

Lessons learned and future directions

Documenting two decades of seismological station maintenance in Venezuela

Roberto Betancourt A.

Venezuelan Foundation of Seismological Research (Funvisis)



INTRODUCTION AND MAIN RESULTS

This study documents and provides detailed information on the extensive experience gained by the Venezuelan Foundation for Seismological Research (Funvisis) in the management of the secondary seismological stations of Puerto La Cruz and Santo Domingo de Mérida during more than two decades of operation as part of Venezuela's commitment to the CTBTO. This article presents a comprehensive methodology based on detailed records of both preventive and corrective maintenance carried out at these ruggedly located stations, as well as on evaluations made in situ and at the Funvisis analysis centre where the NDC operates. The recent joint maintenance effort at the secondary station in Puerto La Cruz is particularly noteworthy. This task, which involved experts from both sides (CTBTO and Venezuelan), not only addresses issues related to expected degradation associated with the lifetime of measurement, communication, power and other parts and components, but also some related considerations for reassessing station locations, taking into account changing factors such as environmental noise, anthropogenic, security (including vandalism) and other varying energy requirements. The consolidation of these experiences into a single paper provides, from the perspective of this NDC, valuable information on how to effectively manage the stations. These results are of benefit to the Venezuelan National Data Centre and to all Member States in general. They promote a collaborative approach to seismological monitoring and improve the harsh conditions under which our secondary stations must continue to operate.

Introduction

The public's perception of scientific institutions is a key factor in determining the legitimacy and effectiveness of policy (Foladori & Martínez, 2021). In Global South contexts, entrenched disparities in knowledge production further erode public confidence in multilateral entities, which are often viewed as proxies of dominant powers (Acharya, 2019). The CTBTO's mission, which is to detect and deter nuclear weapons testing via a global verification network, relies not only on its technical capabilities, but also on the acceptance of its science-based mechanisms by diverse publics on a normative and cognitive level (Betancourt & Echeverri, 2023). This study examines how collective attitudes in Venezuela and Colombia influence, and are influenced by, the CTBTO's role, focusing on socioscientific literacy, institutional trust, and geo-cultural framing.

Survey data
(trust vs.
CTBTO
support,
 $\rho=0.65$)

Geopolitical
narratives
as barriers

"Science
diplomacy
from below"
model



CTBTO
PREPARATORY COMMISSION

Methodology

A convergent mixed-methods design was adopted, a methodological approach that has been shown to facilitate the integration of diverse research methods (Smith, 2019).

- **Quantitative:** The survey was conducted using a stratified random sampling method, with a total of 1.000 participants included in the study. This sample was divided equally between individuals from Venezuela and Colombia, with 500 from each country. The survey participants were selected from the 18 to 65 age group and were balanced in terms of gender and educational level. The instruments employed in this study included a 7-point Likert scale for public-science trust ($\alpha = 0.89$) and a 5-point scale for CTBTO support.
- **Qualitative:** A total of twenty semi-structured interviews were conducted with policymakers, NGO leaders, and university researchers, who were selected via purposive sampling.
- **Media Analysis:** A content analysis was conducted on 56 articles from major outlets (El Universal, Últimas Noticias, El Tiempo, El Espectador) published between 2023 and 2024. The articles were coded for valence, frequency, and thematic emphasis.

Results

The findings confirm that **public awareness has a significant impact on support** for disarmament (Betancourt, 2024). There is a **strong correlation between trust in science and technology, and acceptance** of the CTBTO, which is consistent with the adapted Technology Acceptance Model (Davis, 1989). While institutional efficacy promotes cooperation, **geopolitical narratives can hinder progress** in the absence of meaningful dialogue (Acharya, 2019). **Results from the Global South reveal that epistemic marginalisation creates scepticism** towards multilateral science unless it is rooted in local knowledge systems (Rodríguez, 2022), thereby emphasising the critical role of bottom-up science diplomacy (Espinosa & Cárdenas, 2021).

Recommendations

The **development of Spanish-language materials**, co-authored with regional experts (Betancourt, 2023).

The **implementation of community monitoring workshops** with a view to fostering participatory epistemologies (Foladori & Martínez, 2021).

The **release of open-access**, lay summary reports on verification **data** has been demonstrated to enhance epistemic transparency (Shea, 2017).

Work with major Latin American outlets to provide regular CTBTO briefings and counter geopolitical scepticism.