

Bulletin of Iraqi NDC events analysis

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Through the International Monitoring System (IMS) of the Comprehensive Nuclear Test Ban Treaty (CTBT) and through their continuous work despite COVID-19, we still benefit from IMS data and the International Data Center (IDC) products. We analyzed many events that occurred and detected via infrasound stations. As the meteor in Turkey on 27 May 2020 which was analyzed with software DTK-(G)PMCC and located with the Geotool and compared results with the catalog reference of analyzed events of NASA. As well as the explosion that occurred in Russia near Achinsk on 5 August 2019, which generated intense infrasound signals including both seismic and acoustic arrivals from infrasound and seismic stations of IMS, and also took the opportunity to analyze and locate event via both the DTK-(G)PMCC and the Geotool.

Through SeisComp3 software already installed in our Iraqi NDC an acquisition system to process the real-time data. We will display an earthquake that occurred On 3 June 2020 at the Iraq-Iran border, which was monitored by the Iraqi seismic stations and detected by SeisComp3 and our local stations not belonging to IMS stations and Geotool for analysis and comparing results.

NDC IRAQ: the National Data Center (NDC) as a competent authority to implement the CTBT verification regime was established with well trained specialized staff and has the ability to analyze data received from IDC.

In this paper and data analyzed by NDC Iraq, three types of events have been studied: acoustic, seismic-acoustic, and seismic.

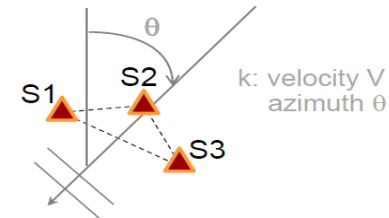
Meteorite event near Turkey on May 27, 2020. We used IMS stations such as: I19DJ, I26DE, I37NO, I43RU. The results of analysis used DTK-GPMCC program and Geotool with back azimuth location of event over Turkey.

Explosion in military arsenal that occurred near Achinsk in Russia on August 5, 2019. We used stations IMS I31KZ, I37NO, I43RU, I46RU, MKAR, ZALV with Geotool seismic analysis program for its location.

Earthquake event on 3 June 2020, was analyzed between the border Iraq and Iran, the tools of Seiscomp3 and Geotool have been used with data from seismic stations from IRIS network, IMS and local stations in Iraq. In addition to the inclusion of real-time stations through SC3.

Progressive Multichannel Cross Correlation (DTK-PMCC):

DTK-GPMCC algorithm produces PMCC results based on PMCC pixels and giving, in particular, the time of arrival of the detected signals and detections attributes such as the back azimuth, the trace velocity, amplitude estimation, the number of array elements that detected the pixels and other exhaustive attributes that the user can use it. The detections in PMCC depend on pixels and family aggregation as it combining PMCC pixels into families. The evolution of PMCC algorithm is detects all needed parameters with non-planar array. (Cansi, Y., Le Pichon, A., 2008).



Meteor event near Turkey on May 27, 2020

Footage shows a supposed meteorite falling from the night sky, witnessed by people in northern Turkey.



Fig. 1. Meteor News

Fireballs Reported by US Government Sensors (1988-Apr-15 to 2021-May-06)

