



## ABSTRACT

The proposed collaboration will be an important contribution from OVSICORI-UNA to the volcanic monitoring in Costa Rica as it will expand the spatial coverage beyond that of the permanent International Monitoring System infrasound component in Latin America and the Caribbean. The installation of the portable infrasound array station by PTS-CTBTO and OVSICORI-UNA in the month of November 2018, in the North-East Zone of Costa Rica in the Selva Biological Station Reserve. The deployment and installation of CTBTO infrasound mobile system in Costa Rica (I69CR), would be beneficial for advancing the understanding of infrasonic sources in Central, Latin American and Caribbean regions. Some data analyzes of seismic events near Costa Rica and volcanic activity detected close to the place of the portable infrasound station I69CR are presented with software DTK-GPMCC 5.7.3, NDC in box SHI-NIAB Mar 2018, CentOS 6.9, ver 4.3.

## INTRODUCTION

The Infrasound Portable Array installed in the North of country to have a quality signal monitoring from active volcanoes: Turrialba Volcano, Poas Volcano and Rincon de la Vieja Volcano. The station I69CR improve the understanding of local and regional infrasonic sources observed by the IMS infrasound network and conjunction with the station I20EC, Galapagos Island in Ecuador. I69CR infrasound station will increase data analysis capabilities of infrasound technology in the NDC Costa Rica.

