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PREPARATORY COMMISSION

Infrasound Bulletin from local and regional sources by the NDC of Costa Rica between 2018 and 2020 and integration of data from I20EC, I51GB, I08BO (IMS) infrasound stations with local volcanic infrasound monitoring networks and portable array I69CR (CTBTO)

Hairo Villalobos, Ronnie Quintero, Daniela Campos

P2.3-286

Volcanological and Seismological Observatory Costa Rica

(OVSICORI-UNA)

POSTER

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ABSTRACT

Since 2018, the inclusion of infrasound monitoring in active volcanoes in Costa Rica with local networks has been implemented by OVSICORI-UNA. In addition, at the end of 2018, two portable infrasound arrays were installed, such as I69CR and IVTCR in cooperation with CTBTO and UNIFI. The NDC-CR includes the integration of IMS stations such as I20EC, I51GB, I08BO, thus making it possible to use the event location option through back-azimuth triangulation for relevant local and regional events in the region of Central America and the Caribbean.

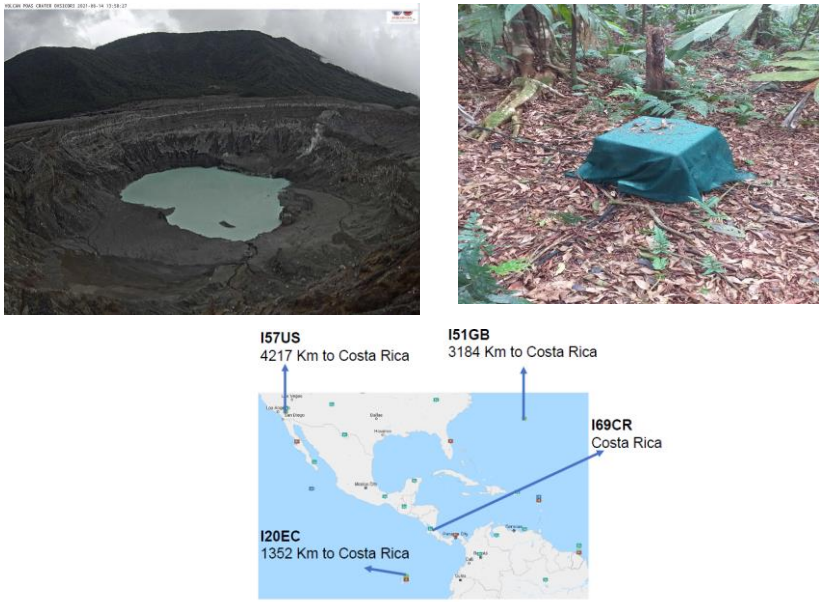

Fig. 1. Project Development Infrasound Stations in Costa Rica

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INTRODUCTION

Station I69CR improve the understanding of local and regional infrasound sources observed in Costa Rica 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 (Report I69CR 2018)

On November 21 and 22, 2018, in collaboration OVSICORI-UNA and UNIFI, we installed a four elements infrasonic array on volcano Turrialba (IVTCR).

The installation of the IVTCR array at Turrialba volcano is part of a project that involves the temporary installation of a large aperture array I69CR in La Selva Biological Station in Costa Rica, at a distance of ~ 60 km from Turrialba volcano (Report UNIFI 2018)

Fig. 2. Installation IVTCR station Turrialba Volcano

Fig. 3. Installation I69CR station Selva Biological

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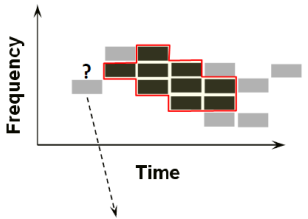
METHODS

Analysis of infrasound sources, data from the IMS stations were used: I51GB, I20EC, I08BO and local infrasound stations such as IVTCR, I69CR and local infrasound stations of one element in the OVSICORI-UNA network. The data were analyzed through the NDC in a box programs such as DTK-GPMCC. For the processing of the infrasound arrays, the Progressive Multi-Channel Correlation method was used (Cansi, 1995). In addition to using the 1/3 octave configuration enabled in the GPMCC.

