# Repeatedly detected ambient noise at I30JP

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## 1. Abstract

In order to improve capability of I30JP to detect and identify incident infrasound signals, it is important to classify the regularly detected signal (hereafter referred to as ambient noise). Although we have attempted to collate the ambient noise observed at I30JP in the past, at this time, we have afresh done it throughout the year of 2022. In this process, we referred to the methodology presented by Romanian NDC at ITW2022. They processed infrasound data, observed by their own facility in Romania, using DTK-GPMCC and showed the dominant frequency-back azimuth histograms with color-coded trace velocity. In their figures, detections of anthropogenic sources such as thermal power plants and natural sources such as microbaroms have different concentrations in specific back azimuths and frequency bands, making it easy to grasp the differences between the sources.

As a result, the directions of artificial sources were clarified, and some interesting features were revealed about natural sources.

## 2. Configuration for PMCC processing

DTK-GPMCC was carried out I30JP data for the year 2022 with following configuration.

1/3 octave
30 frequency bands: 0.01 - 8.0 Hz
Window Length: 2583.6 - 25.6 s

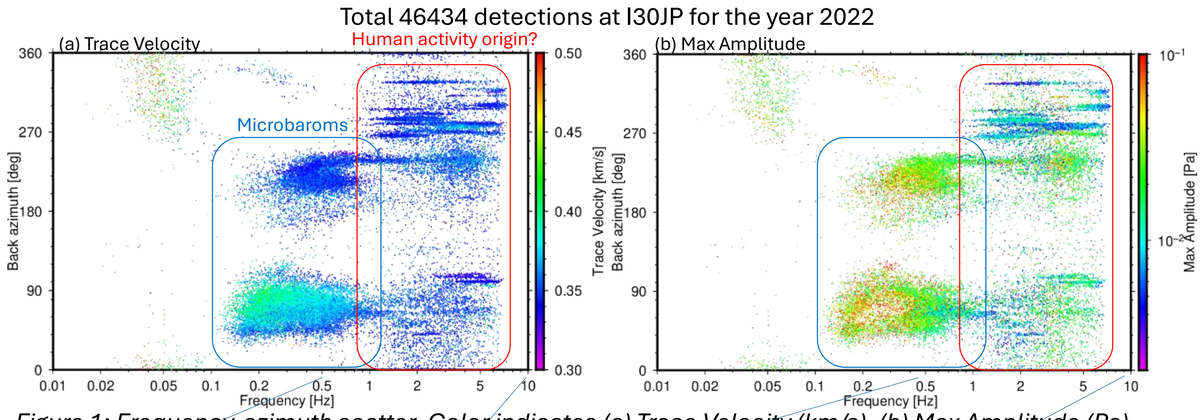


*Figure 1: Frequency-azimuth scatter. Color indicates (a) Trace Velocity (km/s), (b) Max Amplitude (Pa).*

