

Areas of opportunity for GNSS applications in large- scale projects in Mexico

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About...

About me

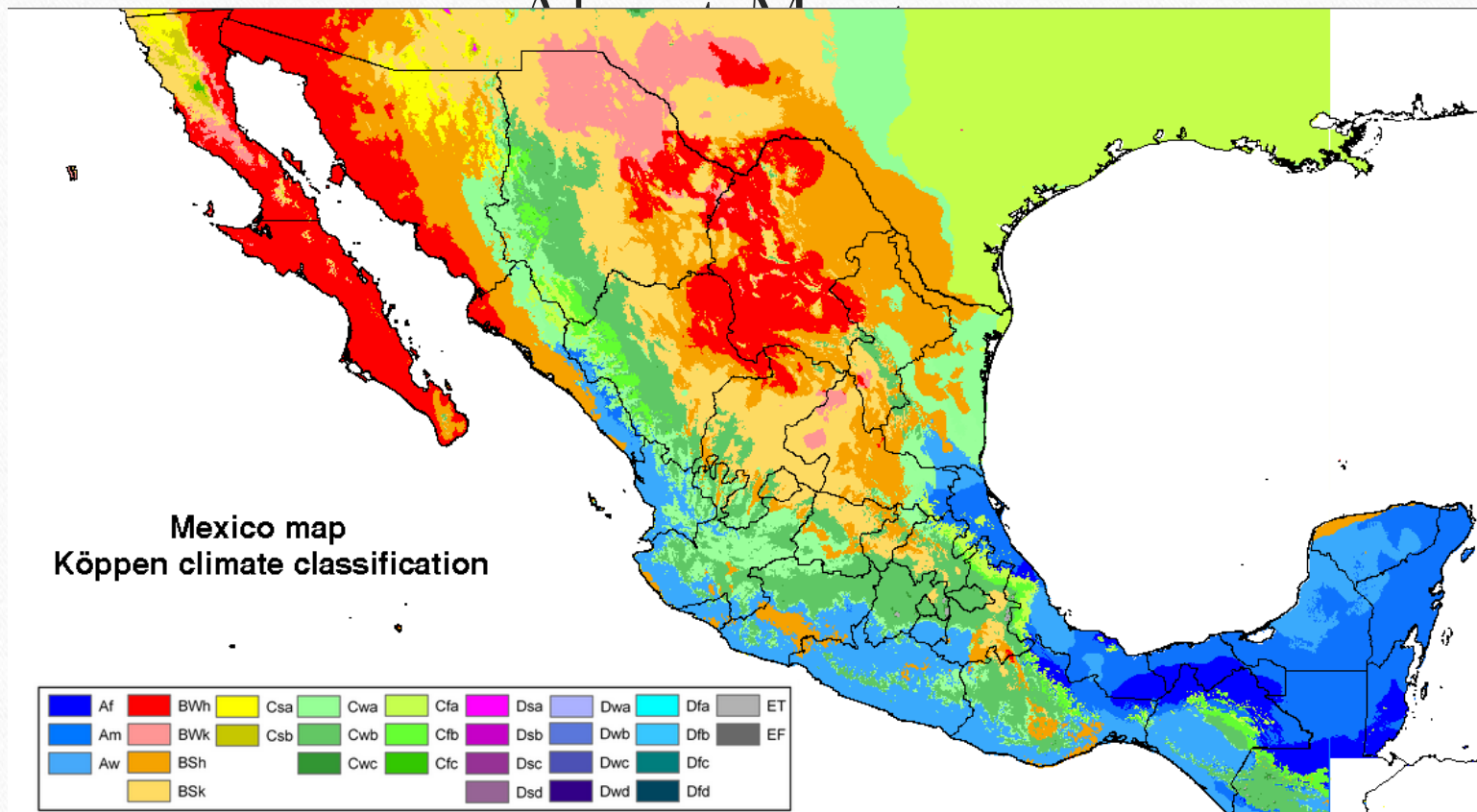
- **Background:** Environmental engineer
- **Master's student @** National Institute of Astronomy, Optics and Electronics
- **Academic interests:** Climate change, natural resources conservation (mostly water), biodiversity

Why this talk?