The event databases were used to visualize meteorite events near the Central American and Caribbean region, such as:

International Meteor Organization (IMO) (https://www.imo.net/)

Center for Near-Earth Object Studies (CNEOS) is the Jet Propulsion Laboratory (JPL) (https://cneos.jpl.nasa.gov/fireballs/)



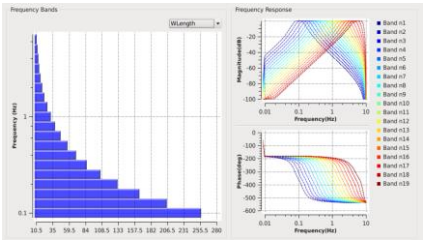


Fig. 4. PMCC process configuration

Fig. 5. IMO – CNEOS database

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RESULTS

Volcanic events: small volcanic explosions Turrialba Volcano

Infrasonic signal recorded at sensor m1 of the array showing a low amplitude transient (0.3 Pa)produced by an ash eruption (*a*) that is identified by the array processing as signal with a back azimuth of ~ 30 °N, consistent with the position of the active crater of Turrialba volcano (*b*) and apparent velocity of 350- 370 m/s (*c*)

Ash eruption that did occur between 22:10 and 22:13 of November 23, 2018. The signal, despite being of very low amplitude (<0.4 Pa)