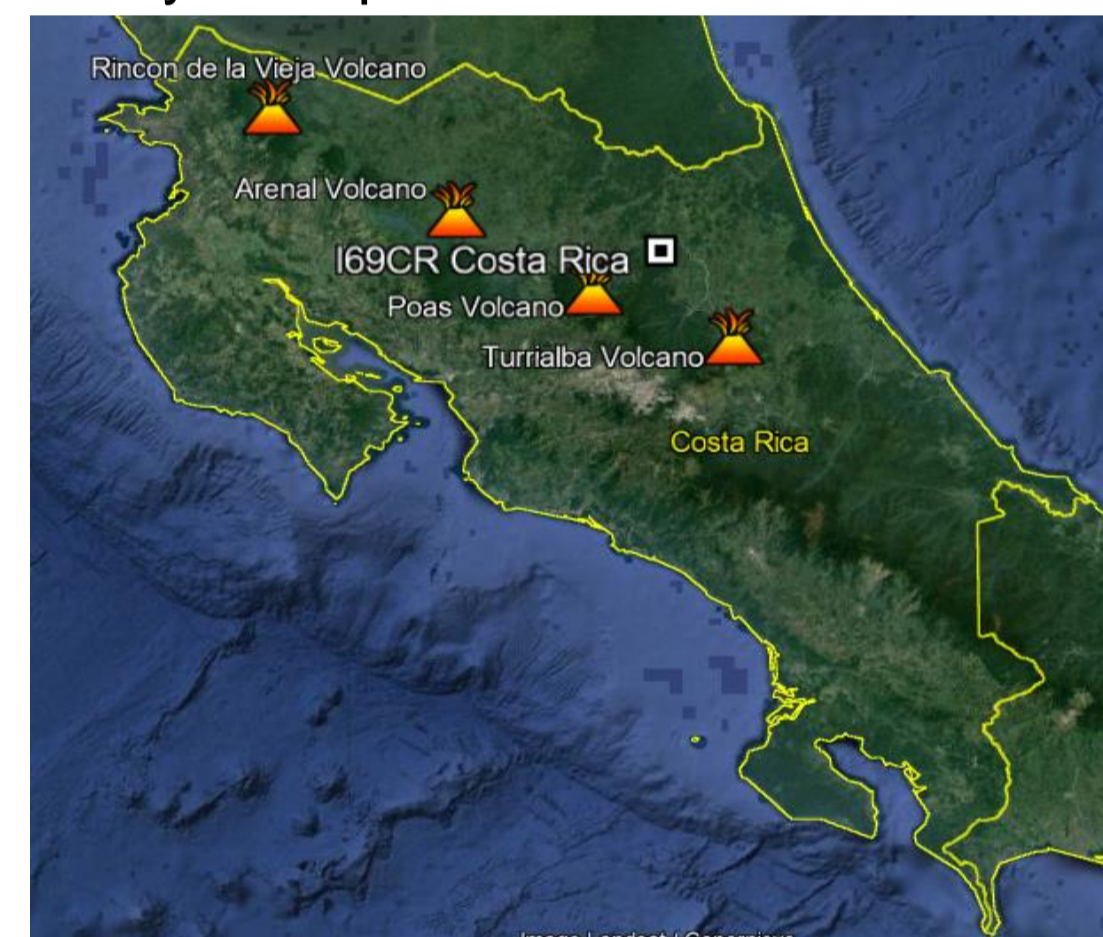


Figure 1. Location of I69CR infrasound station



Figure 2. IMS stations near to I69CR

## DEVELOPMENT IN THE FIELD

The portable infrasound station has 4 elements H1 to H4 with an approximate distance of 1 km opening with an operation sampling of 20 sps. The station was installed in a forest area with trees 20 meters high and achieving a natural barrier to environmental noise. In addition porous hoses were placed with 4 holes of the instrument boxes as mechanism wind noise reduction.



Figure 3. Installation in the field I69CR

The installation of the station was carried out by the cooperation between the Volcanological and Seismological Observatory of Costa and the CTBTO team, in addition to the cooperation of the National University of Costa Rica and the Ministry of Foreign Relations and Worship of Costa Rica.