- Preliminary research for thesis topic
- Potential applications of GNSS (and other satellite) technologies
- Joint solutions for similar problems
- **Illustrative of problems that might happen someplace else**

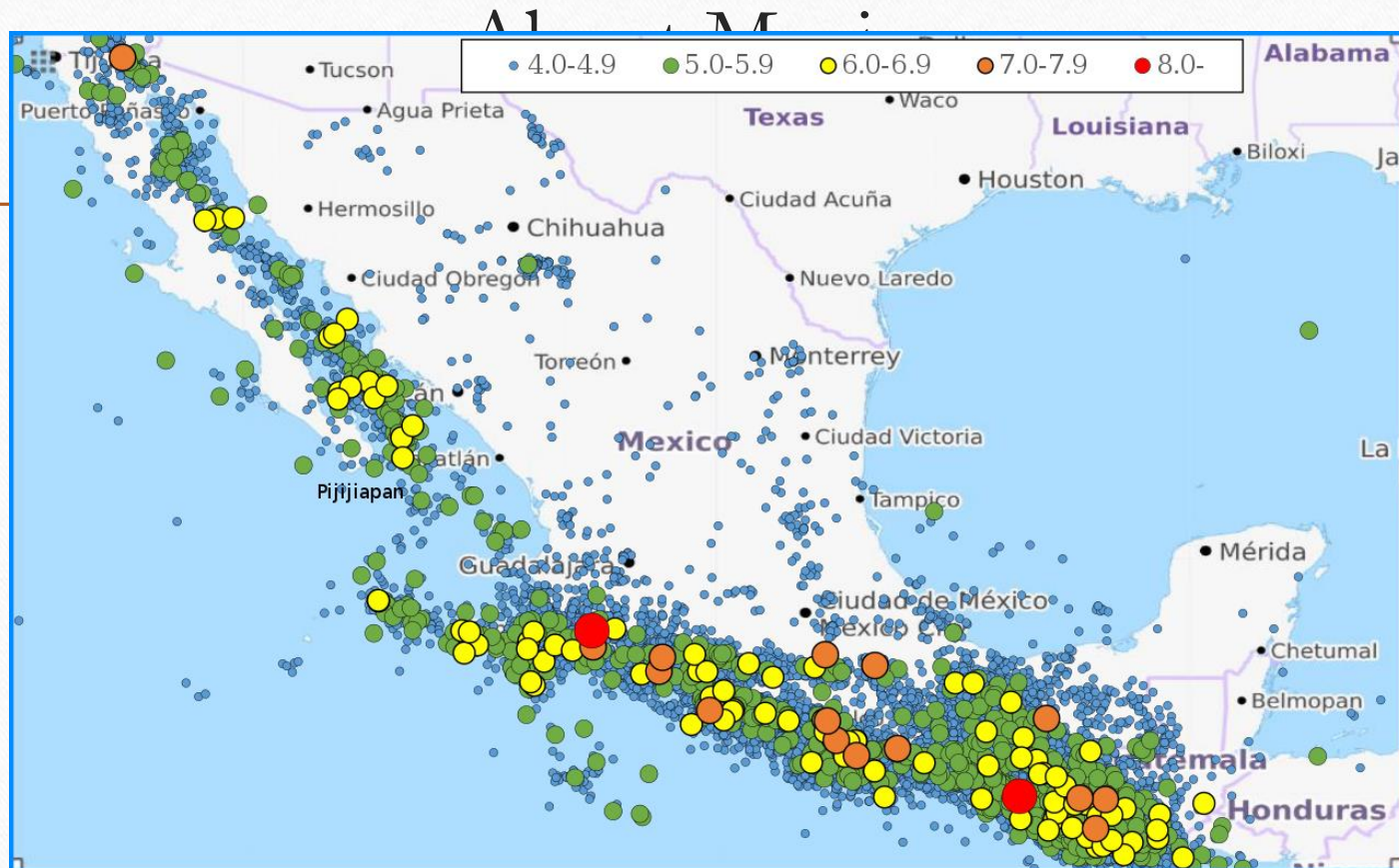
About Mexico

- Really big (1.9 million sq. km; 14th largest by land area)
- Multiple mountain ranges
 - Sierra Madre Oriental
 - Sierra Madre Occidental
 - Sierra Madre del Sur
 - Trans-Mexican Volcanic Belt
- Multiple climates
- **100,000+ species!** (2008)



Climates in Mexico (Image: JavierRA

https://commons.wikimedia.org/wiki/File:Mexico_map_of_Köppen_climate_classification.png, <https://creativecommons.org/licenses/by-sa/4.0/legalcode>)



Seismic activity in Mexico 1990-2017 (Image: Phoenix7777

https://commons.wikimedia.org/wiki/File:Map_of_earthquakes_in_Mexico.svg,

<https://creativecommons.org/licenses/by-sa/4.0/legalcode>)

Areas of opportunity

Papers on satellite usage/tech in MX (1)

Usage of satellite images in forest management in Northeast Mexico

By: Lucio Ancira-Sánchez ; Eduardo Javier Treviño Garza, (2015)

Forest characterization of two sites in Northeast Mexico. Comparison of ortophotography and satellite imagery

Papers on satellite usage/tech in MX (1)

- **Good:** Satellite imagery is cost-effective
- **Bad:** Satellite imagery is , available ortophotos are unreliable
- **Ugly:** Ortophotos are potentially overestimating lumber/timber potential.