IVTCR STATION

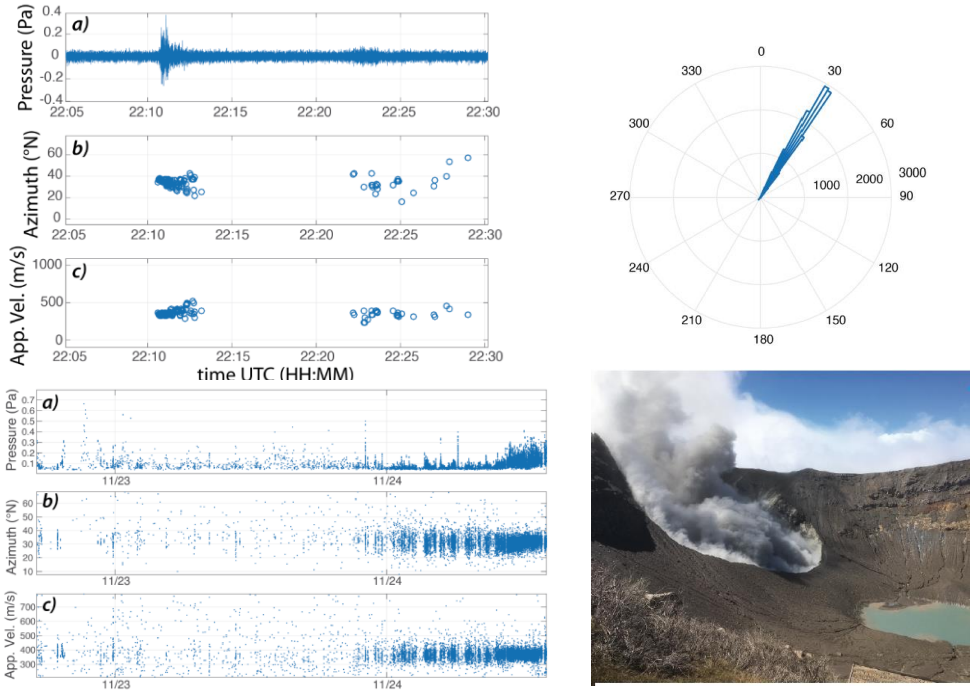

Fig. 6. Analysis data IVTCR

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RESULTS

Fireball over Bering Sea 2018-12-18 23:48:20 UTC

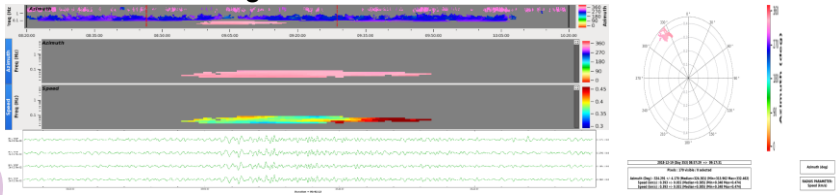

Fig. 7. I69CR detection and back azimuth

Cuba Meteorite 2019-02-01 18:17:10 UTC

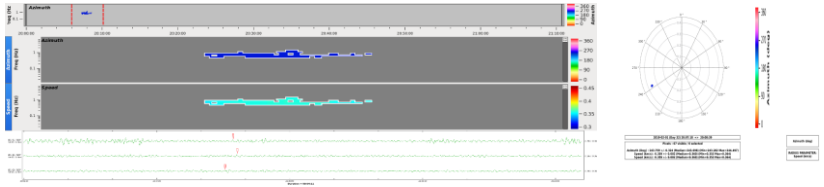

Fig. 8. I51GB detection and back azimuth

Haiti Meteorite 2019-04-14 17:54:33 UTC

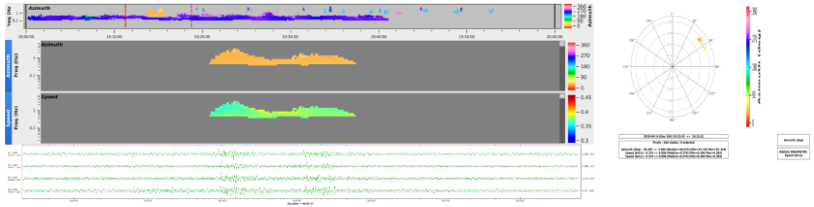

Fig. 9. I69CR detection and back azimuth

South East New Orleans Meteorite 2019-05-04 15:35:46 UTC

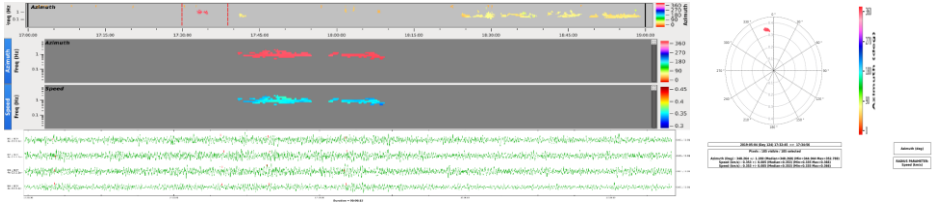

Fig. 10. I69CR detection and back azimuth

North Puerto Rico Meteorite 2020-01-17 21:29:49 UTC

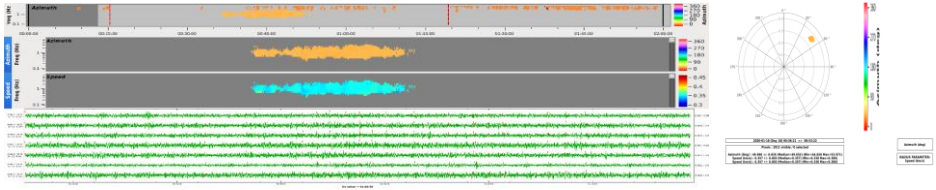

Fig. 11. I20EC detection and back azimuth

Place	Location		Time (UTC)	Station	Arrival time (PMCC)	Distance (km)	AZ (PMCC)	Frecuency (Hz)
Bering Sea	56.9N	172.4E	2018-12-18 23:48:20	I69CR	2018-12-19 08:57:29	9853	324.2	0.635
North Cuba	22.5N	83.8W	2019-02-01 18:17:10	I51GB	2019-02-01 20:07:14	2176	243.7	0.635
West Haiti	18.3N	74.6W	2019-04-14 17:54:33	I69CR	2019-04-14 19:13:42	1338	50.3	1.007
South New Orleans	28.4N	88.3W	2019-05-04 15:35:46	I69CR	2019-05-04 17:32:55	2039	348.2	0.860
North Puerto Rico	19.4N	66.0W	2020-01-17 21:29:49	I20EC	2020-01-18 00:36:22	3463	49.6	1.267

