IX CONGRESO UNIVERSITARIO CENTROAMERICANO DEL CSUCA
16 y 17 JUNIO
HONDURAS 2021

¿PORQUÉ NUESTRAS UNIVERSIDADES DEBEN INVERTIR MAS EN INFRAESTRUCTURA PARA CIENCIA?

EL CASO DEL PRIMER OBSERVATORIO MAGNÉTICO DE HONDURAS

Ph.D. Yvelice Castillo, Ph.D. Javier Mejuto

COLABORADORES Y COOPERANTES

UNIVERSIDAD NACIONAL AUTÓNOMA DE HONDURAS

Departamento de Astronomía y Astrofísica
Departamento de Astronomía y Astronomía Cultural
(Facultad de Ciencias Espaciales, FACES)
Departamento de Ciencias de la Tierra (Facultad de Ciencias)
Laboratorio de Ingeniería Civil (Facultad de Ingeniería)
Centro Universitario del Litoral Pacífico (CURLP)

INTERNACIONALES

Servicio Geológico Británico (BGS) – Grupo INDIGO
Geoforschungszentrum (GFZ) de Alemania
Centro de Investigación para la Tierra y el Espacio de la Universidad de Coimbra (CITEUC)
Observatorio Nacional de Brasil
Instituto de Geofísica de la UNAM
Instituto Costarricense de Electricidad (ICE)
Observatorio Santa Helena de Costa Rica

OBJETIVOS DE UN OBSERVATORIO

- **Capturar las fuentes del vector de campo magnético natural en la superficie de la tierra, libre de interferencias artificiales.**
- **Mantener series temporales continuas, de banda ancha, absolutas y a largo plazo.**
- **Publicar los resultados para uso en el ámbito académico y comercial.**

Turbitt y Gómez-Pérez, 2021

OBJETIVOS ESPECÍFICOS

- Los registros serán publicados en el World Data Centre for Geomagnetism y en INTERMAGNET, la red de observatorios magnéticos mas grande del mundo, dando visibilidad mundial a la ciencia de la región.
- Consolidar grupos de investigadores en campo magnético terrestre, clima espacial, corrientes inducidas geomagnéticas y otros.

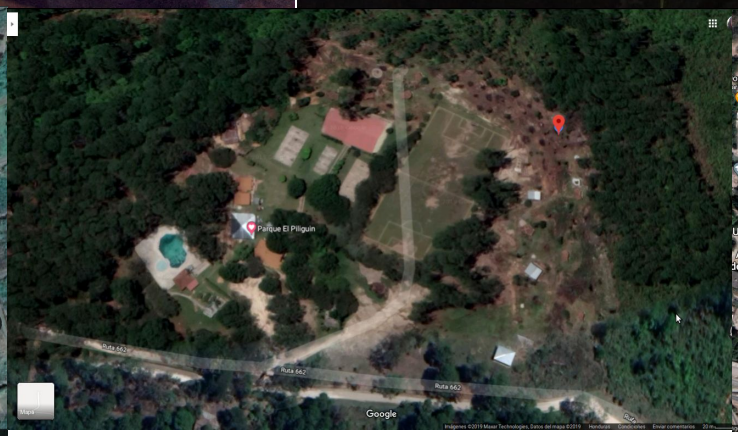
APLICACIONES POSTERIORES

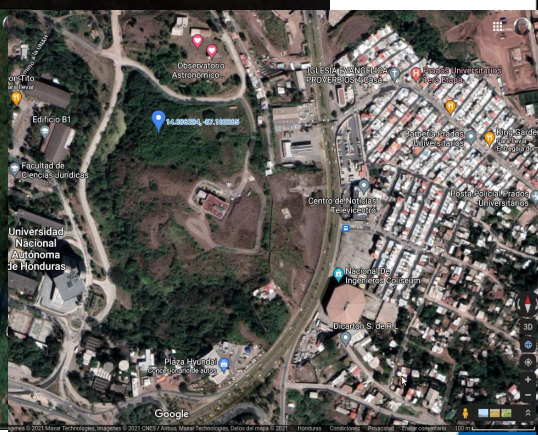
- Análisis geofísico del suelo.
- Medición de anomalías magnéticas para prevención de riesgos sísmicos.
- Estudio de corrientes inducidas en el suelo y en redes de potencia eléctrica.
- Elaboración de mapas magnéticos.
- Ser parte del modelo magnético global (IGRF).

