

# Discrepancies in the Tsunami Warning System

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In-depth Report: [THE TSUNAMI: ONE YEAR LATER](#)

We are dealing with one of the most serious humanitarian disasters in recorded history. It is therefore essential that any failure or recorded discrepancy in the Tsunami warning system be the subject of careful analysis and investigation.

**Magnitude** of an earthquake is defined as:

*“a measure of the strength of an earthquake or strain energy released by it, as determined by seismographic observations. This is a logarithmic value originally defined by Charles Richter (1935). An increase of one unit of magnitude (for example, from 4.6 to 5.6) represents a 10-fold increase in wave amplitude on a seismogram or approximately a 30-fold increase in the energy released. In other words, a magnitude 6.7 earthquake releases over 900 times (30 times 30) the energy of a 4.7 earthquake - or it takes about 900 magnitude 4.7 earthquakes to equal the energy released in a single 6.7 earthquake!”* (USGS <http://neic.usgs.gov/neis/general/glossary.html> )

**“A Major Earthquake”**, according to the US Geological Survey (USGS), has a magnitude of 7.00 to 7.99 on the Richter scale.

When an earthquake has a magnitude of 8.0 or more, it is categorized as **“a Great Earthquake.”**

The magnitude 9.0 earthquake off the coast of Northern Sumatra on the 26th of December 2004, belongs to the category of “Great Earthquakes”.

However, earthquakes with a magnitude of 9.0 or above, on the Richter scale, are recognized as **“rare great earthquakes”** capable of causing major damage over an area in excess of 1000 km (Chile 1960, Alaska 1964, and west coast of British Columbia, Washington, Oregon, 1700) (<http://www.pgc.nrcan.gc.ca/seismo/eqinfo/richter.htm> ).

In this regard, the USGS has categorized the 26 December earthquake as “a megathrust earthquake”: the fourth largest earthquake in the world since 1900.

This categorization of earthquakes is an integral part of the tsunami warning system, applied by different national and international bodies, including the Pacific Tsunami Warning Center (PTWC) based in Hawaii. The latter categorizes earthquakes according to their magnitude and bases its “evaluation” of the danger of a tsunami on the recorded magnitude on the Richter scale. It then emits a “bulletin”, which includes an “evaluation”.

## Discrepancies in the Tsunami Bulletins

Although the complete archive of PTWC bulletins is not available, recent bulletins exhibit a consistent pattern in the evaluation of earthquakes in the Pacific basin as well as in regions adjacent to the Pacific. The “danger of a tsunami” is based on the parameters of the earthquake, namely its magnitude on the Richter scale, with one significant and noteworthy omission: the evaluation on the 26th of December 2004, constitutes an exception to this routine procedure, when compared to the pattern of reporting and evaluation of recent earthquakes, each of which is carefully categorized for the purpose of establishing a tsunami warning.

In other words, one would expect that the danger of a tsunami associated with an earthquake of magnitude 9.0 (i.e. 26 December 2004) would be evaluated according to the same criteria / standards as those pertaining to previous and subsequent earthquakes, all of which were of lesser magnitude.

But this is not what happened!

The fourth largest earthquake since 1900 was neither subject to routine categorization nor to “evaluation” with a view to establishing the “danger of a tsunami”.

It is worth noting, in this regard, that three days prior to the M-9.0 earthquake, a M-7.9 earthquake was recorded with an epicenter off the South Pacific MacQuarie islands on the 23d of December. The PTWC issued the following routine advisory:

“THIS EARTHQUAKE HAS THE POTENTIAL TO GENERATE A WIDELY DESTRUCTIVE TSUNAMI IN THE SEA NEAR THE EARTHQUAKE. AUTHORITIES IN THAT REGION SHOULD BE AWARE OF THIS POSSIBILITY.”

Bear in mind that a M-9.0 earthquake is ten times greater in magnitude than a M-8.0 earthquake, to the extent that one would at least expect a similar statement to that provided in relation to the MacQuarie islands earthquake.

*According to [Columbia University's Earth Institute](#) , the M-9 earthquake of December 26, released energy equivalent “roughly to the energy released in 700 million Hiroshima bombs. An event of this type and of this size is known as a “megathrust,” and occurs in this location approximately every few hundred years.” Ironically, for earthquakes of significantly lesser magnitude (6.8 and above), the PTWC had, as a matter of routine, issued a tsunami warning, with the notorious exception of the M-9.0 earthquake of December 26. (see below)*

Why?

### **December 26, 2004: Omission and Exception in the Pattern of Reporting**

The following pattern can be observed in recent PTWC bulletins, for earthquakes in the Pacific Basin or in a region adjacent to the Pacific:

1. **For an earthquake of M-6.6** on the Richter scale, the following advisory was issued:

ORIGIN TIME - 0626Z 01 JAN 2005 COORDINATES - 5.0 NORTH 92.2 EAST LOCATION - OFF W COAST OF NORTHERN SUMATERA MAGNITUDE - 6.6)

THIS EARTHQUAKE IS LOCATED OUTSIDE THE PACIFIC. NO TSUNAMI THREAT EXISTS TO COASTLINES IN THE PACIFIC.

