

## #SEISMOLOGY

### Incredible Atmospheric Waves

The Hunga volcano ushered in 2022 with a bang, devastating the island nation of Tonga.



Researchers report the first comprehensive account of the Hunga volcano eruption's atmospheric waves. The Hunga volcano ushered in 2022 with a bang, devastating the island nation of Tonga, sending aid agencies and Earth scientists into a flurry of activity. It had been nearly 140 years since an eruption of this scale shook the Earth.

Robin Matoza of the University of California, Santa Barbara led a team of scientists to characterize the eruption's atmospheric waves, the strongest recorded from a volcano since the 1883 Krakatau eruption.

The team's work, compiled in an unusually short amount of time, details the size of the waves originating from the eruption, which the authors



found were on par with those from Krakatau. The data also provide exceptional resolution of the evolving wave field compared to what was available from the historic event. The paper appears in the journal Science.

#### Booms

Early evidence suggests that an eruption on January 14 sunk the volcano's main vent below sea level priming the massive explosion the following day. The January 15 eruption generated a variety of different atmospheric waves, including booms heard 6,200 miles away in Alaska. It also created a pulse that caused the unusual occurrence of a tsunami-like disturbance an hour before the actual seismic-driven tsunami began.

This atmospheric waves event was unprecedented in the modern geophysical record," says Matoza, an associate professor in the earth science department. The Hunga volcanic eruption has provided unprecedented insight into the behaviour of a variety of atmospheric wave types. "The atmospheric waves were recorded globally across a wide frequency band," says co-author David Fee of the University of Alaska Fairbanks Geophysical Institute. "And by studying this remarkable dataset we will better understand acoustic and atmospheric wave generation, propagation, and recording."

This has implications for monitoring nuclear explosions, volcanoes, earthquakes, and a variety of other phenomena.

#### Lamb Waves

The researchers were most interested in the behaviour of an atmospheric wave known as a Lamb wave, which is the dominant pressure wave produced by the eruption. These are longitudinal pressure waves, much like sound waves, but of particularly low frequency. It is such low frequency that the effects of gravity must be taken into account. Lamb waves are associated with the largest atmospheric explosions, such as large eruptions and nuclear detonations, though the wave characteristics differ between these two sources. They can last from minutes to several hours.

After the eruption the waves travelled along Earth's surface and circled the planet in one direction four times and in the opposite direction three times, the authors recorded. This was the same as scientists observed in the 1883 Krakatau eruption. The Lamb wave also reached into Earth's ionosphere, rising at 700 mph to an altitude of about 280 miles.

"Lamb waves are rare. We have very few high-quality observations of them," Fee says. "By understanding the Lamb wave, we can better understand the source and eruption. It is linked to the tsunami and volcanic plume generation and is also likely related to the higher-frequency infrasound and acoustic waves from the eruption."

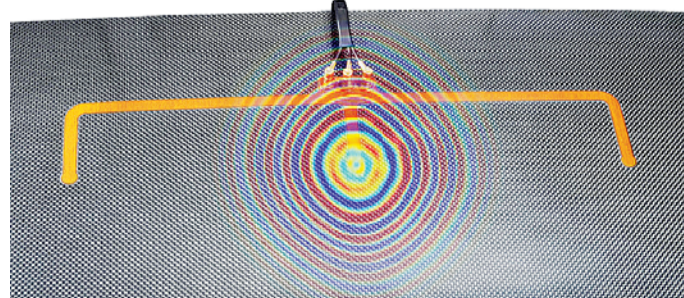
The Lamb wave consisted of at least two pulses near the volcano. The first had a seven-to-10-minute pressure increase followed by a second and larger compression and subsequent long pressure decrease.

#### Atmospheric Waves

A major difference between the accounts of Hunga's Lamb waves versus Krakatau's is the amount and quality of data scientists were able to gather. "We have more than a century of advances in instrumentation technology and global sensor density," Matoza says. "So, the 2022 Hunga event provided an unparalleled global dataset for an explosion event of this size."

