



# Port Moresby Geophysical Observatory: Providing Services to Government, Industry and the Community

## ABSTRACT

The Collaboration between CTBTO and Port Moresby Geophysical Observatory (PMGO) has reached extra heights in terms of achievements in IMS operated networks in Papua New Guinea. The regional seismic monitoring stations of IMS, one of which is located in Port Moresby, AS-75PMG including the National Data Centre (NDC) receive processed earthquake data at PMGO via internet from USGS-NEIC. The seismic data and results of analysis are shared freely by PMGO and other regional organization in global collaboration efforts to monitor and map the distribution of seismic activity in PNG region as well as the nuclear verification regime.

However, despite milestones reached in establishing other additional International Monitoring Stations (IMS) such as Infrasound Station (IS40), Radionuclide Station (RN51), Auxiliary Seismic Station (AS-76) throughout PNG, the mandated National Data Centre (NDC) remains to be revamped in terms of training and capacity building, Linux-software and hard ware upgrades, password for NDC access to IDC data and products, Tsunami Agreements Signing, and Ratifications Agreement Signing are some of the objectives yet to be achieved.

### 1. Introduction

The Port Moresby Geophysical Observatory (PMGO) was established in 1957 and is a Branch of the Geohazards Management Division (GMD) of the Department of Mineral Policy and Geohazards Management (DMPGM). PMGO has the responsibility of conducting earthquake and tsunami surveillance of one of the most seismically-active parts of the world, the Papua New Guinea region. Deployment of a nation-wide network of seismograph and accelerometer stations was completed in 2013.

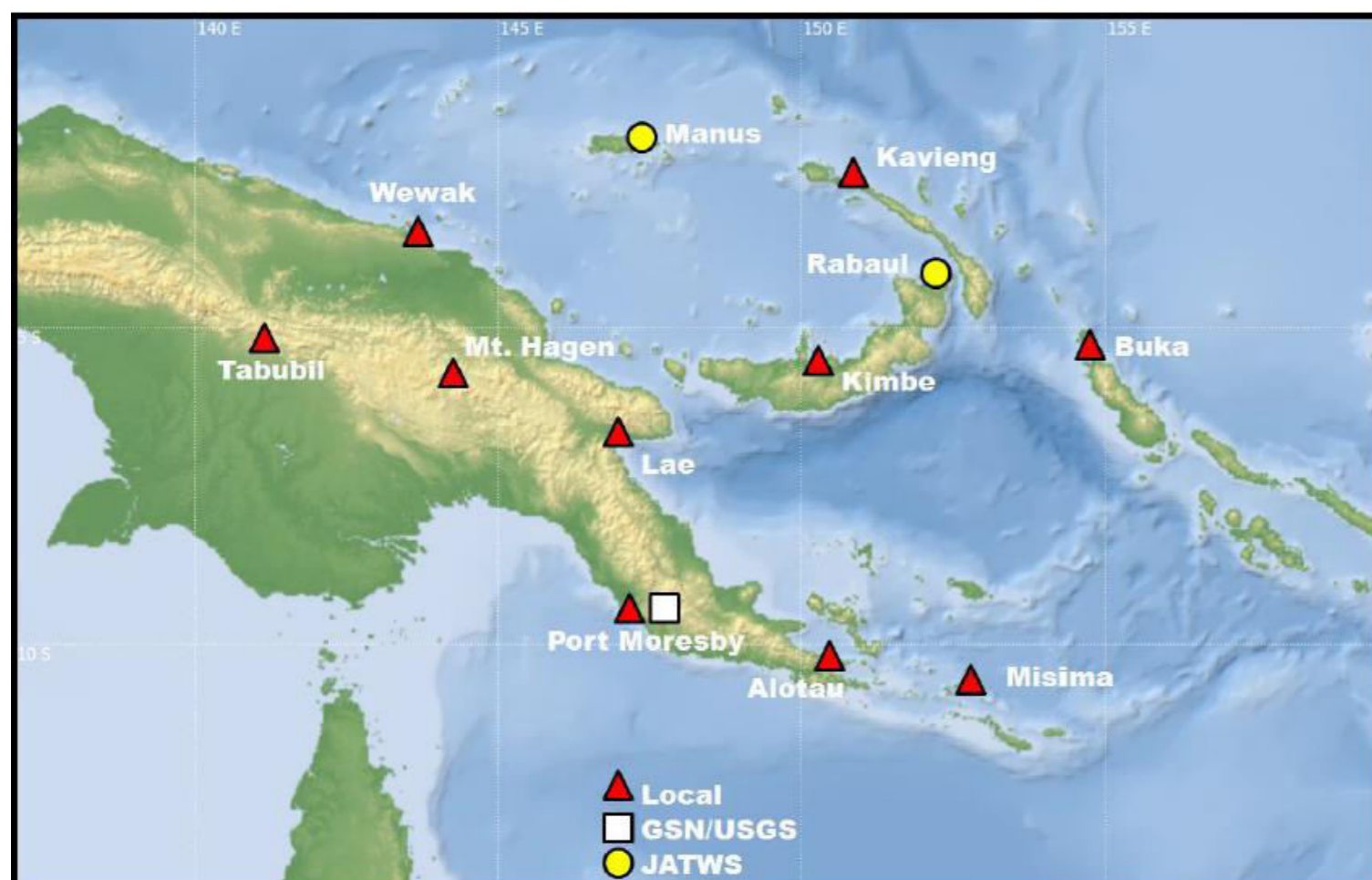
PMGO has close links with other similar institutions, including the National Earthquake Information Service (NEIS) of the United States Geological Survey (USGS), Geoscience Australia (GA), the Australian Seismological Centre (ASC), the Global Centroid Moment Tensor (CMT) Program, the Comprehensive Nuclear Test-Ban Treaty Organisation (CTBTO), the Pacific Tsunami Warning Centre (PTWC), and the Northwest Pacific Tsunami Advisory Centre (NWPTA) of the Japan Meteorological Agency (JMA).

