By Jérôme Aucan

Milton Garces is the director of the Infrasound laboratory operated by the Hawaii Institute of Geophysics and Planetology on the Kona coast on the Big Island. On any given day, you'll find him surfing or kiteboarding with his wife at one of the surf spots accessible only by 4WD north of Kealakekua Bay. When he's not surfing ocean waves, he studies another type of waves—infrasound waves.

Infrasounds are sound waves in the very low frequency end of the spectrum. While surf waves are related to gravity waves and travel at the surface in the ocean, sound waves are pressure waves traveling through the air. Like surf waves, sound waves are described by their frequency (or period).

Humans can hear frequencies from 20 to 20,000 Hz (0.00001 to 0.05 seconds). Large animals can hear at much lower frequencies, including in the infrasound range. Elephants are even suspected to use infrasound to communicate over long distances. Because infrasound waves have a low frequency, they also have a longer wavelength (the rough-cleanest horizontal distance), and they can travel unimpeded for much longer distances than human-audible sounds.

This ability of elephants to detect infrasound may have saved them from the tsunami in Thailand.

The animals may have been able to hear the tsunami coming during the precious few minutes just before it delivered devastation at the coast.

In the case of the tsunami, the infrasounds were generated by either or both the actual tsunami waves that appeared as an ugly, foaming, wall of whitewater, and the seismic waves from the earthquakes that generated the tsunami.

Surf waves that hit the coastline also produce infrasounds. This phenomenon was first described in 2003 by Milton Garces and his colleagues in the scientific journal Geophysical Research Letters.

To any surfer, the noise of breaking waves is all too familiar. On the North Shore, during calm nights, you can hear the low rumble of big waves, even if you stand miles away from the coast. Many other natural phenomena such as meteors entering the atmosphere, explosive volcanoes, and meteorological events also generate infrasounds. So, too, do man-made activities like nuclear explosions.

In 1996, the United Nations established the Comprehensive Nuclear Test Ban Treaty (CTBT). To enforce this treaty, a network of infrasound stations was deployed around the planet, including station ISSC on the Big Island, on the flanks of the Kilauea volcano. Unfortunately, there's been no nuclear activity, but Garces did find a correlation between the level of infrasound energy there and the wave height at the Waimanu Bay during the winter of 2002-2003. Now he is investigating what causes the increase in infrasound when the surf breaks.

By monitoring the infrasound activity generated by an incoming swell and how factors such as swell direction and tidal fluctuations affect the observations, Garces is able to more accurately locate the peak of a swell. This knowledge promises to aid in surf forecasting, enabling surfers to pinpoint where along the coastline the wave energy will be most concentrated, and subsequently, know the best spots to paddle out.

Infrasound technology can help to predict where powerful waves like this will hit. Photo: Nelson