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Costa Rica, Aguas Zarcas Meteorite 2019-04-24 03:13:00 UTC

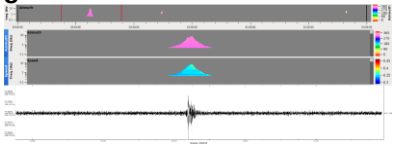


Fig. 12. IVTCR analysis and detection

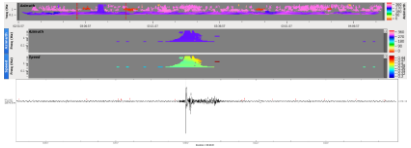
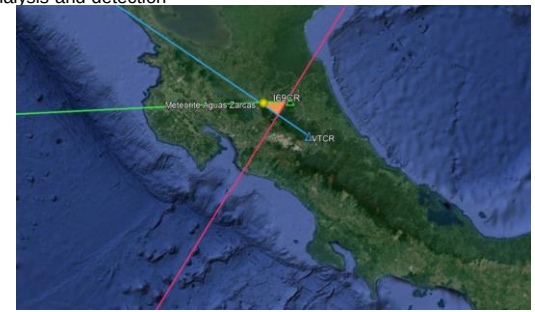


Fig. 13. I69CR analysis and detection



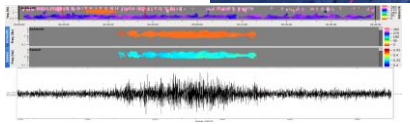


Fig. 14. I20EC analysis and detection

Fireball over Caribbean South Puerto Rico 2019-06-22 21:25:48 UTC

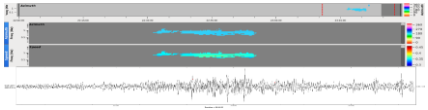


Fig. 15. I51GB analysis and detection

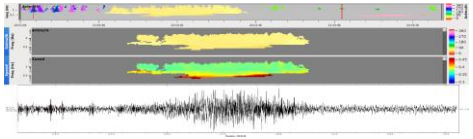


Fig. 16. I69CR analysis and detection

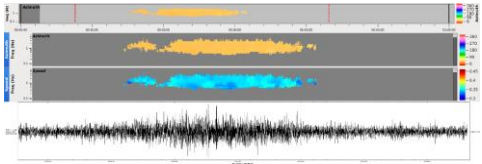
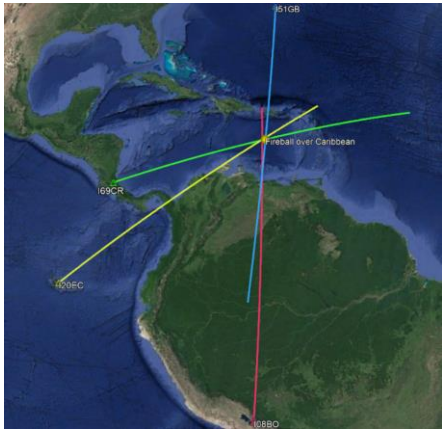


Fig. 17. I20EC analysis and detection



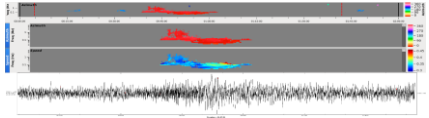


Fig. 18. I08BO analysis and detection

Place	Type	Location		Time (UTC)	Station	Arrival time (PMCC)	Distance (km)	AZ (PMCC)	Frecuency (Hz)
North Costa Rica (Aguas Zarcas)	Meteorite	10.40N	84.35W	2019-04-24 03:13:10	I69CR	2019-04-24 03:07:43	36	264.5	2.763
					IVTCR	2019-04-24 03:11:46	77	301.2	2.510
					I20EC	2019-04-24 04:21:45	1387	28.5	1.732
South Puerto Rico	Fireball	14.9N	66.2W	2019-06-22 21:25:48	I69CR	2019-06-22 23:04:29	1998	72.3	1.260
					I20EC	2019-06-23 00:19:37	3168	54.2	1.537
					I51GB	2019-06-22 23:16:22	1940	188.1	0.635
					I08BO	2019-06-23 00:38:41	3452	1.674	0.519