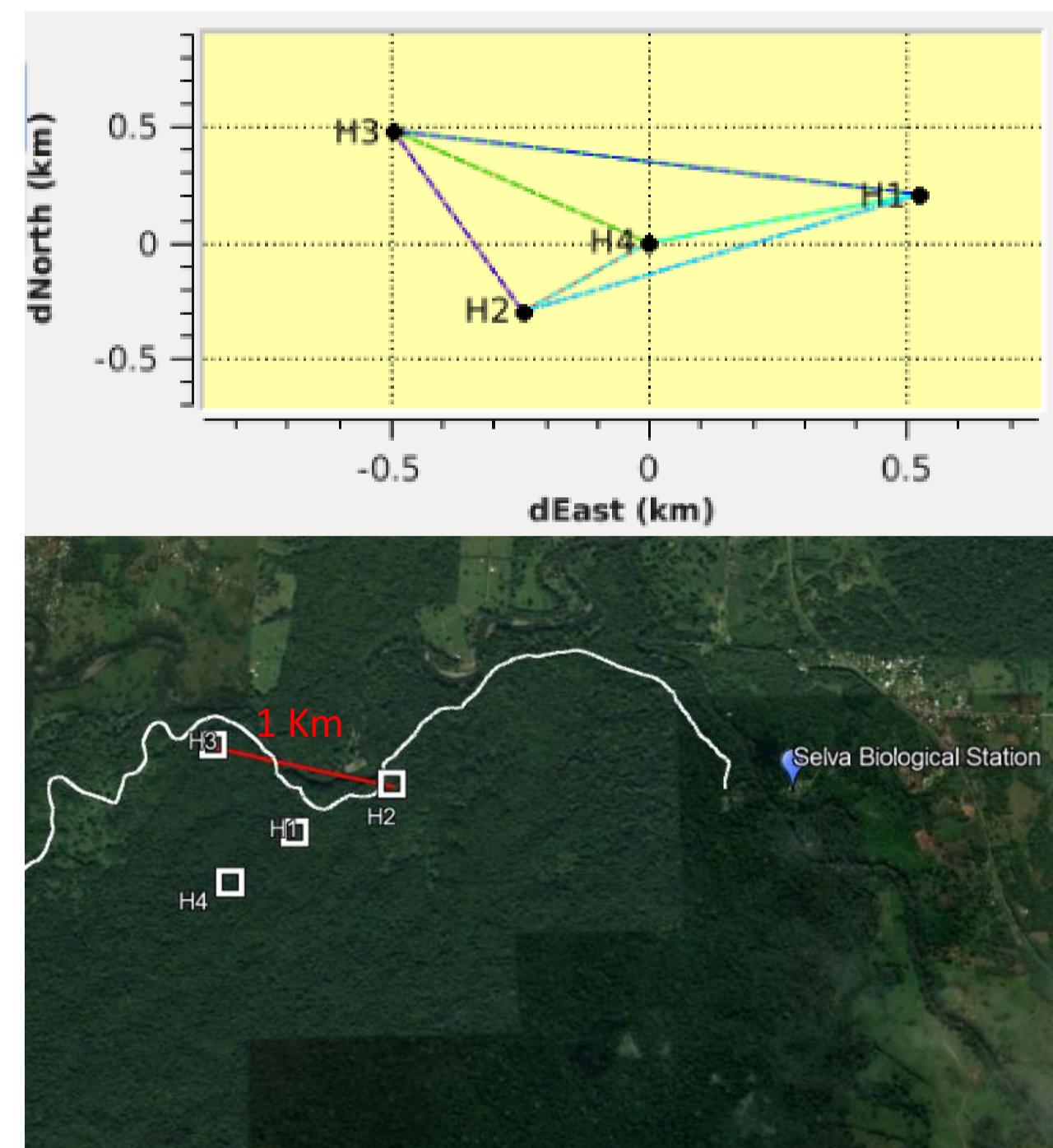


Figure 4. I69CR array geometry

## DATA ANALYSIS I69CR INFRASOUND STATION

The software DTK-GPMCC 5.7.3, NDC in box SHI-NIAB Mar 2018, CentOS 6.9, ver 4.3. is used to analyze the data. The I69CR use the sensor MB3d SeismoWave (Figure 6). The infrasound array between the months of November to March has monitored 89,373 detections (Figure. 5).

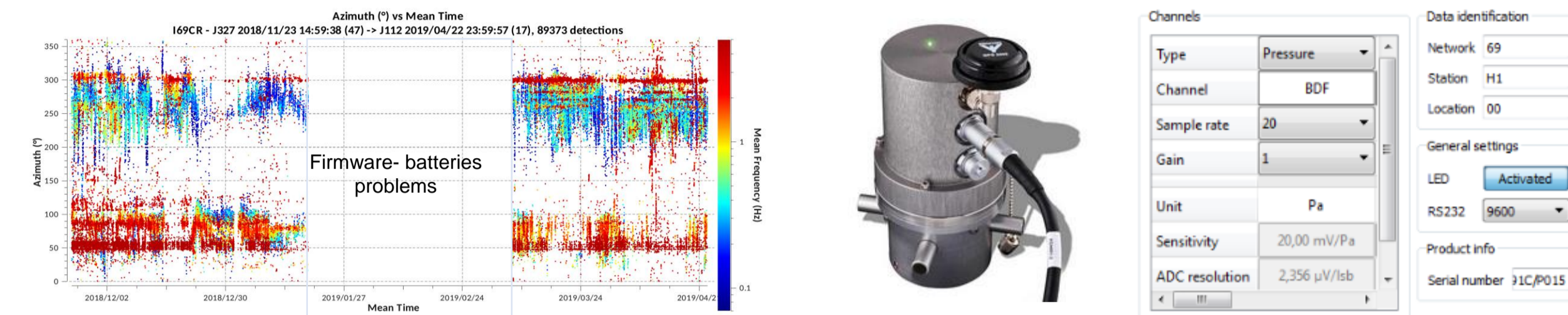


Figure 5. Detections about I69CR, 89373 detections Figure 6. Sensor and Sample Characteristics