II TALLER PANAMERICANO DE GEOMAGNETISMO

Vassouras, Brasil, noviembre de 2017

EVALUACIÓN DE SITIOS





Arriba: Nueva Rosario. Abajo, de izq. a der: UNAH-Tec Danlí; El Piligüín; Ciudad Universitaria.

EVALUACIÓN DE SITIOS

Centro de Investigaciones Acuícolas y Pesqueras (CIAP) del Centro Universitario Regional del Litoral Pacífico de la UNAH

PROPUESTAS PARA OBTENCIÓN DE FONDOS

Part A: To be completed by the Project Implementer

Project Title	The Honduras' first magnetic station as a counterparty for seismic risk and threat prevention.
Which thematic objective does this intervention help meet (e.g. *climate change, human rights and democracy, economic growth and improving business environment, illegal wild life trade, disaster risk preparedness, beyond plastics)*	*Disaster risk preparedness.*
Purpose *This must be NO MORE than one sentence, clearly setting out the "change" to be delivered*	To build a magnetic station as a counterparty for local geomagnetic anomalies identification for seismic risk and threat prevention.
Short Project Summary *In no more than 200 words explain what the project plans to achieve and how (setting out how the Outputs will deliver the Purpose/Objective, and how the activities will deliver each relevant Output), and what difference will it make on the ground over the next few years?* This question will be looked at again during any Evaluation of this project, and when an Impact Report is done. The success of the project will largely be judged on what is said here	The first permanent geomagnetic observatory of Honduras will be established to register in a continuous and absolute basis the magnitude and direction of the Earth's magnetic field vector, and their variations over a baseline. One of the magnetic observatory applications is the detection of major space weather events (i.e., geomagnetic storms). This detection is necessary to identify the local geomagnetic anomalies that contribute to seismic risk and threat prevention. The project execution demands to construct the facilities (two small huts), driveways and perimeter fence, the equipment installation, and the safety personnel recruitment. The equipment, software, hardware, and training related has been matched with the INDIGO project (Intermagnet Digital Geomagnetic Observatories) of the British Geological Survey. This station also intends to be linked to the project "KUK ÀHPÁN: Integrated Regional Study of the Structure and 4D Evolution of the Lithosphere in Central America. Implications in the Calculation of Seismic Risk and Threat", an international project integrated by researchers of Spain, Honduras, Guatemala, El Salvador, Nicaragua, and the Dominican Republic, funded by the Ministry of Science, Innovation, and Universities of the Government of Spain with reference code: RTI-09427-B-C21/C22.
Cost	

Becas de la Oficina de Asuntos Exteriores y del Commonwealth de Reino Unido

PROPUESTAS PARA OBTENCIÓN DE FONDOS

2019 OWSD Early Career Fellowship

Yvelice Soraya Castillo Rosales

The application must be completed in English by the individual project leader.

Please read the eligibility criteria at this link.

While completing this application please use the helptexts where available.

Please note that the system will only accept your application if you answer all the mandatory questions anc upload the documents when requested. Mandatory questions are marked with an asterix*.
All documents must be uploaded through this online application system. Do not email any document to OV unless requested. The OWSD Secretariat reserves the right to judge an application ineligible if the answers and/or documentation do not correspond to the specific question asked (e.g. blank documents, false certifi etc.).