RESULTS

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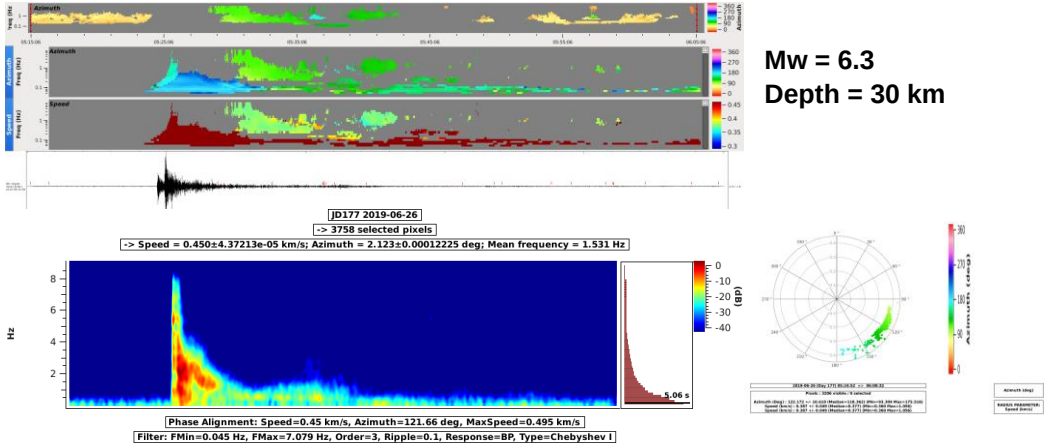
RESULTS

Earthquake near border Costa Rica and Panama 2019-06-26 05:23:48 UTC



Mw = 6.3
Depth = 30 km

Fig. 19. Back azimuth, detections and amplitude event in station I69CR

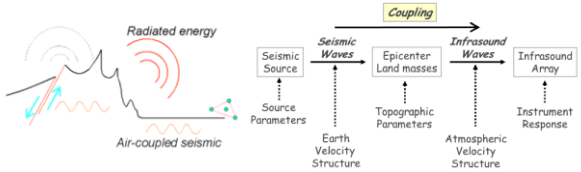


Fig. 20. Seismo-acoustic coupling theory

Irazú Volcano landslide event 2020-08-26 10:02:00 UTC

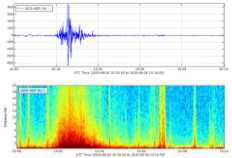


Fig. 21. VICA HDF

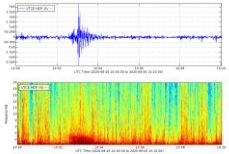


Fig. 22. VTCE HDF

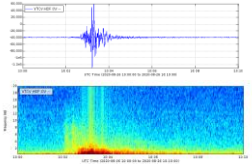


Fig. 23. VTCV HDF

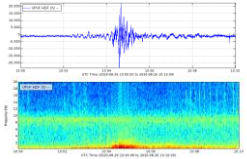


Fig. 24. VPVF HDF

Its collapse finally occurred on August 26 2020 at 4:02 a.m (local time) with an approximate volume of **25 million cubic meters** in the upper basin of the Sucio River.

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CONCLUSIONS

- Thanks of different trainings in use of SHI-NIAB version 5.1 tools. The analysis of local, regional and global sources of infrasound has been improved.
- It was possible to characterize and identify the different infrasound events around the Central American and Caribbean area.
- Improvements were made in the analysis systems of local infrasound sources and in addition to including new studies of infrasound events with the IMS stations near Costa Rica such as: I51GB, I20EC, I25FR, I08BO and local stations.
- Future, seismo-acoustic events near the Central American and Caribbean area will be analyzed.