EARTHQUAKES OF THIS SIZE DO NOT USUALLY PRODUCE DESTRUCTIVE TSUNAMIS. HOWEVER SMALL SEA LEVEL CHANGES MAY BE OBSERVED IN THE VICINITY OF THE EPICENTER.

## **2. for an earthquake of M-6.8:**

ORIGIN TIME - 1415Z 06 DEC 2004 COORDINATES - 43.0 NORTH 144.9 EAST LOCATION - HOKKAIDO JAPAN REGION MAGNITUDE - 6.8

NO DESTRUCTIVE PACIFIC-WIDE TSUNAMI THREAT EXISTS BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI DATA.

HOWEVER -EARTHQUAKES OF THIS SIZE SOMETIMES GENERATE LOCAL TSUNAMIS THAT CAN BE DESTRUCTIVE ALONG COASTS LOCATED NEAR THE EARTHQUAKE EPICENTER. AUTHORITIES IN THE REGION OF THE EPICENTER SHOULD BE AWARE OF THIS POSSIBILITY.

Note: The same phrase has been used in previous warnings: "EARTHQUAKES OF THIS SIZE SOMETIMES GENERATE LOCAL TSUNAMIS THAT CAN BE DESTRUCTIVE ALONG COASTS LOCATED NEAR THE EARTHQUAKE EPICENTER" is a standard evaluation of the US Geological Survey (USGC) applied to earthquakes of M- 6.8 - 7.3 (see <http://www.fema.gov/emanagers/2004/nat050304.shtm>)

## **3. for an earthquake of M-7.9** (subsequently revised to 8.1):

ORIGIN TIME - 1459Z 23 DEC 2004 COORDINATES - 50.1 SOUTH 161.1 EAST LOCATION - NORTH OF MACQUARIE ISLAND MAGNITUDE - 7.9

THIS EARTHQUAKE HAS THE POTENTIAL TO GENERATE A WIDELY DESTRUCTIVE TSUNAMI IN THE SEA NEAR THE EARTHQUAKE. AUTHORITIES IN THAT REGION SHOULD BE AWARE OF THIS POSSIBILITY.

## **4. for one of the largest earthquakes in recorded history, M-9.0, initially assessed at M-8.0** (which is ten times lower than a M-9.0), no Tsunami warning was emitted:

ORIGIN TIME - 0059Z 26 DEC 2004, COORDINATES - 3.4 NORTH 95.7 EAST, LOCATION - OFF W COAST OF NORTHERN SUMATERA MAGNITUDE - 8.0)

THIS EARTHQUAKE IS LOCATED OUTSIDE THE PACIFIC. NO DESTRUCTIVE TSUNAMI THREAT EXISTS BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI DATA

In other words, there was no routine statement in the case of a M-9.0 earthquake which had originally been identified as an 8.0 on the Richter scale. As mentioned earlier, the routine statement should have been similar to the MAGNITUDE- 7.9 of 23 DEC recorded North of MacQuarie.

Moreover, the bulletin was released at 01.14 GMT **after the Tsunami had already hit the Sumatra coastline.**

There were two subsequent bulletins released by the PTWC, the second did not acknowledge the existence of a Tsunami in the Indian Ocean.

The second bulletin was issued at 02.04 GMT on the 26th. It revised the Magnitude to 8.5 and stated that there “is the possibility of a Tsunami near the Epicenter”. This statement is mistaken. By 02.00 GMT, the Tsunami was no longer in the realm of “possibility”, it had already hit the coasts of Indonesia, Malaysia, Thailand and Myanmar.

MAGNITUDE - 8.5

EVALUATION: REVISED MAGNITUDE BASED ON ANALYSIS OF MANTLE WAVES. THIS EARTHQUAKE IS LOCATED OUTSIDE THE PACIFIC. NO DESTRUCTIVE TSUNAMI THREAT EXISTS FOR THE PACIFIC BASIN BASED ON HISTORICAL. EARTHQUAKE AND TSUNAMI DATA. THERE IS THE POSSIBILITY OF A TSUNAMI NEAR THE EPICENTER.

The third bulletin issued the following day on the 27th at 15.35 GMT, acknowledges the tsunami and revises ex post facto the Magnitude from 8.5 to 9.0.

MAGNITUDE - 9.0

EVALUATION: SOME ENERGY FROM YESTERDAYS TSUNAMI IN THE INDIAN OCEAN HAS LEAKED INTO THE PACIFIC BASIN... PROBABLY FROM SOUTH OF THE AUSTRALIAN CONTINENT. THIS ENERGY HAS PRODUCED MINOR SEA LEVEL FLUCTUATIONS AT MANY PLACES IN THE PACIFIC.

### **The Need for an International Inquiry**

#### **Why was the routine practice of evaluating the dangers and consequences of a Tsunami not followed on December 26th?**

Why was the routine practice of establishing the danger of a Tsunami not followed on that particular day (26 December 2004), when in previous and subsequent bulletins, the danger of a tsunami was consistently evaluated in relation to earthquake magnitude? We are dealing with one of the largest earthquakes in recorded history.

A detailed investigation/inquiry under international auspices as well as by the countries affected by the tsunami, should be established without delay with a view to investigating this matter.

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