## Popocatepetl Volcano, Mexico

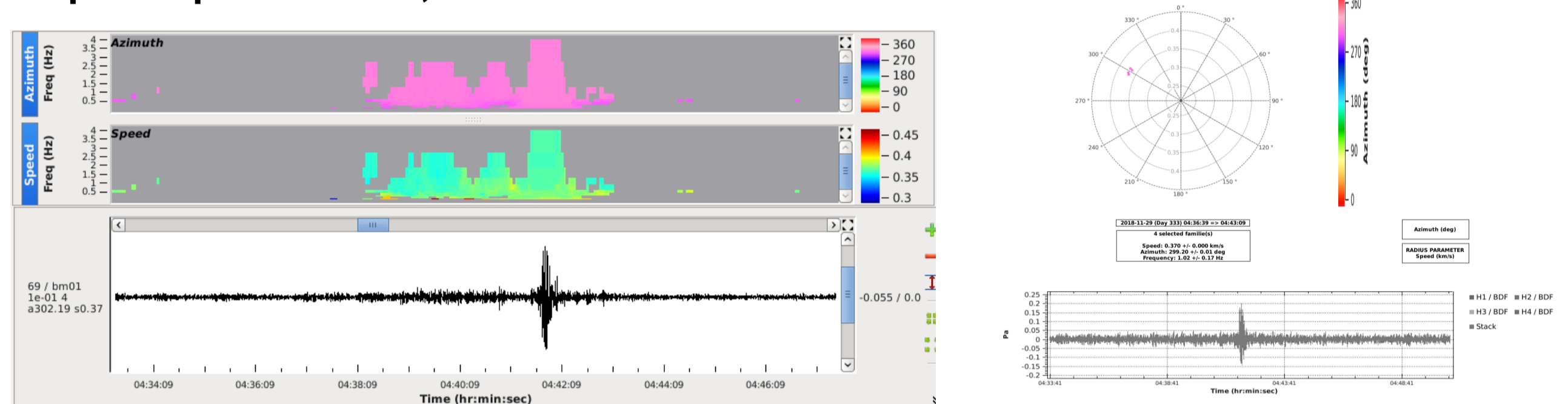


Figure 7. I69CR Popocatepetl Volcano explosion

Figure 8. Back azimuth - amplitude explosion

The detection of volcanic explosion on November 29, 2018.

## SEISMIC EVENTS DETECTED BY I69CR

The detection of seismic events occurred in the Caribbean on November 25, 2019 and Panama on May 12, 2019.

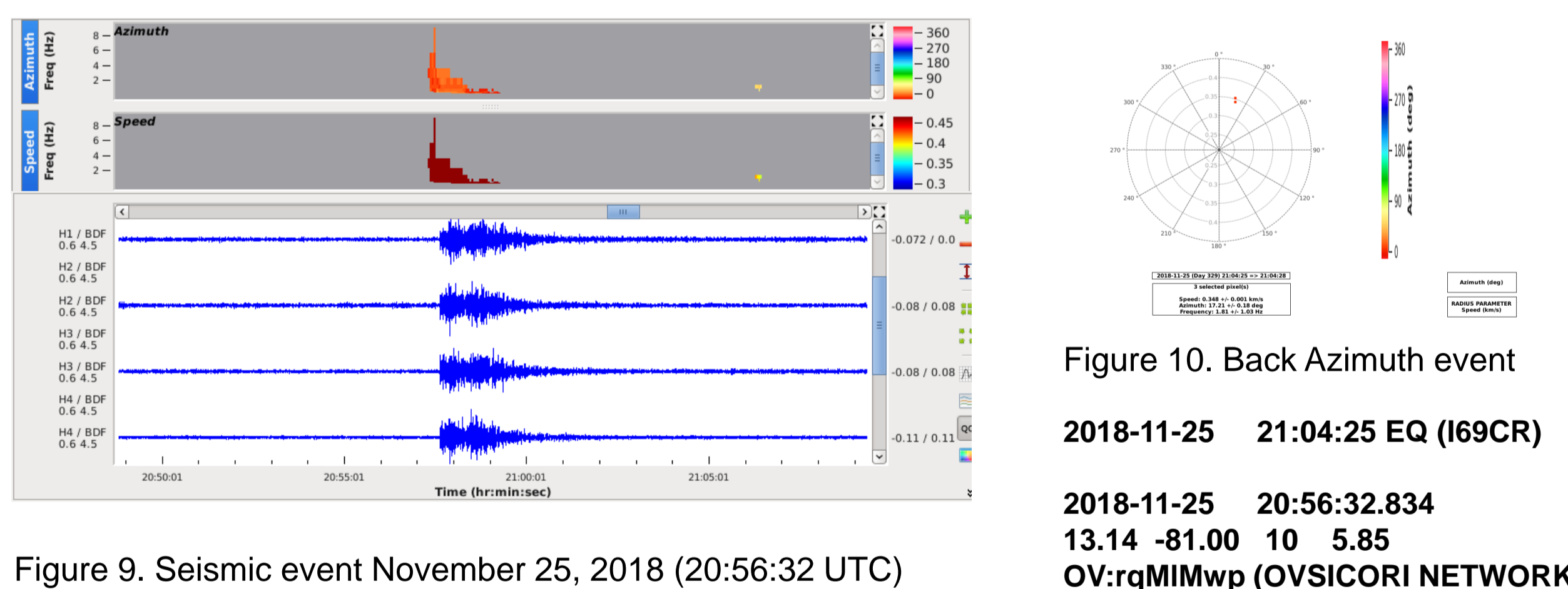


Figure 9. Seismic event November 25, 2018 (20:56:32 UTC)