Have you read the information about eligibility criteria at the relevant link above? *

Yes

Family name/Surname (as it appears in your passport) *

Castillo Rosales

Given name(s) (as it appears in your passport) *

IHCIETI
Instituto Hondureño de Ciencia, Tecnología y la Innovación

GOBIERNO DE LA REPÚBLICA DE HONDURAS

SECRETARÍA NACIONAL DE CIENCIA, TECNOLOGÍA Y I

FORMULARIO "A" PROPUESTA TÉCNICA

Código: **ICDT-A01**	Versión: 02	Elaboró: Departamento de Investigación Científica
	Página **1** de **17**	Aprobó: Dirección Ejecutiva

PROYECTOS DE INVESTIGACIÓN APLICADA (PIA) 2021

A. INFORMACIÓN GENERAL

TÍTULO DEL PROYECTO

PRIMER OBSERVATORIO GEOMAGNÉTICO DE HONDURAS

LINEA DE INVESTIGACIÓN DEL PROYECTO

Biotecnología	☐
Tecnologías de la información y la comunicación (TIC	☐
Energía y medio ambiente	**X**
Electrónica aplicada	☐
Ciencia e ingeniería de materiales	☐

NOTA: Seleccionar todas las que apliquen.

RESUMEN DEL PROYECTO

El "***PRIMER OBSERVATORIO GEOMAGNÉTICO DE HONDURAS"*** se instalará dentro de los predios de Ciudad Universitaria, Tegucigalpa. La medición continua de las variaciones del campo magnético terrestre permitirá determinar la intensidad de las corrientes eléctricas que penetran desde el espacio exterior, atraviesan la atmósfera terrestre y el suelo hasta varios kilómetros de profundidad, y que pueden causar sobrecargas en las líneas de potencia eléctrica, daños a los satélites y a los sistemas dependientes de ellos, como GPS, drones, navegación aérea, marítima y terrestre, redes bancarias, aplicaciones geodésicas y de ingeniería, transmisiones de televisión, de sistemas metereológicos, militares, comunicaciones UHF y VLF, etc. El grupo INDIGO (Observatorios geomagnéticos digitales de la red INTERMAGNET), con sede en Reino Unido, proveerá los instrumentos necesarios para la medición continua de la intensidad del campo magnético terrestre y de las perturbaciones al mismo, ocasionadas por eventos solares intensos que impactan a la Tierra (eventos geomagnéticos). Se pretende que el Observatorio Geomagnético de Honduras llegue a formar parte de la red de observatorios geomagnéticos global INTERMAGNET, y que sus datos se publiquen de manera continua en los portales Web del ***World Data Centre for Geomagnetism, Edinburgh, y de INTERMAGNET.*** Sus datos permitirán realizar posteriormente estudios de campo magnético terrestre,

Beca de la Organización para Mujeres en Ciencia para Países en Desarrollo (OWSD), Beca del Instituto Hondureño de Ciencia y Tecnología

PUBLICACIONES

Scanning the crust with magnetospheric currents

Fernando Pinheiro[1] Fernando M. Santos[2] Alexandra Pais[1,3] Anna Morozova[1]
Paulo Ribeiro[1] Yvelice Castillo[5] Cristiana Francisco[3] João Fernandes[1,4]

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UNIVERSIDADE D COIMBRA · CITEUC CENTRO DE INVESTIGAÇÃO DA TERRA E DO ESPAÇO UNIVERSIDADE DE COIMBRA · INSTITUTO DOM LUIZ · FCT Fundação para a Ciência e a Tecnologia

A proposal for a Magnetic Observatory in Honduras

Yvelice Castillo [1,2,3], M. Alexandra Pais [1,3], P. Ribeiro [1], João Fernandes [1,4], Anna L. Morozova [1], Fernando J. G. Pinheiro [1]

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Abstract

The Department of Astronomy and Astrophysics of the National Autonomous University of Honduras (UNAH) is interested in installing the first magnetic observatory of Honduras. The nearest magnetic observatories are located in Costa Rica, Cuba, México, Puerto Rico and Colombia. During the II PANGEO we made the first approaches to people of those observatories. We are also in touch with the Magnetic Observatory of the University of Coimbra (COI) in Portugal, where we will make a traineeship in magnetic measurements and data treatment. Later, with local colaborators we are planning to purchase the equipment to make local geomagnetic field measurements in different places of Honduras, in order to define the best location for our future magnetic observatory. We also want to establish alliances with the nearest observatories

Magnetic observatories can monitor the geomagnet activity and give information on the arrivalof energet particles from the Sun. They can contribute to a deeper understanding and a better prediction of space weathe events

Acknowledgements

CITEUC is funded by National Funds through FCT Foundation for Science and Technology (projec UID/Multi/00611/2013) and FEDER - European Regiona Development Fund through COMPETE 202 Operational Programme Competitiveness an Internationalization (project: POCI-01-0145-FEDEF 006922).
Yvelice Castillo is supported by the Department Astronomy and Astrophysics of the UNAH.