Seismic data and results of analysis are shared freely by PMGO and these organisations in global collaborative efforts to monitor and map the distribution of seismic activity in the PNG region. From these primary surveillance operations stems a number of industry- and community-related applications, as discussed below.

### 2. Primary Surveillance Operations

#### (i) Monitoring

PMGO monitors seismicity of the PNG region using a nation-wide network that currently includes 10 stations. Earthquake station is equipped with a short period seismometer and an accelerometer. The co-determination of ground accelerations provides information vital to industry in general, but particularly to the mining and petroleum industry, to construction/engineering companies and to town planners. Earthquake records are telemetered to the strategically located hub of the network, at Port Moresby, via the Telikom PNG data services.

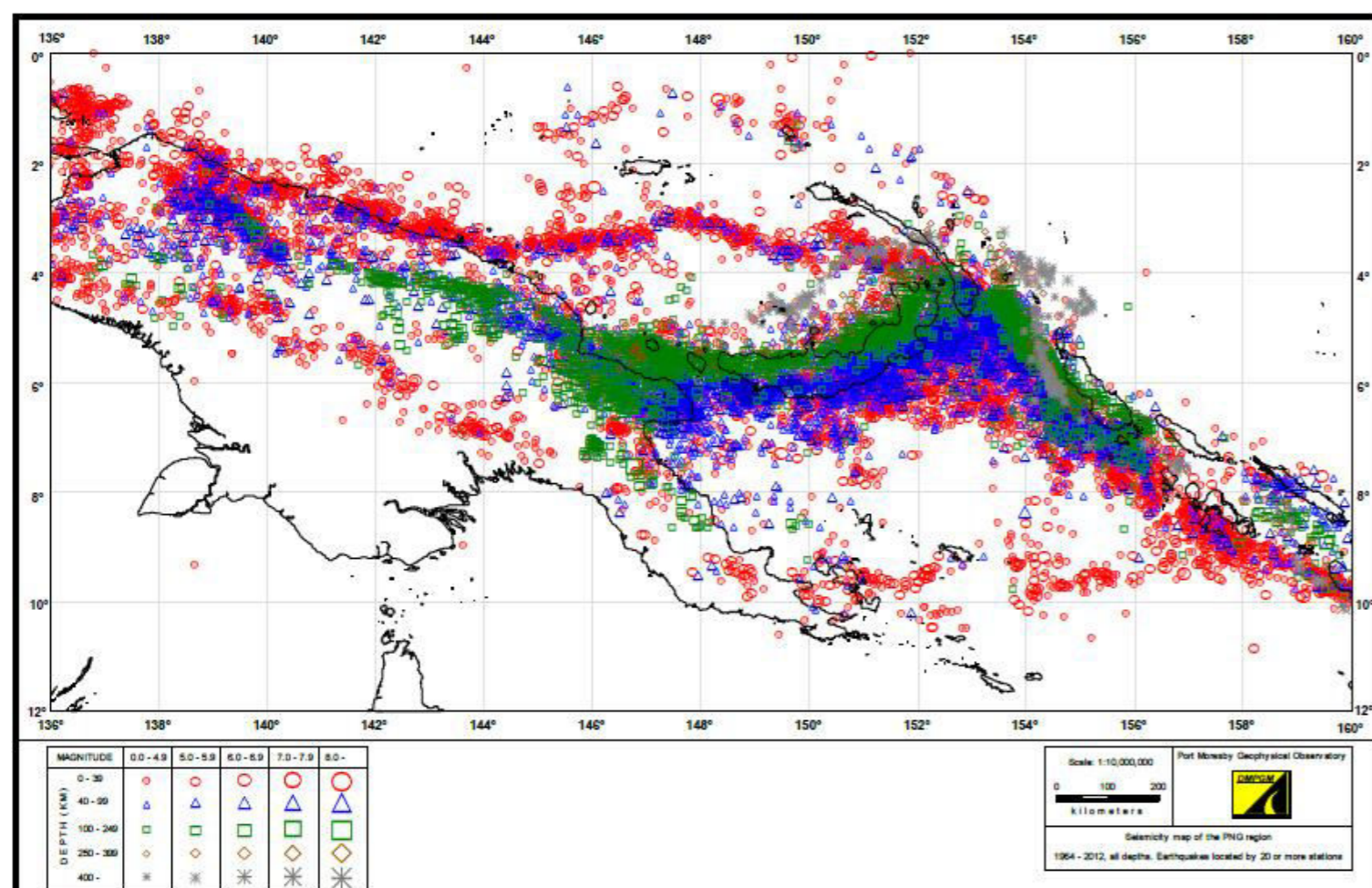


New PNG nation-wide earthquake surveillance network, completed July 2013.