Figure 10. Back Azimuth event

2018-11-25 21:04:25 EQ (I69CR)

2018-11-25 20:56:32.834  
 13.14 -81.00 10 5.85  
 OV:rqMIMwp (OVSICORI NETWORK)

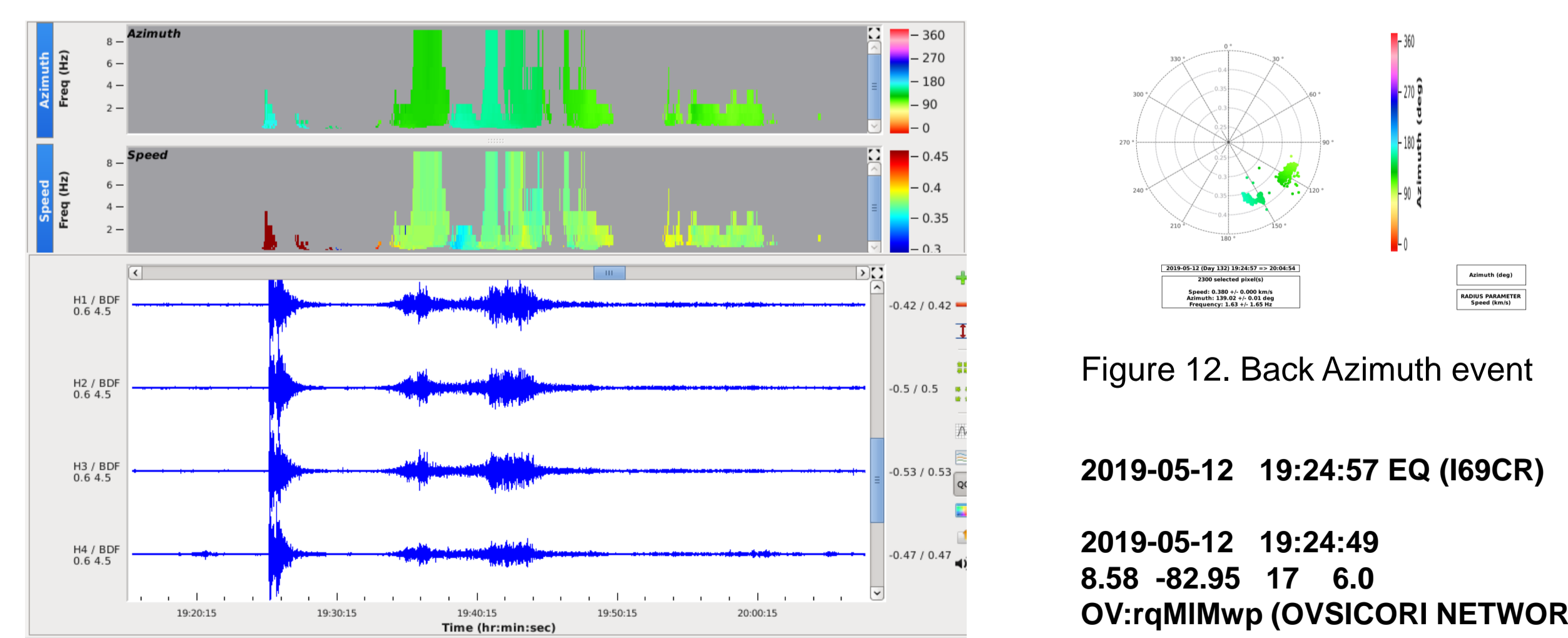


Figure 11. Seismic event May 12, 2019 (19:24:49 UTC)

Figure 12. Back Azimuth event

2019-05-12 19:24:57 EQ (I69CR)

2019-05-12 19:24:49  
 8.58 -82.95 17 6.0  
 OV:rqMIMwp (OVSICORI NETWORK)

## ANALYSIS OF INITIAL DATA - METEORITE AGUAS ZARCAS OF APRIL 23, 2019

NDC Costa Rica process the initial analysis of data stations I20EC (Galapagos Island, Ecuador) part of IMS-IDC network and I69CR (Sarapiquí, Costa Rica) infrasound portable array. The event was April 23, 2019 21:07:23 local hour (April 24, 2019 03:07:23 UTC). The web cams installed in volcanoes of Costa Rica; they saw the event.