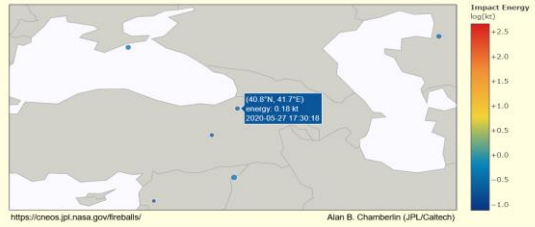


Fig. 2. Source <https://cneos.jpl.nasa.gov/fireballs/>

I19DJ

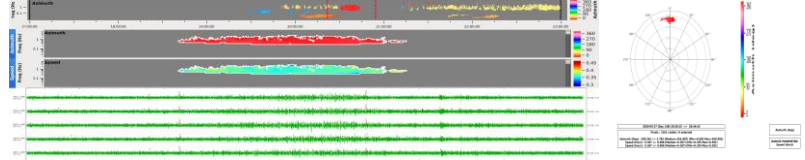


Fig. 3. Analysis data and detections I19DJ

I26DE

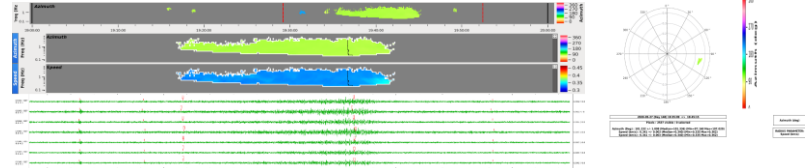


Fig. 4. Analysis data and detections I26DE

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I37NO

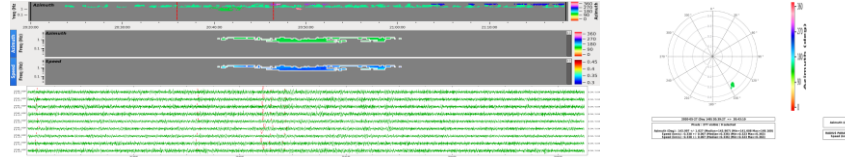


Fig. 5. Analysis data and detections I37NO

I43RU

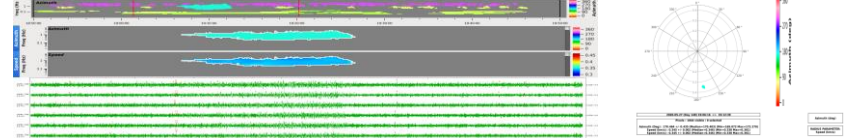


Fig. 6. Analysis data and detections I43RU

Location with Geotool

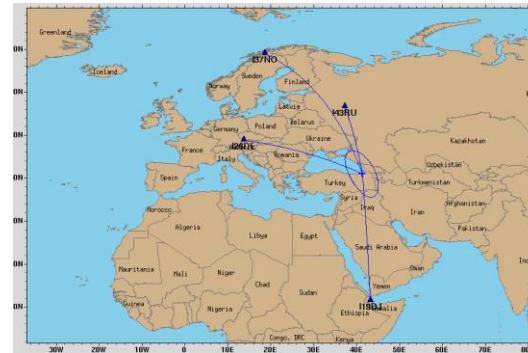


Fig. 7. Event location with I19DJ, I26DE, I37NO, I43RU

NDC-IRAQ results

Event ID	Lat	Long	Time (UTC)	Energy (J)	Speed (km/s)	Altitude (km)	Duration (s)	Area (km²)	Volume (km³)
I19DJ	40.98	41.45	2020-05-27 17:30:52	1.0E+10	15.0	10.0	1.0	1.0	1.0
I26DE	40.92	41.09	2020-05-27 17:31:14	1.0E+10	15.0	10.0	1.0	1.0	1.0
I37NO	40.98	41.45	2020-05-27 17:31:14	1.0E+10	15.0	10.0	1.0	1.0	1.0
I43RU	40.92	41.09	2020-05-27 17:31:14	1.0E+10	15.0	10.0	1.0	1.0	1.0

Lat: 40.98° Long: 41.45°
2020-05-27 17:30:52 UTC



IDC-REB:

Lat: 40.92° Long: 41.09°
2020-05-27 17:31:14 UTC

Explosion in military arsenal near Achinsk in Russia on August 5, 2019



Fig. 8. Event explosion

Station	Lat	Long	Depth	Time	Origin
1	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
2	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
3	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
4	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
5	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
6	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
7	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
8	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
9	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC
10	56.06	90.24	10	2020-05-27 17:42:41 UTC	IRAC

NDC-IRAQ results

Lat: 56.06° Long: 90.24° 2020-05-27 17:42:41 UTC

IDC-REB:

Lat: 56.19° Long: 90.14° 2019-08-05 11:42:40 UTC

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I31KZ

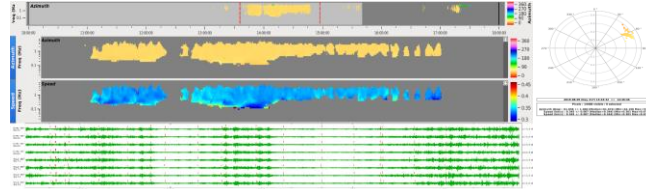


Fig. 9. Analysis data and detections I31KZ

I43RU

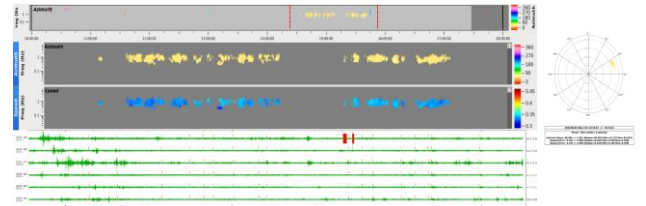


Fig. 11. Analysis data and detections I43RU



Fig. 13. Event location with geotool

I37NO

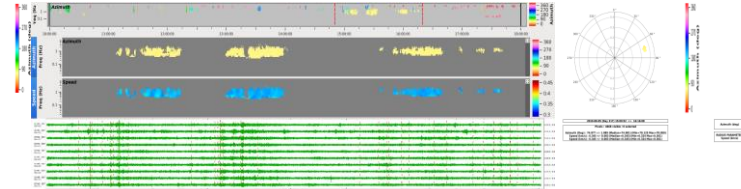


Fig. 10. Analysis data and detections I37NO

I46RU

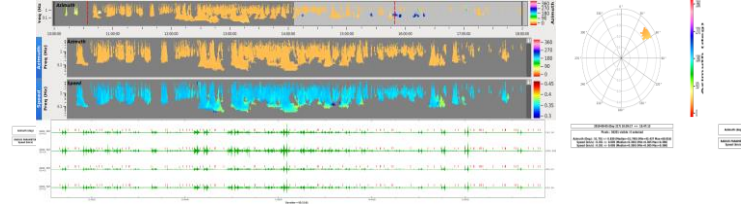


Fig. 12. Analysis data and detections I46RU



EVENT 17689593 SOUTHWESTERN SIBERIA, RUSSIA

Station	17689593	Lat	56.06	Long	90.24	Depth	10	Time	2020-05-27 17:42:41 UTC
Station	17689593	Lat	56.06	Long	90.24	Depth	10	Time	2020-05-27 17:42:41 UTC
Station	17689593	Lat	56.06	Long	90.24	Depth	10	Time	2020-05-27 17:42:41 UTC
Station	17689593	Lat	56.06	Long	90.24	Depth	10	Time	2020-05-27 17:42:41 UTC
Station	17689593	Lat	56.06	Long	90.24	Depth	10	Time	2020-05-27 17:42:41 UTC