Geomagnetic induced currents in south-western Iberia

Fernando Pinheiro[1,3], Joana Alves Ribeiro[1,3], Fernando Santos[2], Maria Alexandra Pais[1,3], Anna Morozova[1,3], Paulo Ribeiro[1,4], Yvelice Castillo[5], Cristiana Francisco[3], João Fernandes[1,6]

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Abstract

Geomagnetic storms induce electric fields along power lines, which are the source of GICs observed at high latitudes. However, there have been accounts of GICs at mid-latitudes. For this reason, countries such as Spain, Italy and Brazil are evaluating the impact of GICs in their territory. Portugal is also giving its first steps in this field. MAG-GIC is a project funded by the Portuguese Science Foundation (FCT) aiming to assess the potential hazard of GICs on the national high voltage power grid. This project involves a collaboration with REN - the Portuguese power distribution company.
In this presentation, we show how to evaluate the geoelectric fields generated in the Portuguese mainland during some of the strongest geomagnetic storms recorded at University of Coimbra's geomagnetic observatory (IAGA code: COI) during solar cycle 24. This analysis takes into account impedance matrices computed considering local magnetotelluric (MT) observations. The geomagnetic observations are complemented with simulations from the Tsyganenko-Sitnov TS04 model, which can separate the contribution of different magnetospheric current systems, giving a better instight of the phenomena involved. Additionally, we provide our first estimations of the expected GIC values based on the real distributions of transformer stations located across the Portuguese South-West (the region with the sparsest distribution of transformer stations).

1. Introduction

Geomagnetic field disturbances (B) and ground resistivities play a key role in the generation of the GICs driving electric fields (E). As is known since Tikhonov (1950) and Cagniard (1953), the 1D induced field can be expressed:

$$E_{X,Y}(\omega) = (1/\mu_0)Z(\omega) \times B_{Y,X}(\omega),$$

where $Z(\omega)$ is the MT impedance of the Earth.
Compared to the 50Hz high voltage AC current, GICs behave like a quasi-direct current. Thus the computation of GICs can be reduced to solving an electric circuit problem, using Kirchhoff laws (Lehtinen & Pirjola's,1985):

$$\mathbf{GIC} = (\mathbf{1} + \mathbf{YZ})^{-1}\mathbf{J}$$

where $\mathbf{1}$ is the identity matrix, $\mathbf{Y}$ the network admittance matrix and $\mathbf{Z}$ the earthing impedance matrix. The "perfect-earthing" currents generated along a grounded conductor ($\mathbf{J}$) are computed from the integration of the electric field along its path.

5. Preliminary GIC model

Our model was tested against Horton's (2012) benchmark. Figure 5 shows the GIC amplitudes generated at each transformer station, assuming normalised geoelectric fields of 1V/km in the North-South and East-West directions.
Results for SPM, SER, SAV, STVR are unreliable, as these stations are connected to other nodes not included in the calculations (substations further north and/or connected to substations in Spain).
Portimão substation (SPO) seems to be the most susceptible to GICs, which makes it the right candidate for connecting a GIC sensor to test our model (see poster p11 in this session).

