P5.2-613

Advanced Capacity Building System in Iraqi NDC and Event Data Analysis

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INTRODUCTION AND MAIN RESULTS

In this study, we present the installation of the Capacity Building System (CBS) in Iraq in May 2024, as well as the analysis of the Northern Iran earthquake on October 5, 2024, at 03:30 UTC, which was detected by this system. Additionally, we present the results of the analysis of the major earthquake in Vanuatu on December 17, 2024, at 01:47:23.760 UTC, which was detected by both International Monitoring System (IMS) stations and non-IMS stations, including stations of the Iraq Seismic Network in IRIS.

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Introduction

In May 2024, one expert from the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) was hosted at the Iraqi National Data Center to install the Capacity Building System (CBS) equipment donated by the CTBTO. This installation will enhance our technical capacity and provide valuable hands-on experience. The earthquake in Northern Iran was detected by 5 IMS stations (GEYT, BRTR, KBZ, MKAR, and LZDM) out of 12 configured to deliver data in real time from the IDC to the CBS server. The waveforms were analyzed using GeotoolQT software, which is a tool that forms part of the CBS analysis system available to National Data Centers (NDCs).

Capacity Building System Installation

Fig 1. Removing the broken old CBS and unpacking and testing the new UPS and its two batteries extensions.

Fig ٣ .NDC staff review events detected by SeiscomP automated system

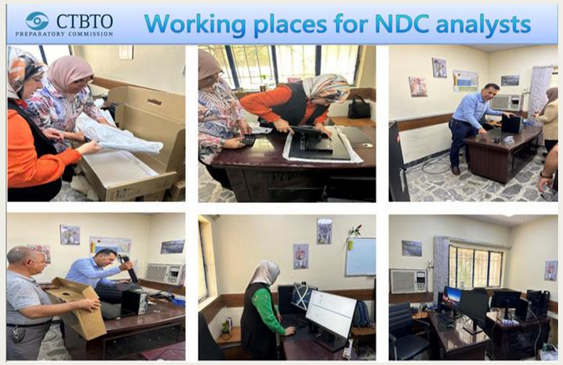


Fig 2. Unpacking and installation of computers and monitors to equip working places for NDC analysts

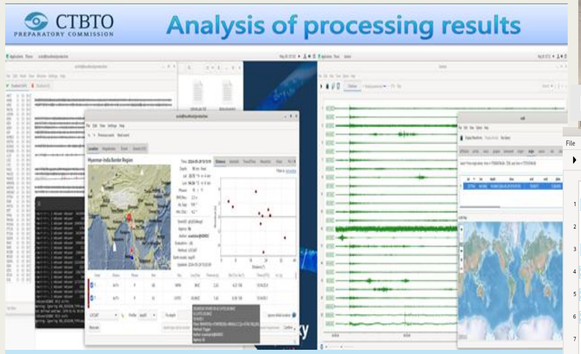


Fig ٤ .List of the seismic events detected by the SeisComP automated system loaded into Geotool for interactive processing.

Method / Data

Northern Iran Seismic Event

More than 25 IMS stations provided data that, when reviewed with REB Bulletin reports, indicated the seismic event was consistent with past earthquakes in this part of Iran

Fig. 1: Location of the event. Data from REB -IDC

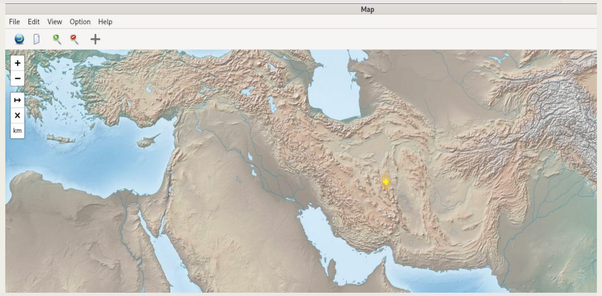


Fig. 2: Event location in Geotool Qt (NDC User)

