Secondary tsunamis induced by submarine slope slidings triggered by earthquakes in tropical countries

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Hatori(1994) pointed out that there is a tendency that the magnitudes of tsunamis in tropical countries such as Indonesia and Philippines are one grade larger than those in the Japanese sea area (Fig.1). It is suggested that in many cases of earthquakes accompanied with tsunamis in tropical countries tsunamis are not only induced directly by the earthquakes but also induced secondary by a submarine landslide.

On February 17, 1996, a huge earthquake (M8.1) broke out in the north sea region of Biak Island, Irian Jaya, Indonesia, and the accompanied tsunami hit both the north and the south coasts of Biak Island. At several villages on the south coast of the Islands, the initial wave hit only five minutes after the main shock, while the expected arrivel time of the first wave of the tsunami was 50 minutes after it. In this case, it is also suggested that a secondary tsunami induced by a submarine slope sliding triggered by the shaking of the earthquake was generated and reached the villages on the south coast about 45 minutes before the arrival of the first waves of the tsunami induced by the crustal deformation by the main shock.

In June 15, 1998 an earthquake of magnitude 7.0 occurred in the sea area north off Aitape City on the northern coast of Papua New Guinea, and more than 2,000 people were killed due to the accompanied tsunami. Sea water rose up to 15 meters above the mean sea level. This event also such a case that the magnitude of the accompanied tsunami was too large for the magnitude of earthquake, and moreover tsunami arrival time to the coast was too later compared with the theoretically predicted one. It was pointed out that a huge submarine landslide was induced by the main shock and the main part of the tsunami was generated by the landslide and not by the earthquake itself (Tsuji, 2001). In those two cases the secondary tsunamis were larger than the first tsunamis, which were caused by the crustal motion of the sea bed.