SnT 2025 8 SEPTEMBER ONLINE DAY 9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

A Dense Nodal Array in Cartago, Costa Rica Defines Ground Truth Events and Enables Stacking of Teleseismic Waveforms from Potential Nuclear test Explosions

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INTRODUCTION AND MAIN RESULTS

An urban, dense array of 70 short-period three-component operated in Cartago, Costa Rica for 10 months.

Data processed for the first 75 days of the array, results in 455 manually located events within the network, with uncertainties in epicentral location of only a few hundred meters and in depth of less than one km.

Ground Truth Events and moderate magnitude teleseismic events were recorded precluding the use of dense nodal arrays in the detection of potential nuclear explosions.

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Introduction

To contribute to the identification and mapping of active faults and their geometries in and around Cartago, central Costa Rica, scientists from the Costa Rica Volcanological and Seismological Observatory at the National University (OVSICORI-UNA) and from the United States Geological Survey (USGS) have joined efforts to install and operate an urban, dense array of seismic nodes. The network consists of 70 short-period three-component nodes on a grid with an average spacing of about two km. This network was installed in early July 2024 and will operate until late April 2025.

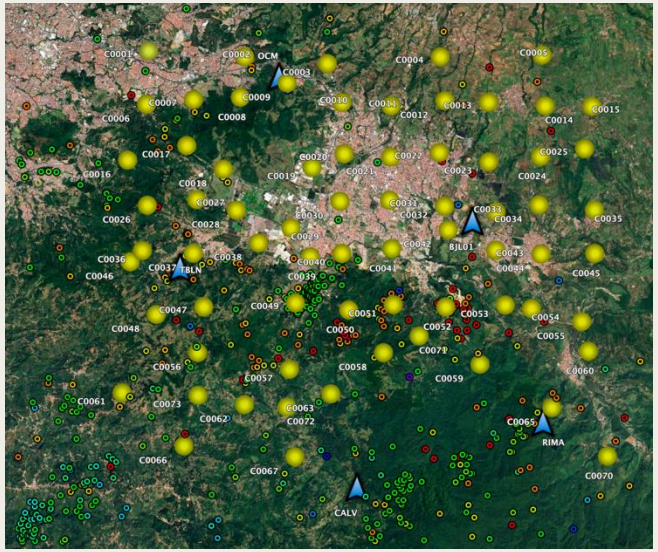


Figure 1. Map of Cartago withy the distrubution of seismic nodes and location of 455 events recorded in the first 75 days of the array.

Results

455 local events manually located within the network in 75 days. Magnitude ranges from -0.3 to 2.9.

The largest located event so far in our analysis (Mag. 2.9) has over 200 arrival times, more than 150 arrivals from stations 15 km or closer from the epicentre. There are many more events that satisfy the conditions of ground truth events.

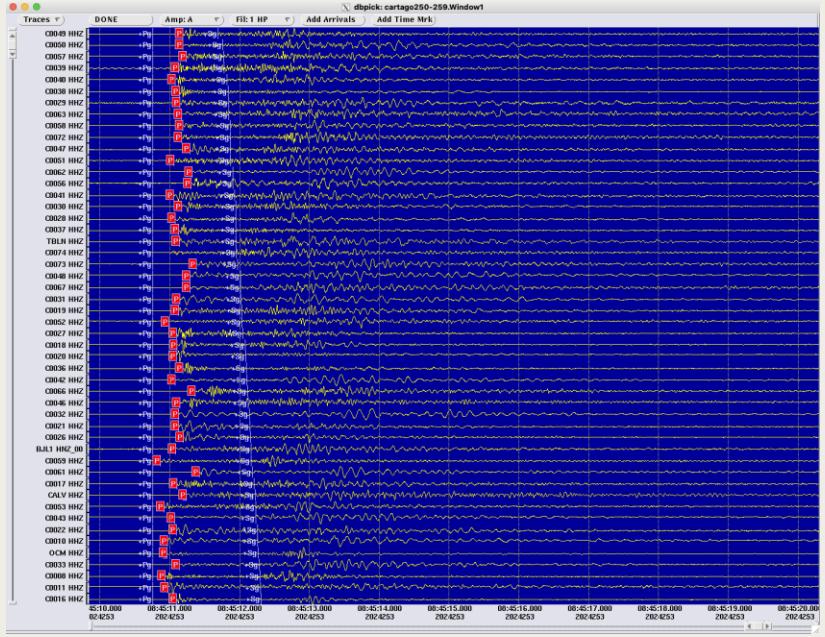
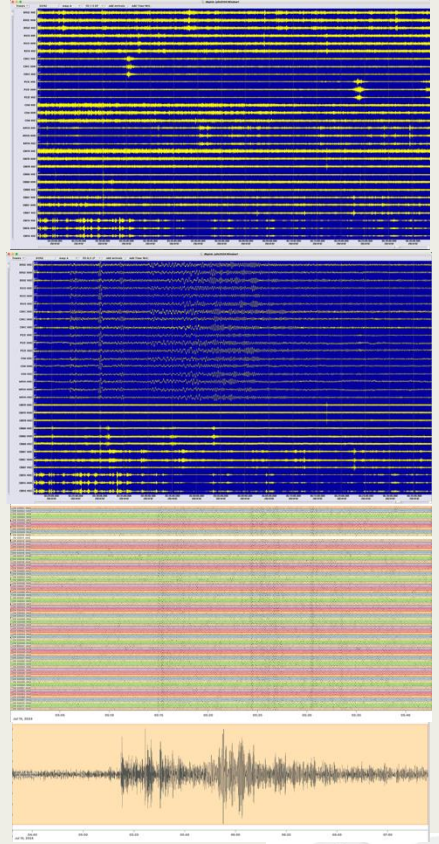


Figure 2. 10 seconds of vertical seismograms for the 50 stations nearest to the epicenter of a ground truth event.

Conclusions

The record of moderate magnitude teleseismic events preclude the use of dense nodal arrays in the detection of potential nuclear explosions.



Bandpass (1-5 Hz) records of a Mw=6.6 earthquake south of South Africa at 4 km depth.

Same stations, same time, but with a lowpass filter at 0.3 Hz, showing the event in broadband stations but not on nodes.

Body waves of the South Africa event bandpass filtered at 0.15-2 Hz.

Stack of vertical channel of all 70 nodes (.1-0.01 Hz).

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USGS science for a changing world

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