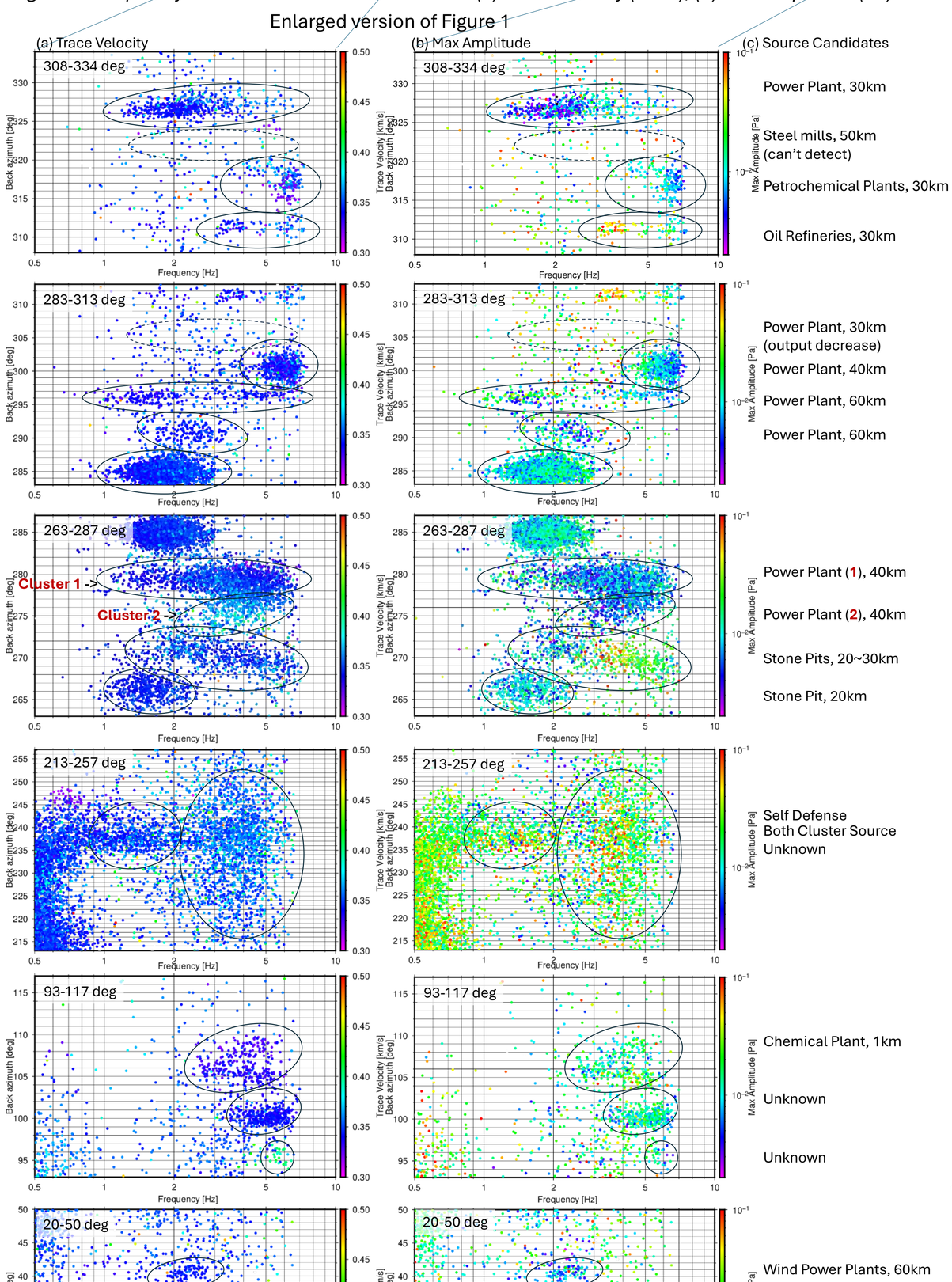


*Figure 2: Scatter of enlarged Figure 1 Color indicates (a) Trace Velocity (km/s), (b) Max Amplitude (Pa). Clusters are outlined, not detected or poorly detected with dotted line. (c) Corresponding Source Candidates and distance from I30JP.*

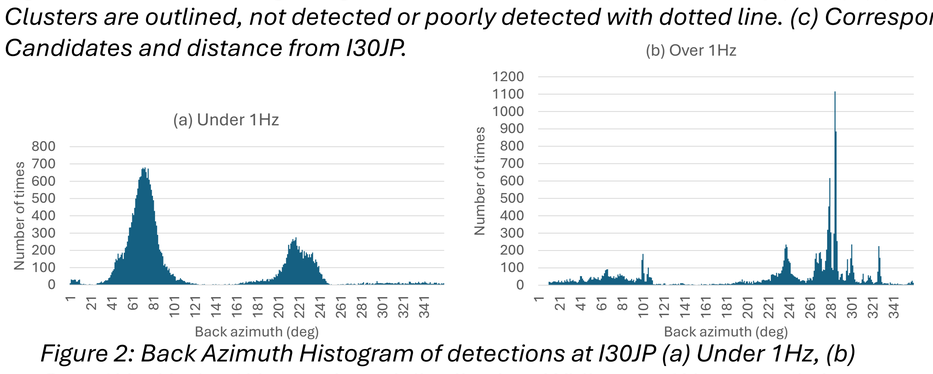


*Figure 2: Back Azimuth Histogram of detections at I30JP (a) Under 1Hz, (b) Over 1Hz. Under 1Hz, two broad distribution. While over 1Hz, several sharp peaks were observed. This also suggests that the direction of arrival over 1Hz is more stable than under 1Hz.*

