Source : www.thehindu.com Date : 2020-09-20

SCIENTISTS USE INDIAN OCEAN EARTHQUAKE DATA TO TELL HOW FAST IT IS WARMING

Relevant for: Environment | Topic: Environmental Degradation - GHGs, Ozone Depletion and Climate Change

Representational image via Caltech website.

Scientists have developed a novel method to determine how fast the Indian Ocean is warming by analysing the sound from seabed earthquakes, an advance that may lead to a relatively low-cost technique to monitor water temperatures in all of the oceans.

According to the researchers, including those from the California Institute of Technology (Caltech) in the U.S., as much as 95% of the extra heat trapped on the Earth by greenhouse gases like carbondioxide is held in the world's oceans, making it important to monitor the temperature of ocean waters.

In the current study, published in the journal *Science*, the scientists used existing seismic monitoring equipment, as well as historic data on earthquakes, to determine how much the temperature of the ocean has altered, and continues changing, even at depths that are normally out of the reach of conventional tools.

They assessed a 3000-kilometer-long section in the equatorial East Indian Ocean, and found temperature fluctuations between 2005 and 2016, with a decadal warming trend that "substantially exceeds previous estimates."

By one estimate, the scientists said the ocean could be warming by nearly 70% greater than had been believed.

However, they cautioned against drawing any immediate conclusions, as more data need to be collected and analysed.

Jorn Callies, a co-author of the study from Caltech, noted that the method works by monitoring underwater quake sounds, which are powerful and travel long distances through the ocean without significantly weakening.

The researchers explained that when an earthquake happens under the ocean, most of its energy travels through the earth, but a portion of that energy is transmitted into the water as sound.

They said these sound waves propagate outward from the quake's epicenter just like seismic waves that travel through the ground, but added that the sound moves at a much slower speed.

The study noted that the ground waves arrive at a seismic monitoring station first, followed by the sound waves, which will appear as a secondary signal of the same event.

This effect, according to the researchers, is similar to how one often sees the flash from lightning seconds before hearing its thunder.

Since the speed of sound in water increases as the water's temperature rises, they found that the length of time it takes a sound wave to travel a given distance in the ocean can be used to deduce the water's temperature.

The scientists said analysing earthquakes which happen again and again in the same place can shed more information on the rate of warming.

“In this example we’re looking at earthquakes that occur off Sumatra in Indonesia, and we measure when they arrive in the central Indian ocean,” said Wenbo Wu, lead author of the study from Caltech.

“It takes about a half hour for them to travel that distance, with water temperature causing about one-tenth-of-a second difference. It’s a very small fractional change, but we can measure it,” he added.

In the study, the scientists used a seismometer that has been in the same location in the central Indian Ocean since 2004.

They said this helps them look back at the data it collected each time an earthquake occurred in Sumatra, for example, and determine the temperature of the ocean at that same time.

“We are using small earthquakes that are too small to cause any damage or even be felt by humans at all,” Mr. Wu said.

“But the seismometer can detect them from great distances, thus allowing us to monitor large-scale ocean temperature changes on a particular path in one measurement,” he added.

Based on the data analysed so far, the researchers confirmed that the Indian Ocean has been warming, as other data collected through other methods have indicated.

But they added that the ocean might be warming even faster than previously estimated.

“The ocean plays a key role in the rate that the climate is changing,” Mr. Wu said.

“The ocean is the main reservoir of energy in the climate system, and the deep ocean in particular is important to monitor,” he added.

Since undersea earthquakes happen all over the world, the researchers said the system can be developed to monitor water temperatures in all of the oceans using existing infrastructure and equipment at a relatively low-cost.

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