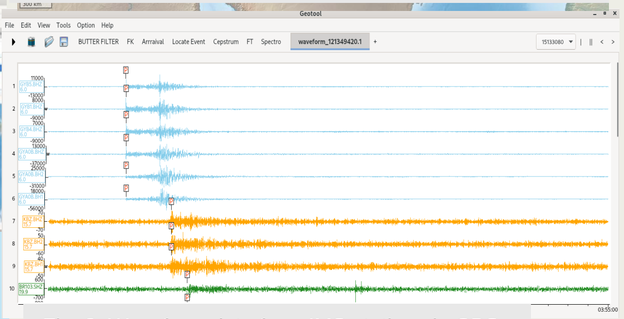


Fig. 3: Waveform data from IMS stations in CBS

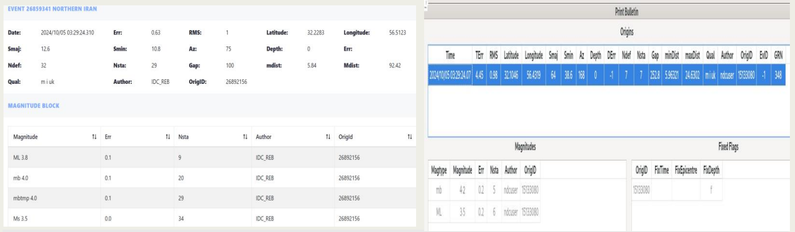
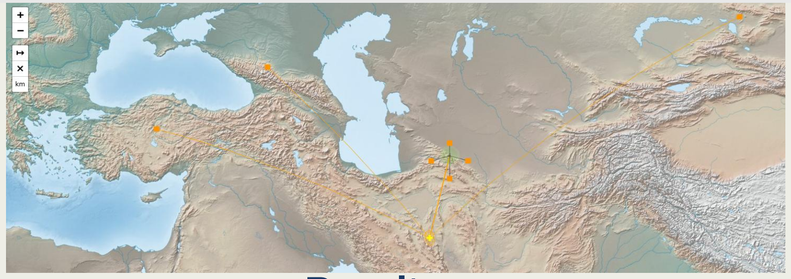


Fig. 4: Bulletin
1- REB-IDC 2- Geotool Qt - NDC User

The event location was determined using Geotool Qt in CBS.

Fig. 5: Location map with Geotool Qt, IMS stations in CBS that detected the event



Results

Following the installation of the CBS at the NDC Iraq, data from IMS seismic stations became available in real time through the CBS server and supported by NDC -in-a-BOX that installed for waveform analysis the signals clearly indicated the event onset and were consistent across the contributing stations, confirming the regional detectability of the event.

Conclusions

The CBS installation represents a significant step in strengthening Iraq's capacity to contribute to the verification regime of the CTBT and to expand its national capabilities in seismic monitoring analysis.

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Introduction

On 17 December 2024, at 01:47:23.760 UTC, a magnitude 7.3 earthquake struck near Port Vila, the capital of Vanuatu. The event also generated a small tsunami, with waves of approximately 25 cm recorded along the coast. The waveform data of the seismic event were analyzed using Geotool QT software version 7.2 and DTK-GPMCC version 7.4.1, which are tools that form part of the analysis systems for NDCs, such as SHI-NIAB-Jul2024, Rocky 9.4 version 7.1

Method / Data

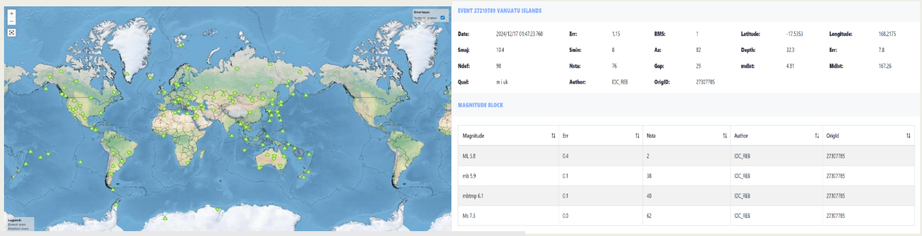

Fig. 1: Location of the event. Data from REB -IDC

The IMS stations were reviewed alongside REB Bulletin reports, and the Vanuatu event was located using data from approximately 76 IMS stations that detected the seismic event.

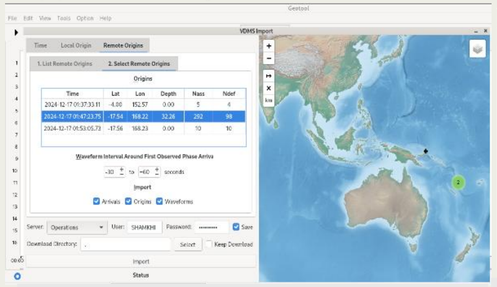

Fig 2. Download of data from the IMS stations in Geotool Qt

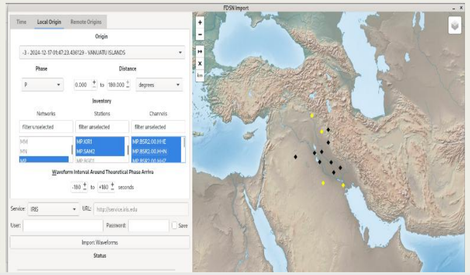

Fig. 3:Download of data from non-IMS stations of the MP network in Iraq via IRIS using Geotool Qt

For the analysis of the data from the Vanuatu event, auxiliary and primary IMS seismic stations were used, along with the infrasound stations I40PG and I55US which had the clearest detections, and the hydroacoustic stations H01W and H02S,in addition to the MP stations: Iraqi Seismic Observatory (ISO)