## 3. Repeatedly detected ambient noise

Following Romanian NDC's figures, we created a similar figure for I30JP. Detections under 1Hz distributed widely, while those upper 1Hz concentrated linearly in a specific directions (Figure 1, 3). Considering the frequency and concentration of detections (cluster), source candidates are assumed that under 1Hz is microbaroms and upper 1Hz is anthropogenic activities such as fixed thermal power plants (Figure 2). Figure 2 suggests that near azimuth but different trace velocity or amplitude originate from different sources. For example, cluster 1 and cluster 2 in the "Trace Velocity" diagram for "263-287 deg".

No microbaroms were detected from the southeast to southwest of I30JP (Figure 1, 3, 6).

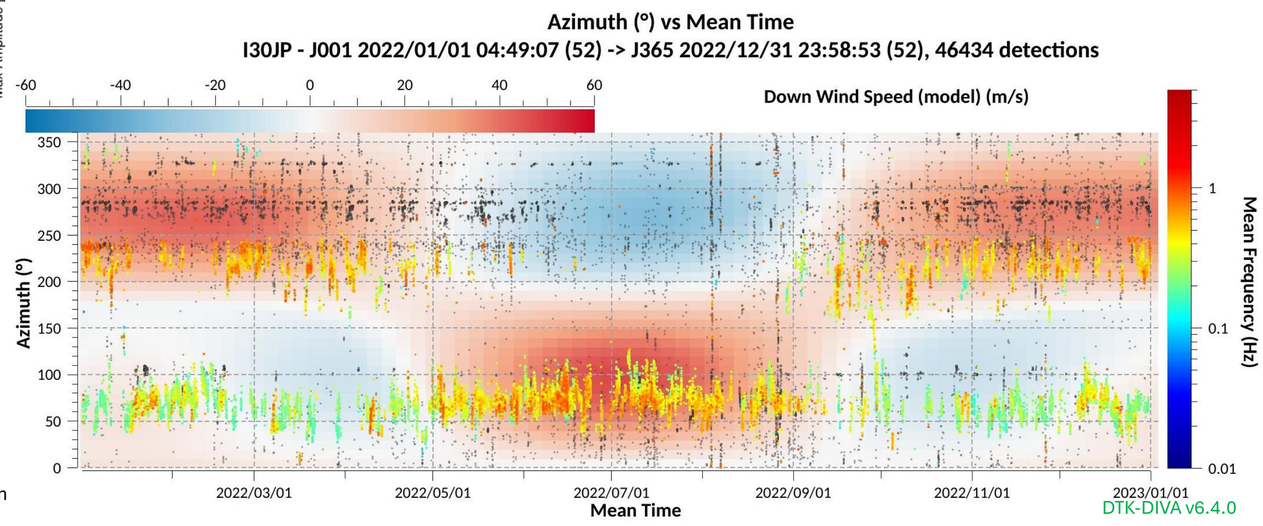


*Figure 4: Time-azimuth scatter of detections. The plot is color-coded with Mean Frequency, which 0.1-1.0 Hz selected in Figure 5. Gray is outside frequency. Red background colors indicate favorable propagation condition with dominant down wind, while blue background colors indicate unfavorable with up wind (HWM14/MSIS00). In other words, the colored plots represent microbarom origins, and show that microbaroms from the southwest are difficult to detect from June to August when easterly winds prevail.*

