

# Dellys Fireball: Determination of Characteristics Using Infrasound and Seismic Detections

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## INTRODUCTION AND MAIN RESULTS

This work presents the initial findings concerning the fireball that occurred on the night of November 24 to 25, 2022, at approximately 11:21 p.m. near Dellys, a town in northwestern Algiers city.

The estimate location of the fragmentation was determined by analyzing the seismic signals from four local stations that detected the event.

The infrasound signals received from two local stations allowed us to estimate the energy of the main fragmentation.

## Eyewitnesses and social media observations

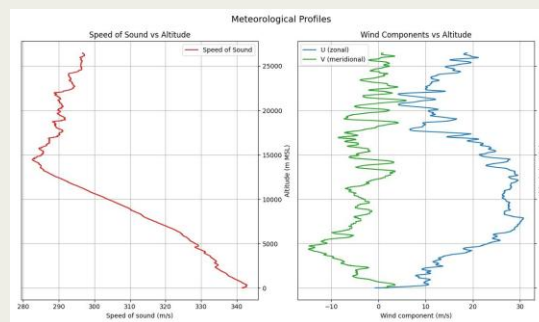
On December 5, 2022, a field mission was organized with the objective of gathering as much information as possible about the event. The town of Dellys was selected as a site of investigation because local residents and fishermen reported observing a large meteor in the vicinity around 11:21 p.m on the night of November 24, 2022.

The majority of the eyewitnesses described the object as a bright orange moving fireball in the sky, accompanied by a very sharp, loud sound (boom). According to the testimony of several witnesses, the object in question manifested as an assemblage of three discrete components. These witnesses further attest to the object's trajectory, which they observed to be from a southwest to a northeast direction, with a trajectory that appeared to be directed towards the sea.

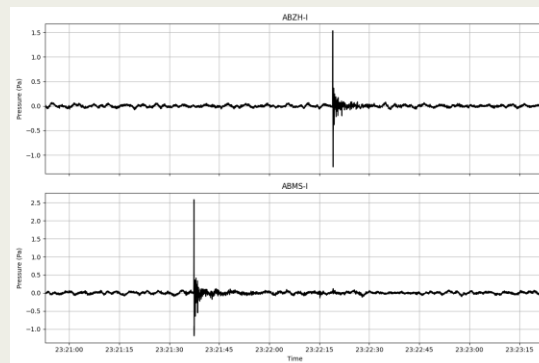
The event was disseminated via social media on Facebook (a page dedicated to the town of Dellys). The reports were consistent with those previously received from local residents, with the addition of reports from residents of neighboring towns who alleged they had heard a noise and felt a vibration or had seen a light at very low altitude.

## Main seismic and infrasound results

The atmospheric model used in this work have been provided by the National Meteorological Office (ONM) (**Fig.1**) This model allows us to estimate the travel time of the acoustic wave from the fragmentation location to the seismic



**Fig.1:** Sound speed and wind speed profiles.



**Fig.2:** Infrasound signals from two local stations.

From Infrasound signals (**Fig.2**) we estimate a quantity of energy equivalent to 0.054 kt of TNT using Los Alamos empirical relation, and 113 kg of TNT using AFTAC relation.

The recorded data by seismic stations are caused by acoustic disturbances. The location of the fragmentation was estimated by means of the travel time method, with the aid of the aforementioned arrivals. Times are shown in **Table 1**. The analysis indicated an altitude of 10 km north of Dellys above the Mediterranean Sea (**Fig.3**).

Station code	ABMS	AKED	ABZH	ATKJ
Longitude (°)	03.4842	03.4136	03.0321	04.1244
Latitude (°)	36.7590	36.6510	36.7972	36.4426
Altitude (m)	32	112	342	1352
Abs. Max. amplitude (µm/s)	4.01	1.24	1.11	0.43
Arrival time, UTC	23:21:42,028	23:22:07,880	23:22:19,460	23:23:35,100

**Table 1;** Location of seismic stations, arrival time of shock wave and maximum amplitude.



**Fig.3:** Location of the fragmentation using the four stations that recorded the event.