#### (ii) Earthquake Mapping

Using appropriate computer software, staff at PMGO determine locations and magnitudes of earthquakes in the PNG region. The results of this analysis are routinely checked against the results determined by other agencies, and re-determinations are made where necessary to reduce location uncertainties. For all felt and/or damaging earthquakes, location and magnitude data and felt effects are promptly made known to PNG government authorities and news media.

The Observatory has established and maintains databases containing information about earthquakes that occurred in the PNG region since 1900. From these data, areas of seismicity have been defined and are progressively being refined as more seismic data become available.



Seismicity of the PNG region, 1964 to 2012, earthquakes located by 20 or more seismic stations (Source: PMGO).

### 3. Applied Seismology

#### (i) PNG Seismotectonics and Structure

On-going seismological studies are revealing the geological structure and dynamics of the PNG region on both large and smaller scales. The boundaries of the lithospheric plates in the PNG region are becoming clearer, although some boundaries remain uncertain. The nature of the processes at the plate boundaries are also being revealed by seismological studies.

On a smaller scale, a number of recent studies have shown the value of monitoring earthquake sequences (main event and aftershocks) which have resulted in mapping of active faults and determination of sense of motion on the faults.

Understanding the structural controls on and tectonic setting of mineral and hydrocarbon systems is the key to the mapping and development of these resources. The progressive study of earthquake sequences helps to define crustal structure both by direct evidence on individual faults and by association between elements of fault systems.

Dense and mobile networks of seismic stations allow detailed studies to be made in specific areas of seismic activity. Strategic deployment of seismic network stations assists in the elucidation of active crustal structures. In many cases, this information will be relevant to existing mineral and petroleum deposits which are located in areas of young, active and evolving tectonics.

#### (ii) Seismic Hazard/Risk

Evaluation of seismic hazard/risk at different scales is progressing. On a regional scale, studies have been conducted to determine return periods and probabilities of occurrence of large earthquakes. These studies have contributed to the definition of seismic zones in PNG and to the establishment of the PNG Earthquake Loading Building Code. The results of this work are routinely applied to areas of specific concern such as population centres and in the vicinity of industrial (including mining and petroleum) development projects.

Seismic hazard Assessment of the PNG region is currently being undertaken by GA and PMGO in order to produce maps of seismic hazard at various scales. This work builds on a detailed multi-hazard and risk study of East New Britain Province, also conducted by GA with assistance from DMPGM's Geohazards Management Division.

#### (iii) Tsunami Hazard/Risk

Studies by PMGO have catalogued historical tsunamis in the PNG region and defined areas of greatest tsunami vulnerability. These studies have demonstrated that a common cause of tsunamis is earthquakes. Because of the high speed of the waves that constitute tsunamis, it has become clear that over the relatively short distances of propagation of these waves within the PNG region, tsunami warning systems that track the tsunamis themselves give insufficient time for practical warnings. Probably the most effective warning for earthquake-induced tsunamis is the causative earthquake itself whose speed through the ground is much greater than the speed of tsunamis. Thus, the maintenance of a regional seismic network can be a very important tsunami surveillance measure.

Studies of the seismic events related to the 1998 Aitape tsunami indicate that the threat of tsunami generation may involve not just large shallow earthquakes but also unconsolidated, unstable sediments in off-shore areas that are displaced by the earthquake shaking, and by local bathymetry. These results can be used to help identify other areas of coastal PNG which are vulnerable to local tsunami generation, including project sites and population centres.

New studies are in progress to evaluate the geological history of tsunami in PNG. In a pilot study of the northeastern part of the Gazelle Peninsula, East New Britain, prehistoric tsunami deposits have been identified and planned radiocarbon dating of suitable samples will help to establish a chronological framework for the recent geological history of tsunami attack on this coastline.



Searching for prehistorical tsunami deposits at Kokopo, East New Britain.

### 4. Summary

1. PMGO operates a nation-wide network of instruments to monitor seismic activity in the PNG region.
2. PMGO has strong international links with global and regional seismic surveillance agencies.
3. The earthquake databases maintained by PMGO constitute a valuable and growing national earth science resource.
4. The applied seismological studies conducted by PMGO provide valuable services to the mining, petroleum and engineering industries and to land use planners.
5. PMGO works closely with other government authorities to provide services for the welfare of the general community.