

## The Infrasound Reference Event Database (IRED) need to be revised



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### INTRODUCTION

The IDC created the Infrasound Reference Event Database (IRED) in July 2010. The IRED collected and documented significant infrasound events. It may be necessary to revise the IRED to ensure its continued relevance and accuracy.

### METHODS/DATA

I have reanalyzed some existing events from the IRED to check if any corrections are needed, conducted a study on the changes in the IMS Infrasound network since 2010, and reviewed infrasound events that have occurred after 2010, considering their potential addition to the IRED.

### RESULTS

1 out of 7 reanalyzed infrasound events from the IRED requires a correction in terms of the Origin Time. Additionally, the network has expanded with the addition of 10 new IMS infrasound stations, and several newly detected infrasound events are eligible for potential inclusion in the IRED.

### CONCLUSION

Existing Infrasound events in IRED need to be revalidated. New Infrasound Reference Events need to be added to the IRED for the infrasound Stations installed after 2010. Newly detected infrasound events are eligible for potential inclusion into IRED.

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## The Infrasound Reference Event Database (IRED)



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The Infrasound Reference Event Database (IRED) created by the International Data Centre to:

- Collect, review and document infrasound events of special interest
- Archive the data for each event into database tables
- Use IRED for training, testing and validation purposes

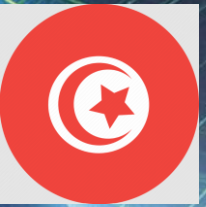
IRED contains 616 events grouped in 12 categories (as of February 2010) as shown in Table below and it is available for NDCs (by request from IDC Services) :

### Inventory

Mine and quarry blasts (220)	Aircraft (13)
Explosions (129)	Military exercise (12)
Earthquakes (85)	Cultural noise (8)
Volcano eruptions (58)	Avalanches and landslides (7)
Rocket launches/re-entries (56)	Synthetic data (1)
Meteorites and Bolides (26)	Unknown (1)

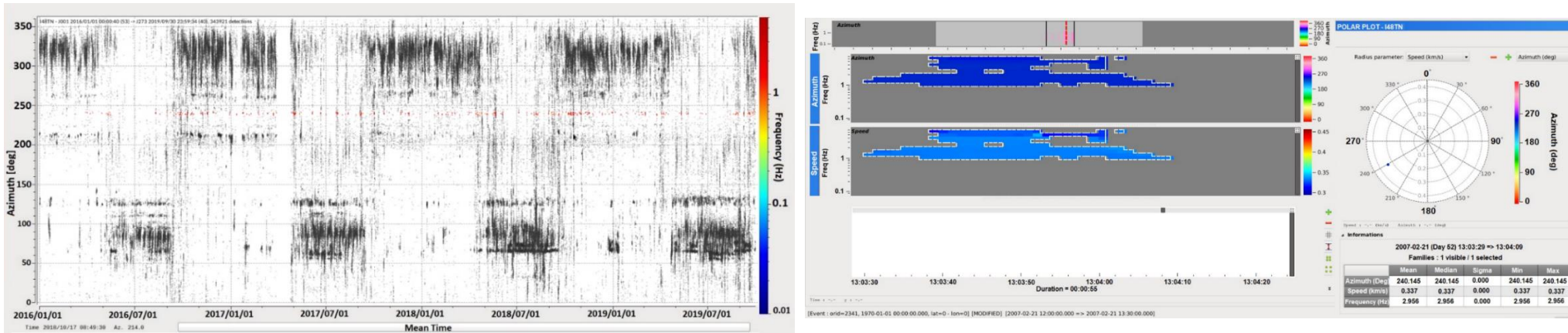
The Objectives of this study are to:

- Check the accuracy of the existing IRED events parameters (Location, Origin Time, ....etc)
- Check the continued relevance and accuracy of the IRED after more than 12 years of it's creation



I have reanalyzed seven infrasound events from the Infrasound Reference Event Database (IRED) detected by the station I48TN using the same method employed for analyzing IRED events. The NDC-in A Box Package (GPMCC, DIVA, and GEOTOOL) was utilized for this purpose. Presented below is an example of one of the reanalyzed infrasound events:

(Mine blast in Mechtat Ouled Saad).



