and polygonization; second, in 1970-1990, it was adjusted to the Transit Satellite System; third, since 1990's, the Navigation Global Positional System was used to implement the current National Satellital Geodetic Network (RGNS, Red Geodésica Nacional Satellital).

2. THE PLAN

The Mexican territory sits on a very active seismic zone in which tragic earthquakes occur quite often. After an earthquake, technical and scientific studies have to be made to determine the deformation of the vertices of the RGNS. This work proposes



Fig. 1. Red Geodésica Satellital Nacional de México.

a way to quickly determine the changes of vertices coordinates via an intercalated VLBI to the RGNS, by joint VLBI observations of quasars and GPS satellites, with radiotelescopes (Saucedo et al. 2014).

The method to be used compares the two RGNS coordinates referenced to VLBI, at a time when the Earth's surface is stable. After an earthquake the coordinates' adjustments are calculated (Plajov et al. 1986; Zharov 2011). A considerable part of the Earth's surface in Mexico is subject to constant seismic activity, but in other regions of the territory only occasional seismic activity is experienced.

One of the radiotelescopes could be the Large Millimeter Telescope Alfonso Serrano, which belongs to INAOE and UMass, in Sierra La Negra, Puebla

¹Astronomy and Cosmic Geodetic Dept., Moscow State University of Geodesy and Cartography, Xorojovski St, Building 4, Moscu, Rusia (vikrylov@rambler.ru).

²Centro de Astronomía, Universidad Autónoma de Sinaloa, Ciudad Universitaria, C.P. 80013, Culiacán, Sinaloa, México.



Fig. 2. Large Millimeter Telescope, INAOE.

(see Figure 2). The other could be a communication antenna converted into a radiotelescope, located on a point of the RGNS in Hermosillo. The Mexican Space Agency is planning to convert some communication antennas (two of 30 m and other smaller) into radio telescopes (see Figure 3). It would only require to move one of these antennas to Hermosillo. The following procedures is proposed:

- a) Once the VLBI addition to the RGNS is working, a program of joint observations is done and after the mathematical processing, a standard catalog is elaborated.
- b) After a strong geodynamic event, reflected in the deformation of the Earth's surface of Mexico, another set of joint observations is carried out. Upon processing the observations, new coordinates are then compared to those of the standard catalog to obtain the magnitude of the deformation.



Fig. 3. Communication Antena, 30 m size, located in Tulancingo, Hidalgo, México.

- c) The comparison, done with the least squares method, can be in two modes: on distance measurements between the stations or with respect to the reference ellipsoid. We propose the first method as best.

3. FINAL COMMENTS

This network could also serve as a base to build the Fundamental Geodetic Astrometry Network in Mexico. Then, México would join the group of countries that have geodetic astronomical fundamental networks: Australia, Canada, China, all the European countries, Russia and the Unites States of America.

REFERENCES

- Plajov, Y. V. et al. 1986, *Cosmic Geodesy*, ed. Nedra, Moscow
- Saucedo M., J. C., Kokina, T., & Mendoza A., D. 2014, "Earth's rotation and a feasibility study of a possible Mexican participation with a VLBI station" in 40th COSPAR Scientific Assembly. Held 2-10 August 2014, in Moscow, Russia, Abstract id. PSD.1-38-14
- Zharov, V. E. 2011, in *Fundamentals of Radio Astrometry*, ed. Lomonosov State University, Moscow