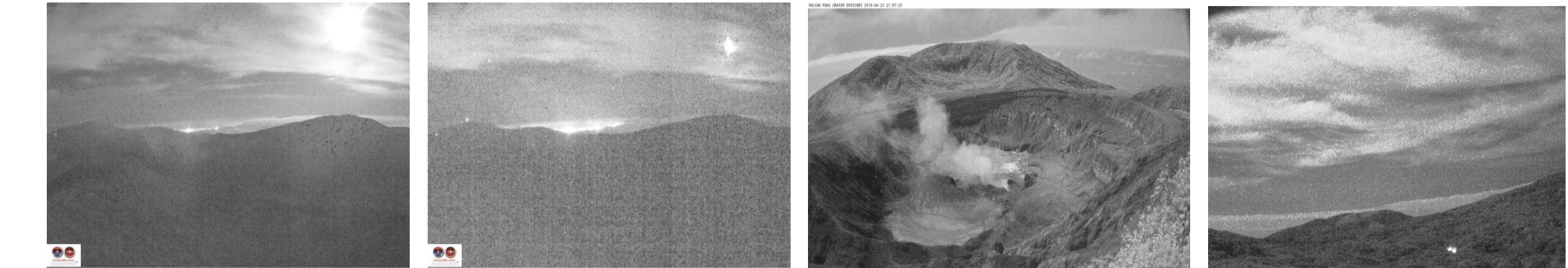


Figure 13. Web Cams locate in Turrialba Volcano (left photos) and Poas Volcano (right photos)

## I69CR DATA ANALYSIS

4 Elements H1,H2,H3,H4. Back azimuth 265.52 +/- 0.02 deg.  
 Event time 03:08:29 to 03:10:59. Speed 0.388 Km/s.  
 Frequency 1.65 Hz +/- 2.00 Hz. Amplitude 0.3 Pa.

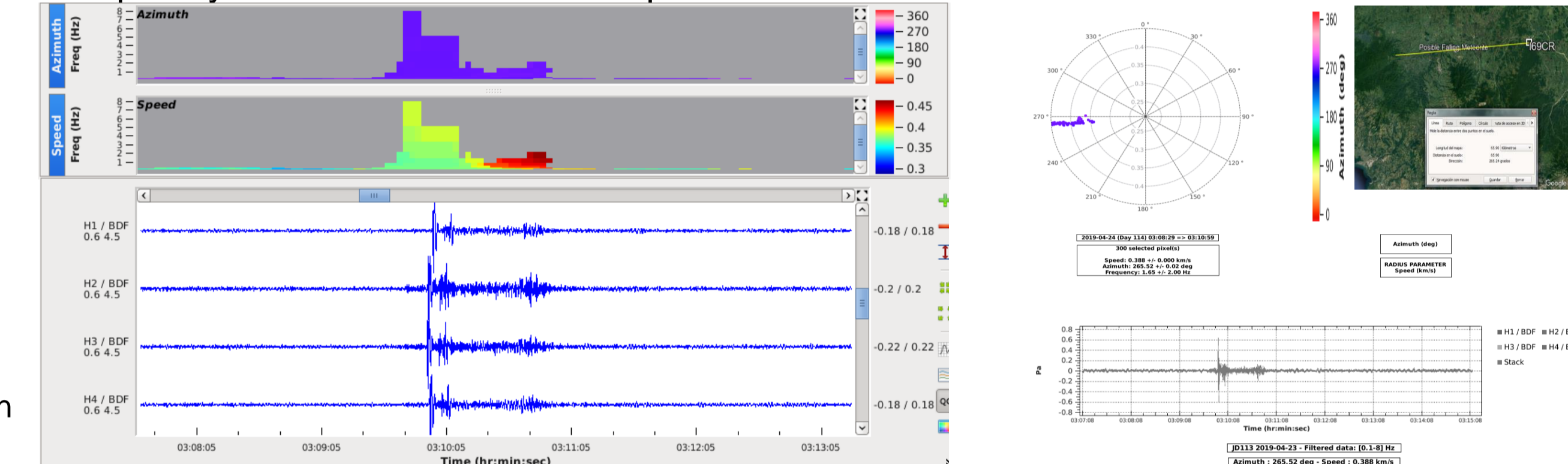


Figure 14. Data analysis I69CR. Waveforms and polar plot azimuth - speed. Location event