Scientists noted other findings about atmospheric waves associated with the eruption, including remarkable long-range infrasound-sounds too low in frequency to be heard by humans. Infrasound arrived after the Lamb wave and was followed by audible sounds in some regions. Audible sounds reached Alaska, about 6,200 miles from the volcano, where they were heard around the state as repeated booms. "I heard the sounds," Fee recalls, "but at the time definitely did not think it was from a volcanic eruption in the South Pacific."

The scientists believe the sounds heard in Alaska couldn't have originated in Hunga. While there's still much to learn, it's clear that standard sound models cannot explain how audible sounds propagated over such extreme distances. "We interpreted that they were generated somewhere along the path by non-linear effects," Matoza explains.



Tajinder Pal Singh Bagga arrested by Punjab cops.

**Dr Goutam Sen**  
CTVS Surgeon  
Traveler  
Story teller

## Keystone Cops!

I wonder how many of you can recall the comedy feature films known as Keystone Cops. This comedy feature was a part of English films programmed when shown in cinema halls. Since the main film was of shorter duration than the traditional Hindi film these entertaining twenty minute features were used as fillers.

#### Criminal Intimidation

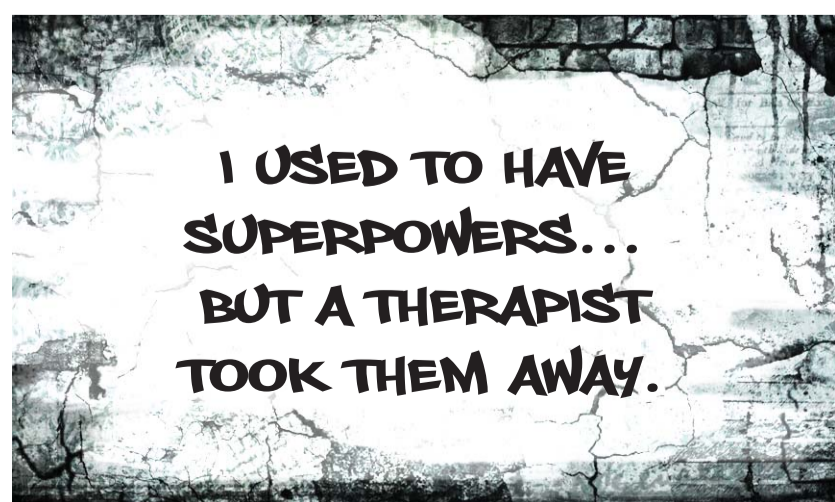
The antics of the Punjab Police and Delhi Police a few days ago remind me of the Keystone Cops. The BJP MLA Tajinder Pal Singh Bagga, from Delhi, had used the social Media and Twitter to cast aspersions on the AAP leader Arvind Kejriwal and his party. In response to these comments a complaint was lodged at Mohali Police station against Bagga by AAP spokesperson Dr Sunny Singh Ahluwalia stating that Bagga's action tantamounted to criminal intimidation...to cause violence...imminent hurt to Arvind Kejriwal and other Members of AAP. As soon as the FIR was registered at the Mohali police sent notices to Bagga, to appear before them. Bagga ignored all the five notices sent to him. At last the Punjab Police lost its patience and decided to go to Delhi to arrest Bagga. It must be remembered that there was a newly formed AAP government in Punjab.

The Punjab police team reached Bagga's home in the morning and forced their entry pushing away people who tried to stop them. Bagga was roughly handled and not even allowed to put on his turban.



The Punjab police team reached Bagga's home in the morning and forced their entry pushing away people who tried to stop them. Bagga was roughly handled and not even allowed to put on his turban.

## THE WALL



## #COMEDY

The plan was to whisk him away to Punjab. It is not uncommon for police from one state to cross its borders and go to another state to apprehend a wanted person. After all we are a Federal nation. There is however a protocol to be maintained, which requires the raiding party to inform the local police prior to the action. In fact the local police then joins the team to expedite the arrest. On this occasion the Punjab police is purported to have neglected to give prior information (for best known reason of their own) and just informed the Delhi police in passing as they returned post haste to Punjab.