Surveying via GNSS could mitigate these problems

Papers on satellite usage/tech in MX (2)

By: Trejo and Dirzo (2000)

Analysis of dry tropical deforestation in Mexico. Uses two analog datasets as baseline. The estimation of spatial changes in vegetation was made with three satellite images (1973, 1989 and 1996)

Papers on satellite usage/tech in MX (2)

- **The good:** Accurate survey of Southeast forests
- **The bad:** Deforestation has been *underestimated*
- **The Ugly:** 84% of the area under study was actually lost from 1967-1986

The reverse scenario

Papers on satellite usage/tech in MX (3)

Satellite-assisted irrigation

By: Palacios Vélez et al. (2011)

Estimation of Calculation of the Moisture Stress Index (and other related Indexes) on an Irrigation District in Northeast Mexico.

The final aim is to start a GIS.

Papers on satellite usage/tech in MX (3)

- **The good:** Successful monitoring of critical irrigation metrics using Landsat imagery and
- **The bad:** None (?)
- **The ugly:** Users/farmers can easily monitor their crops' irrigation and moisture conditions to act... provided that they have some kind of satellite receiver.

Why not also use GNSS while we're at it?

What I wish to work on

Protected Natural Area: El Texcal

Jiutepec, Morelos

- 258 ha (20 of those recovered from invasion)
- Hueyapan Lagoon: water reservoir for 40k people
- Natural corridor for 10 animal species (at least 1 endemic)
- Local jobs & educational/research opportunities

El Texcal: problems

- Irregular human settlements
- Illegal dumping sites
- Incomplete characterization on Lagoon
- Non-constant monitoring of animal & plant species

This is far from the only example...

Thank you!

Contact info

Write me! [acruzycorro at inaoep.mx](mailto:acruzycorro@inaoep.mx)

Send:

- Questions
- Interesting topics on GNSS and Natural Resources conservation
- **Scholarship offers welcome**

References and bibliography

Ancira Sánchez, Lucio, and Eduardo Javier Treviño Garza. 2015. “Utilización de Imágenes de Satélite En El Manejo Forestal Del Noreste de México.” *Madera Y Bosques* 21:77–91. <http://www.redalyc.org/articulo.oa?id=61738656007>.

Dirzo, Rodolfo, and María C. García. 1992. “Rates of Deforestation in Los Tuxtlas, a Neotropical Area in Southeast Mexico.” *Conservation Biology* 6 (1). Blackwell Science Inc:84–90. <https://doi.org/10.1046/j.1523-1739.1992.610084.x>.

Palacios Vélez, Enrique, Julio Enrique Palacios Sánchez, and Luis Alberto Palacios Sánchez. 2011. “Agricultura de Riego Asistida Con Satélites.” *Tecnología Y Ciencias Del Agua* II:69–81. <http://www.redalyc.org/articulo.oa?id=353531973005>.

Trejo, Irma, and Rodolfo Dirzo. 2000. “Deforestation of Seasonally Dry Tropical Forest: A National and Local Analysis in Mexico.” *Biological Conservation* 94 (2):133–42. [https://doi.org/https://doi.org/10.1016/S0006-3207\(99\)00188-3](https://doi.org/https://doi.org/10.1016/S0006-3207(99)00188-3).

Vega Guzmán, Álvaro, José López-García, and Lilia de Lourdes Manzo Delgado. 2008. “Análisis Espectral Y Visual de Vegetación Y Uso Del Suelo Con Imágenes Landsat Etm+ Con Apoyo de Fotografías Aéreas Digitales En El Corredor Biológico Chichinautzin, Morelos, México.” *Investigaciones Geográficas (Mx)*, 59–75. <http://www.redalyc.org/articulo.oa?id=56911125005>.

Wikipedia contributors. 2018. “List of Countries and Dependencies by Area — Wikipedia, the Free Encyclopedia.” [\url{https://en.wikipedia.org/w/index.php?title=List_of_countries_and_dependencies_by_area&oldid=831304135}](https://en.wikipedia.org/w/index.php?title=List_of_countries_and_dependencies_by_area&oldid=831304135).