## I20EC DATA ANALYSIS

8 Elements H1,H2,H3,H4. Back azimuth 29.72 +/- 0.01 deg.  
 Event time 04:22:12 to 04:32:33. Speed 0.355 Km/s.  
 Frequency 2.04 Hz +/- 0.88 Hz. Amplitude 0.02 Pa.

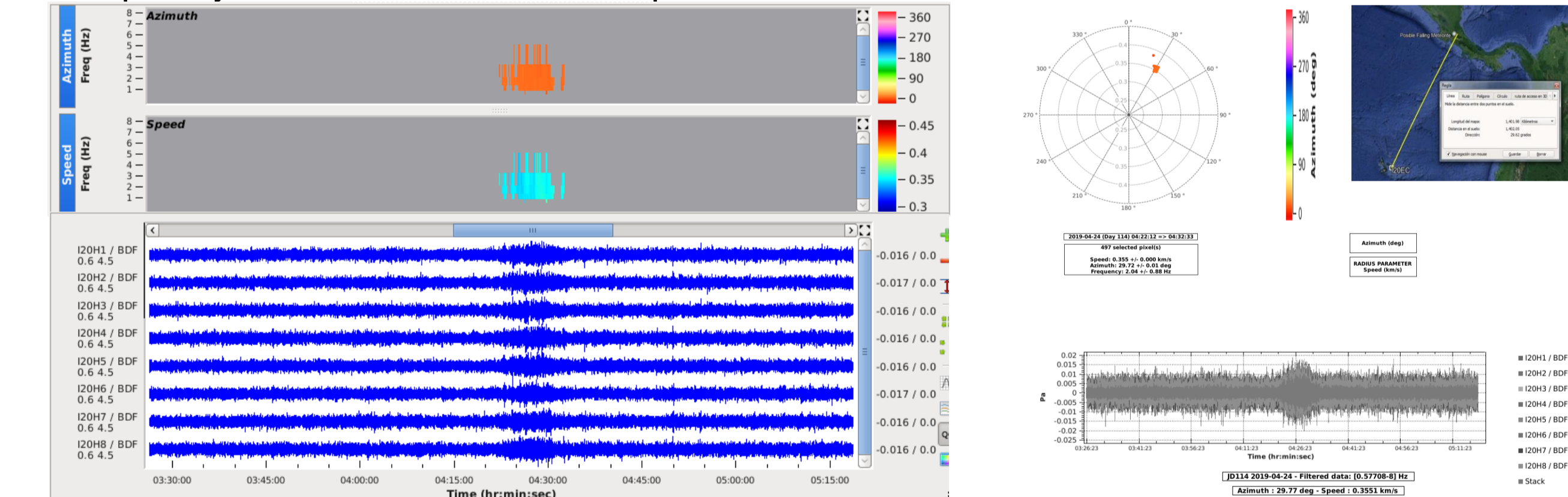


Figure 15. Data analysis I20EC. Waveforms and polar plot azimuth - speed. Location event.

## CONCLUSIONS

Increase the capacities of NDC Costa Rica in the analysis and characterization of infrasonic events in the Latin American and Caribbean region.

Correlating data from the I69CR station with the IMS stations such as I20EC, I08BO, I51GB and local infrasound stations located in volcanoes such as IVTCR in the Turrialba Volcano.

Improve data analysis capabilities with the DTK-DIVA program.

## REFERENCES

- Le Pichon, A., Blanc, E., Hauchecorne, A.(2019). Infrasound Monitoring for Atmospheric Studies Challenges in Middle Atmosphere Dynamics and Societal Benefits (2-ed). Switzerland: Springer, pp 989-1077.
- Cansi, Y., Le Pichon, A. (2008). Infrasound event detection using the progressive multi-channel correlation algorithm. In: Havelock D., Kuwano S., Vorlander, M. (eds) Handbook of Signal Processing in Acoustics. New York: Springer, pp 1425-1435.

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