#### High Drama

Meanwhile the relatives of Bagga complained to Delhi police of this 'kidnapping'. Since the protocol had not been followed by the Punjab Police, the Delhi Police registered an FIR against them and conveyed the vehicle numbers to the Haryana Police with a request that the vehicles be stopped and Bagga be brought back to Delhi to appear before a local court. It must be remembered that the Delhi Police takes orders from the Centre. Similarly the Haryana Police has its orders from its own Government (Incidentally both are BJP governments).

All this was high drama. The Punjab police was stopped and Bagga released. The team returned empty handed to Punjab. Of course, allegations have now been made by all the police teams and the battle will continue for long in the courts. It is also likely that the matter will be allowed to cool and new reasonable ways will be found to solve the issue.

After being amused by these antics serious thinking needs to be done about the law and order situation along the borders in India. As it is a state subject each police force receives their orders from the ruling government of the moment and hence indirectly from the political masters. Politicians have elephantine memories. It is common for them to seek and create situations where the opponents are earmarked for past harassment or 'sins' done earlier. The police of the state change its colour like chameleons. The newly appointed officers have to prove their loyalty to the present government.



Keystone cops on patrol! betmann.

After being amused by these antics serious thinking needs to be done about the law and order situation along the borders in India. As it is a state subject each police force receives their orders from the ruling government of the moment and hence indirectly from the political masters. Politicians have elephantine memories. It is common for them to seek and create situations where the opponents are earmarked for past harassment or 'sins' done earlier.

#### Expression of Possession

Let us for a moment consider borders. The boundary walls of our properties or barriers between two areas are an expression of possession and hence control of the area. This is a sort of 'monarch of all I survey' situation. Here the rules too are created by the owner. Anyone encroaching across the border therefore has to confirm to the rules. Trespassing is absolutely a 'NO! NO!' The fences, barriers and walls are constructed to make sure the entry to the area is restricted and only authorized people enter through a properly supervised gateway. For a moment let us expand the property from a single plot to a colony or a set of Apartments. Here again each area is gated and manned by a security force. They are empowered to inspect all personnel and vehicles that enter it. Similar measures are seen at the entry to five star hotels. The inspection at the hotel gates is so cursory that it can be considered a farce. If a bomb or weapon was tucked away in a hidden space of any vehicle it

would certainly be not revealed by running a mirror under the chassis or looking into the boot. When guard dogs are used it is possible that the inspection may be more effective. The point to remember is that a border has been crossed and so permission is required. Similar rules and laws come into place when a state border or that of a nation is crossed. There will be areas where the local customs may dictate that certain material cannot be allowed within. For example, most pilgrim towns in India will not allow non-vegetarian fare. Meat or meat product along with alcohol is forbidden. When it comes to national borders all international flyers have to fill an immigration form declaring that they are not carrying any contraband. In most nations specialist dogs do a better job than humans in sniffing out drugs. The smuggling of drugs has very severe consequences. Many nations go to the extent of punishing by death sentence if even a small amount of drug is detected (Saudi Arabia and Thailand).

All this was high drama. The Punjab police was stopped and Bagga released. The team returned empty handed to Punjab. Of course, allegations have now been made by all the police teams and the battle will continue for long in the courts. It is also likely that the matter will be allowed to cool and new reasonable ways will be found to solve the issue.

#### A Constant Headache

Protection of our borders from aggression has become a constant headache for our country. Our neighbours for best known reasons covet our land. All these nations claim that we have some part of their land under our control. The borders marked by the British in 1947 were marked on our maps without any consent of the neighbouring country, especially China. All sorts of obtuse causes are put forth. Kashmir is coveted by Pakistan because it has a dominant Muslim population. China is even worse. In the beginning we had no common border with it but it soon became our neighbour having gained control of Tibet. Ever since they kept on claiming some tract or other. They have the gumption to send their forces into the disputed Pangong Lake in Ladakh. For the first time shots were fired along the LAC near Galwan, Hot Springs and Gogra. We have to maintain forces throughout the year in the subzero temperatures in Aksai Chin. Naturally we have prevented them from entering the area. If they have entered some remote area it is possible that we have to use our military to push them back across our



Border Lines.