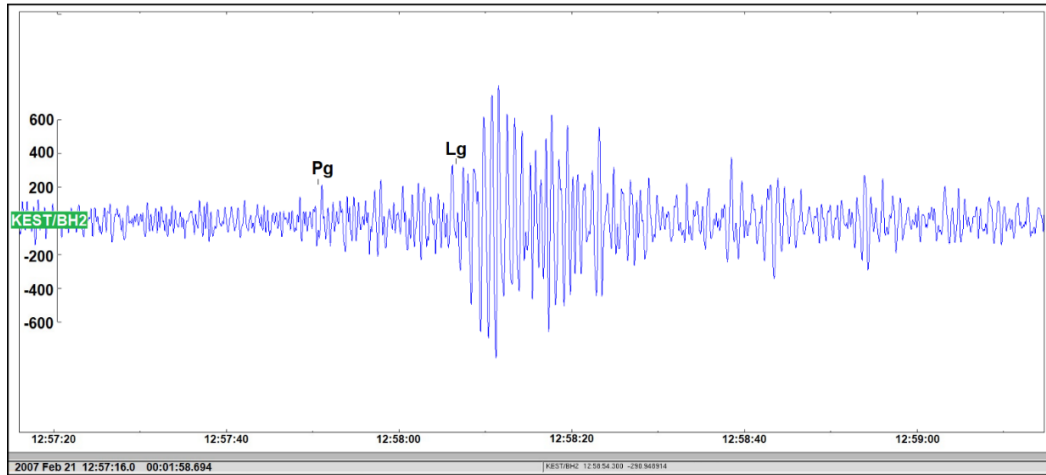
Station	Time	Phase	BackAz	Speed (m/s)	Frequency
I48TN	2007-02-21 13:03:29	I	240°.145	337	2.956

As shown above, data from I48TN shows the back Azimuth of the blast in mechtat Ouled saad Mine: 240°

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# Reanalyze of seismic data for the same event (Mine blast in Mechtat Ouled Saad)



orid	lat	lon	depth	time	sdepth
-37	35.1192	8.3220	0.0000	2007Feb21 12:57:31	-1.0000

P	T	A	S	sta	P-37	timeres-37	time
<input type="checkbox"/>	I	d	n	n	I48L7	I	0.34 2007Feb21 13:03:36
<input type="checkbox"/>	I	d	n	n	I48L4	I	0.13 2007Feb21 13:03:38
<input type="checkbox"/>	I	d	n	n	I48L3	I	-1.27 2007Feb21 13:03:36
<input type="checkbox"/>	I	d	n	n	I48L1	I	0.31 2007Feb21 13:03:39
<input type="checkbox"/>	I	d	n	n	I48L2	I	0.60 2007Feb21 13:03:39
<input type="checkbox"/>	I	d	n	n	I48L5	I	-0.43 2007Feb21 13:03:41
<input type="checkbox"/>	I	d	n	n	I48L6	I	0.48 2007Feb21 13:03:39
<input type="checkbox"/>	Pg	d	n	n	KEST	Pg	0.00 2007Feb21 12:57:51
<input type="checkbox"/>	Lg	d	n	n	KEST	Lg	-0.00 2007Feb21 12:58:05

Origin Time		2007-02-21 12:57:31			
Station	Time	Phase	Latitude	Longitude	Depth (km)
KEST	2007-02-21 12:57:51	Pg	35°.119	8°.322	0
KEST	2007-02-21 12:58:05	Lg			

Using Geotool, above are the results of reanalysing seismic data from the IMS station (KEST) for the same event (Mine blast in Mechtat Ouled Saad). The results shows the origine time of the event: 21 February 2007 at 12:57:31



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## Comparison of the reanalyzed event parameters to IRED results