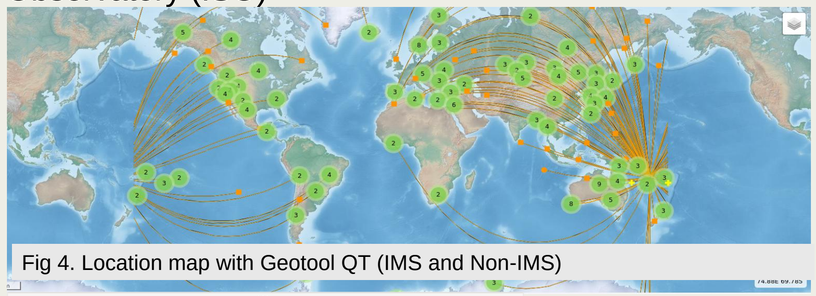

Fig 4. Location map with Geotool QT (IMS and Non-IMS)

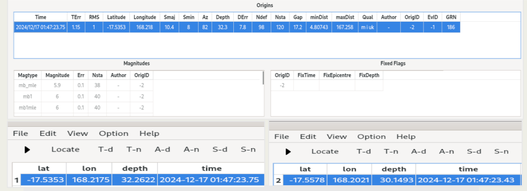

Fig 5. Bulletin NDC user and locate event
1- IMS 2- Non IMS with Geotool Qt

The event location was determined using Geotool Qt,in addition downloading the data with NMS within the program.

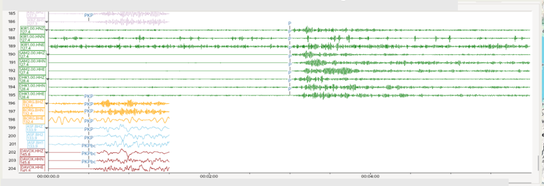

Fig 6. Waveform Data MP and IMS networks

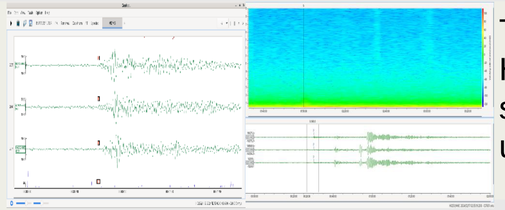

Fig 7. Data Hydro station H02S

The hydroacoustic station H02S was used. At this station, the P-wave was utilized for event location

For the analysis of hydroacoustic and infrasound data, the DTK-GPMCC software was used. The analysis was carried out using the back azimuth and frequency spectrum of waveforms from stations H01W, I40PG, and I55US

IMS Hydroacoustic and Infrasound Stations

P5.2-613

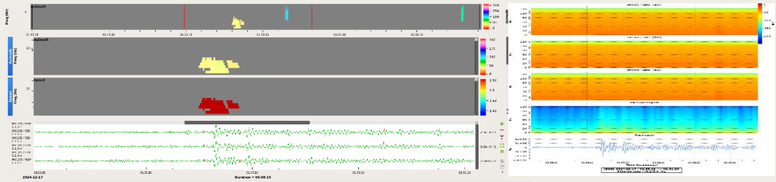

Fig 8. H01W station and spectrum

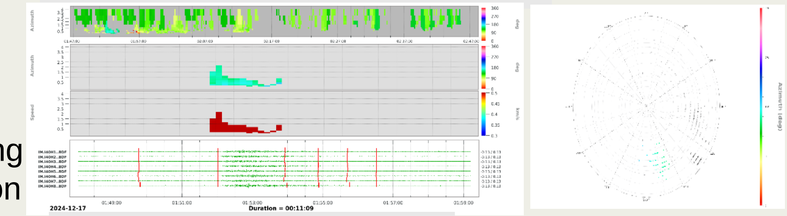

Fig 9. I40PG station and back azimuth

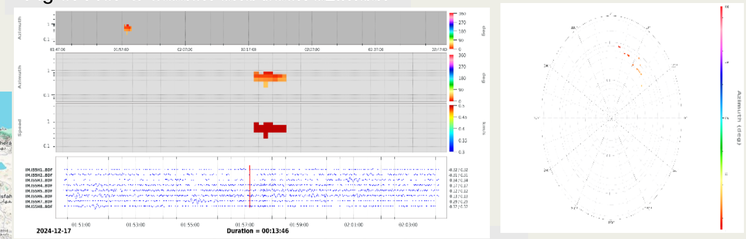

Fig 10. I55US station and back azimuth

Results

The event was clearly detected and located using IMS and non-IMS stations. Analysis with the most recent version of the NDC-in-a-Box package produced reliable and consistent results for both event location and magnitude estimation.

Conclusions

This event underscores the robustness of the CTBTO verification regime and highlights the importance of different technology data fusion for global monitoring.