Contents lists available at ScienceDirect

Journal of Atmospheric and Solar-Terrestrial Physics

journal homepage: www.elsevier.com/locate/jastp

Geomagnetic activity at Northern Hemisphere's mid-latitude ground stations: How much can be explained using TS05 model

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ARTICLE INFO

Keywords:
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Geomagnetic activity
Magnetospheric sources
Tsyganenko and Sitnov model

ABSTRACT

For the 2007 to 2014 period, we use a statistical approach to evaluate the performance of Tsyganenko and Sitnov [2005] semi-empirical model (TS05) in estimating the magnetospheric transient signal observed at four Northern Hemisphere mid-latitude ground stations: Coimbra, Portugal; Panagyurishte, Bulgary; Novosibirsk, Russia and Boulder, USA. Using hourly mean data, we find that the TS05 performance is clearly better for the X (North-South) than for the Y (East-West) field components and for more geomagnetically active days as determined by local K-indices. In ~ 50% (X) and ~ 30% (Y) of the total number of geomagnetically active days, correlation values yield $r \geq 0.7$. During more quiet conditions, only ~ 30% (X) and ~ 15% (Y) of the number of analyzed days yield $r \geq 0.7$. We compute separate contributions from different magnetospheric currents to data time variability and to signal magnitude. During more active days, all tail, symmetric ring and partial ring currents contribute to the time variability of X while the partial ring and field aligned currents contribute most to the time variability of Y. The tail and symmetric ring currents are main contributors to the magnitude of X. In the best case estimations when $r \geq 0.7$, remaining differences between observations and TS05 predictions could be explained by global induction in the Earth's upper layers and crustal magnetization. The closing of field aligned currents through the Earth's center in the TS05 model seems to be mainly affecting the Y magnetospheric field predictions.

PROCESOS ADMINISTRATIVOS

Engorrosos procesos para gestiones administrativas:

- **donaciones y desaduanajes,**
- **obtención y manejo de fondos,**
- **construcción de infraestructura,**
- **movilidad de equipo y personal,**
- **contratación de nuevo personal,**
- **manejo de fondos,**
- **instalación de equipos,**
- **manejo de inventario.**

Hace falta de una oficina encargada de la gestión de fondos para proyectos de investigación, como se acostumbra en otras universidades.

EL OBSERVATORIO DE ARECIBO

- **El ejemplo de infraestructura científica mas exitosa en Astronomía, para toda América Central y el Caribe fue el telescopio de Arecibo, en Puerto Rico, recién desmantelado por falta de financiamiento.**
- **Por muchos años fue el motor principal que impulsó la Astronomía, representando el 72% de la producción científica en Astronomía de la región.**
- **Este telescopio atraía astrónomos visitantes y motivaba a los jóvenes a estudiar astronomía y otras ciencias o ingenierías: 100.000 visitantes anuales, 30% de ellos niños (Montero-Camacho, 2021).**

PRESUPUESTOS PARA CIENCIA

- **Estos presupuestos provienen primariamente del presupuesto público asignado a la educación superior, que en Honduras es de 0,9 % del Producto Interno Bruto (PIB)[1], en Costa Rica es el 1,58 %, en Cuba es el 2,23 % (Montero-Camacho, 2021).**

- **En Costa Rica, el 56% del presupuesto público de educación superior se asigna a la UCR, la cual invierte ~12% en investigación para todas las áreas (Montero-Camacho, 2021).**

[1]PIB: el valor total de bienes y servicios producidos por un país en un año (Economipedia, 2021).

CONCLUSIONES

- Nuestros países deben reconsiderar su inversión en infraestructura, así como la simplificación de los procesos para apoyar a la investigación.
- Es urgente reducir y simplificar los procesos burocráticos en las universidades y en los estados, para favorecer la investigación y los proyectos científicos.
- El personal administrativo debe apoyar mas a los investigadores y comprender que la actividad académica universitaria no es simplemente impartir las tradicionales 3 a 5 asignaturas.

CONCLUSIONES

- **Es necesaria también la inversión en programas de doctorado en ciencia básica, en incrementar las estadías de investigadores provenientes de países con mas desarrollo e infraestructura de investigación, para realizar investigaciones, proyectos y posdoctorados, que eleven el nivel de nuestros investigadores y de nuestras investigaciones, contribuyendo también a mejorar el nivel de vida de la sociedad.**

- **Debemos motivar mas al estudio de la ciencia desde la infancia, en particular a niñas, mediante modelos de científicos nacionales y extranjeros.**

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¡MUCHAS GRACIAS!