Fig. 14. Event REB-IDC

Earthquake event on 3 June 2020 at Iraq – Iran border

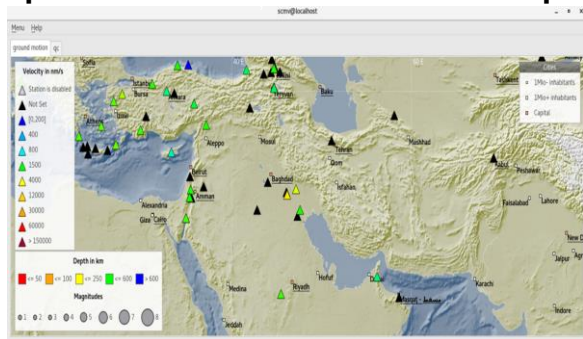


Fig. 15. Map with seismic stations in SeisComP3 (NDC-IRAQ)

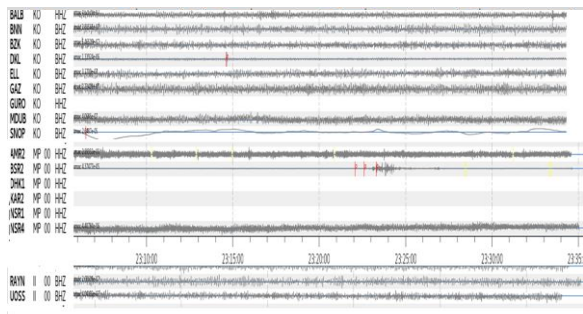


Fig. 16. Realtime waveform local, regional and global stations (NDC-IRAQ)

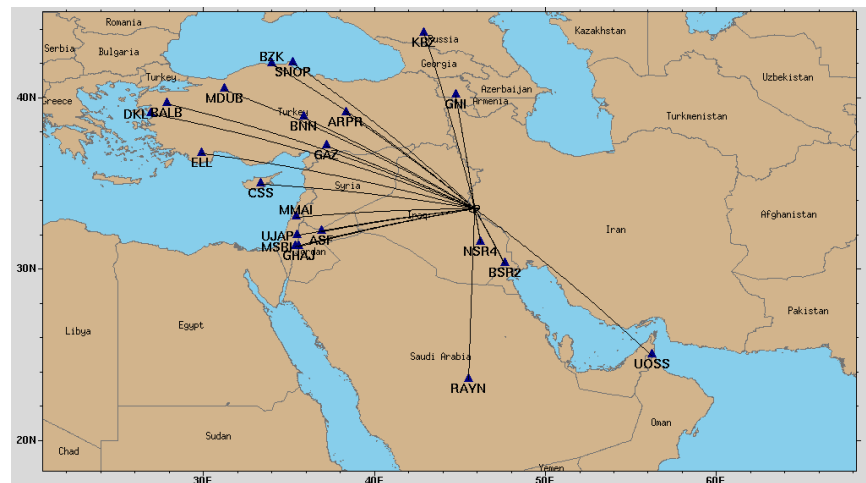


Fig. 17. Location event with Geotool

NDC-IRAQ results

For location event used stations: BZK, SNOP, ARPR, BNN, MDUB, GAZ, ELL, DKL, BALB, CSS, UJAP, MSBJ, GHAI, RAYN, UOSS, **NSR4,BSR2 (Iraq local stations), KBZ,GNI, MMAI, ASF, (IMS stations).**

Location by NDC-IRAQ:

Lat: 33.52° Long: 45.85° (2020-06-03 08:16:54 UTC)

Magnitude: 4.2 ML

Depth: 10.0 km

- ❖ The different events analyzed in this work were of great advance in the use of the tools for the NDCs. Data from the IMS stations were used.
- ❖ The infrasound event analysis technique in the NDC-IRAQ is used to locate and detect events from different sources of infrasound such as meteorites and explosions.
- ❖ The East and North of Iraq is representing the front line of the Arab and Iranian zone in the East with the Turkish zone in the North. These zones are still under quakes and bounces waves. The main reason for this is due to extend of Arab zone from the Red Sea towards the Iranian zone. The quake is considered to be within the seismic activity zone between Iraq and Iran because of the rocky nature of the borders between the two countries. Consequently, this location made Iraq among what is called the active seismic zone.
- ❖ In NDC-Iraq, improvements have been made to the systems for acquiring and locating global and near seismic events on the Iraq-Iran border.

Thank you for your Attention