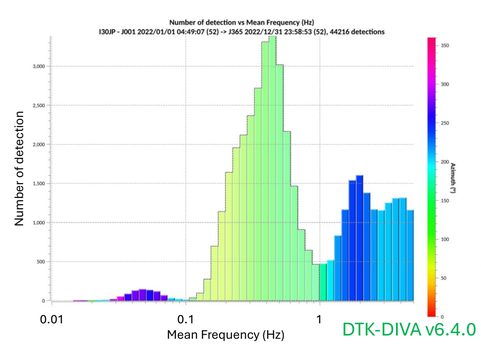


*Figure 5: Mean Frequency Histogram of detections at I30JP. This histogram was created using DTK-DIVA v6.4.0 (NDC Advanced Training on Infrasound Data Analysis in September 2024). 0.1-1.0 Hz bars are selected to view the time series of microbarom detection in Figure 4.*

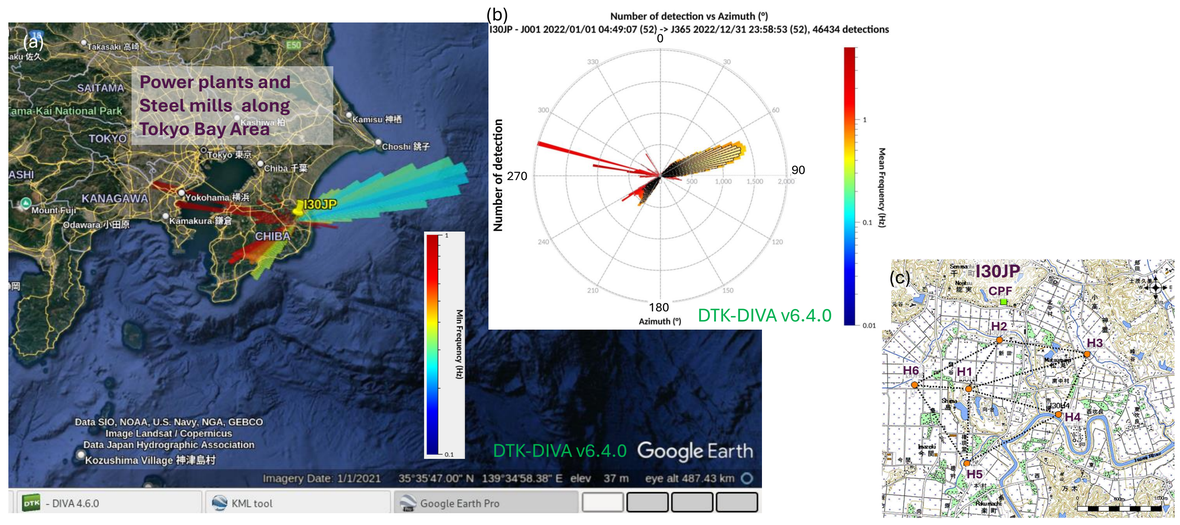


*Figure 6: Polar Histogram of detections at I30JP for the year 2022 (a) All histogram with color-coded with Min Frequency, (b) Black bars correspond to 0.1-1.0 Hz selected in Figure 5, (c) Layout of I30JP*

## 4. Conclusion and further plan

* In the frequency band under 1Hz, signals (clusters) thought to be due to microbaroms were concentrated to the east and southwest of I30JP. They were not detected from the southeast to south direction.
* It is better to look at both trace velocity and maximum amplitude.
  * I30JP had detections (cluster) of over 1Hz from the west to the northwest. Many thermal power plants in the Tokyo bay area are located in this direction. It appears that a flare was detected from a thermal power plant.
  * Signals were also detected from a chemical plant near I30JP, an oil refineries on the Tokyo Bay coast, a wind power plants located 60km north, and a regional stone pits.
  * On the other hand, no signals were detected in the direction of oil tank and steel mills.

* We will investigate the reason why signals due to microbaroms were not detected from the southeast to southwest of I30JP.
* When plotting the direction of arrival and frequency band enlarged, the distribution of clusters appears to differ depending on the source, and it may be possible to distinguish source candidates based on the distribution. We will continue to investigate the characteristics of the distribution.