Immigrants trying to settle after crossing the border.



Sunny Singh Ahluwalia, AAP spokesperson.

Borders therefore are a need of the day, but I do hope there will come a day when nations will use them for demarcation alone. Battles and wars in the past have been used to preserve our borders at tremendous loss of young lives. I pray that such wars may never take place again.

Borders while negotiating at all levels using the local forces to the meeting of the senior-most Commanders in our forces. Even at the diplomatic level our foreign ministries are in constant touch to avoid a conflagration. I have often wondered what would happen if nations had borders but did not require documentation to cross them. I guess European Union is an example of that thought. It felt quite odd when I transited through Zurich without going out of the airport to see Spain, Italy and France. At the end of the holiday my passport showed no evidence of these countries. My entry and exit was date stamped by the Swiss because I was flying Swiss

Air Relations between nations allowing free access to each other have not been idyllic. Shifting of parts of the population of one nation to another due to better employment conditions and living conditions have led to strife between people. In some regions this has created ghettos of religious minorities which too are a cause of concern.

#### Futile Hopes

Borders may become more pervasive due to political thought at times. The border between India and Bangladesh is an example where people cross with impunity through the unfenced borders. If they stay long enough they even acquire documentation like Aadhar Card, Ration Card and worse still voter's card..... Borders therefore are a need of the day, but I do hope there will come a day when nations will use them for demarcation alone. Battles and wars in the past have been used to preserve our borders at tremendous loss of young lives. I pray that such wars may never take place again. My hopes are probably futile as border wars are being fought all over the world even now. Each of these simmering borders can lead to a World War again. writetogait@ashtradoot.com

By Rick Kirkman & Jerry Scott

## BABY BLUES



## ZITS



By Jerry Scott & Jim Borgman

## #J'ADORE

### Perfect Playtime Outfits for Kids

Creating summer playtime outfits for kids is basically about choosing clothes that are made of summer-friendly fabric and come in light or pastel colours.

There's nothing about summers that you cannot love, (except the blazing hot sun on some days maybe) especially summer clothes. We absolutely love summers and summer fashion. It's the time of the year you do not have to worry about layering up

or carrying an umbrella. Kids too love summers - courtesy: summer vacation. Summer vacation calls for summer camps, workshops, and a day-long of playing every day! This means you should stack up your child's wardrobe with some breezy summer clothes that are perfect playtime outfits.



T-shirt - Shorts - Crocs

Simple tees and shorts never go out of style and are a fashion staple for the entire year. No matter what the season is (except, maybe winters) your boy can sport this outfit with a pair of easy crocs.



Cotton Dress - Sandals

It's best to opt for flowy and airy dresses as opposed to body-hugging clothes. Cotton dresses, with simple frills or layers that float in the wind should be great for the summer. You can choose sleeveless, spaghetti straps or halter necks for these dresses. Pair this outfit with comfy sandals and a high pony for the best summer look.



If your daughter isn't much of a dress-lover, you can get her a pair of denim shorts or chino shorts. Pair this with a baggy top with prints that echo the summer vibe. You can choose an off-shoulder or cold-shoulder top to go with the shorts. A simple braid and a pair of sandals will perfect your little girl's look.



Get your son a pair of cool slip-ons to complete the playtime outfit.

#### Hat and Sunglasses



Everything is incomplete for summer without a hat and sunglasses. When parents are planning to shop for cool outfits they should include hats and sunglasses. Kids are very sensitive, so to protect them from harsh weather we have to include these in their fashion wear. In fact, nothing beats these summer accessories. Wearing classy hats and cool sunglasses gives a feeling of comfort and confidence to the little kiddos.

-Shruti Kothari