Source	Results of Infrasound and seismic data analysis					International Data Centre results (IRED)*				
	Origin Time	Pg	BackAz (°) I48TN	Speed m/s	Freq Hz	Origin Time	Pg	BackAz (°) I48TN	Speed m/s	Freq Hz
<u>Mdhilla</u>	2007-02-14 13:41:35	13:42:08	200.7	352	2.19	2007-02-14 13:41:00	13:42:09	198.6	363	1.71
<u>Metlaoui</u>	2007-02-14 13:12:30	13:13:05	207.1	358	2.29	2007-02-14 13:12:33	13:58:07	207.6	379	1.72
<u>Redeyef</u>	2007-02-16 12:21:13	12:21:45	212.5	367	2.40	2007-02-16 12:21:15	12:21:46	213.4	345	1.68
<u>Djebel Onk</u>	2007-02-25 12:11:25	12:11:53	223.3	357	2.41	2007-02-25 12:11:28	12:11:54	222.8	365	1.42
<u>Mechtat ouled Saad</u>	2007-02-21 12:57:31	12:57:51	240.1	337	2.95	2007-02-21 12:09:18	12:57:52	239.9	338	1.57
<u>Bou Khadra</u>	2007-02-18 12:04:29	12:04:49	268.3	341	3.49	2007-02-18 12:04:27	12:04:49	268.3	341	1.86
<u>Jebel Ressay</u>	2007-02-16 16:46:37	16:47:00	45.7	346	2.98	2007-02-16 16:46:39	16:47:00	45.5	346	1.87

Upon comparing the reanalyzed data results with the information provided by the IRED, we observed that six events yielded similar results. However, there was a discrepancy in the source location for the event in Mechtat Ouled Saad, where the origin time recorded in the IRED (12:09:18) differed from the revised result (12:57:31).

In our revised analysis, the Pg arrival time was 12:57:51, whereas the IRED results indicated 12:57:52, demonstrating a difference of 1 second, which is within an acceptable range. In our results, the difference between the Pg arrival time and the Origin time was 20 seconds, which falls within the acceptable margin. However, in the IRED results, the difference exceeded 48 minutes, significantly surpassing the acceptable margin which is in general not exceeding tens of seconds



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The IMS infrasound network in 2010 consisted of 43 stations, but as of 2023, we now have 53 certified infrasound stations. Since the establishment of the IRED in 2010, the IMS infrasound network has detected several noteworthy events, such as volcanic eruptions, meteorite impacts, and explosions.

Here are three significant events:

Type of events	Event	Date	IMS stations	Notes
<b>Meteor</b>	Chelyabinsk meteor (Russia)	February 15, 2013,	I31KZ I46RU	The Chelyabinsk meteor was estimated to have been approximately 20 meters (65 feet) in diameter and had a mass of about 10,000 metric tons. It is classified as a super bolide, a very bright meteor that explodes in the atmosphere.
<b>Explosion</b>	Beirut explosion (Lebanon)	August 4, 2020	I48TN I26DE I42PT I17CI I11CV	The Lebanon port explosion refers to a catastrophic event that took place on August 4, 2020, in the port of Beirut, the capital city of Lebanon. The explosion occurred when a large quantity of ammonium nitrate, a highly explosive material, stored in a warehouse at the port, detonated. The blast was incredibly powerful and had a devastating impact on the surrounding area. It resulted in extensive destruction of buildings, infrastructure, and vehicles in the vicinity of the port.
<b>Volcano</b>	Hunga Tonga–Hunga Ha'apai Volcano eruption (Tonga)	January 15, 2022	I22FR I36NZ	The explosive submarine eruption began on December 20, 2021, with the largest explosion occurring on January 15, 2022. The explosion was hundreds times more powerful than the atomic bomb dropped on Hiroshima, and was heard as far as Fairbanks, Alaska, nearly 10,000 km away. Fluctuations in air pressure were recorded all over the world as the pressure wave has fully circled the world several times.



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## Results:

1 out of 7 reanalyzed infrasound events from the IRED requires a correction in terms of the Origin Time.

The IMS infrasound network has expanded with the addition of 10 new IMS infrasound stations

Several newly detected infrasound events are eligible for potential inclusion in the IRED (e.g, Chelyabinsk meteor, Beirut explosion, Hunga Tonga Volcano eruption)

## Conclusions:

Existing Infrasound events in IRED need to be revalidated.

New Infrasound Reference Events need to be added to the IRED for the infrasound Stations installed after 2010.

Newly detected infrasound events are eligible for potential inclusion into IRED.



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- Characterisation of the coherent infrasound sources recorded by the infrasound International Monitoring System station I48TN in Tunisia (Mines & Quarries), 2021: distributed under “*Atmospheric and Climate Sciences* Vol.11 No.1,  
[DOI: 10.4236/acs.2021.111014](https://doi.org/10.4236/acs.2021.111014)
- CTBTO, [swp.ctbto.org](http://swp.ctbto.org)
- CTBTO (IRED)



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