CERAMAH TEKNIK TECHNICAL TALK

UKM Geophysics: Past, present and future

Mohd Hariri Arifin
Date: 14 December 2022
Platform: Microsoft Teams

The field of geophysics is one of the main sub-fields under the Geology program, Universiti Kebangsaan Malaysia (UKM). Since UKM was established in 1970, undergraduate level geophysics has been taught by Dr. Ismail Mohd Noor and several contract lecturers from renowned Indonesian universities. This geophysics course was then taught by Dr. Abdul Rahim Samsudin who is a geology graduate from UKM who successfully obtained a Master of Science (Geophysics) degree from the University of Leeds United Kingdom in 1975. Also joining forces to teach this geophysics course is Dr. Umar Hamzah who obtained a Master's degree in Science (Geophysics) from the University of Birmingham (UK). Now the legacy is continued by Dr. Mohd Hariri Arifin and other academic colleagues in the geology program. The pairing of academic staff for this course has yet to be filled as there are no candidates with suitable qualifications based on the university's current requirements. At the undergraduate level, the engineering and environmental geophysics program has been introduced as coursework since 2010. This geophysics master's program is more focused on exploration and applied aspects and focuses heavily on the four main geophysical methods, namely the geoelectrical resistivity method, the seismic method, and the gravity and magnetic method. The use of geophysical methods in various fields, especially engineering and the environment, including the exploration of earth resources, underground water (cold/hot/saltwater intrusion), pollution (landfills and oil spills), archaeology, site investigation (development and engineering problems) and meteorites impacts. In the future, UKM geophysics is determined to continue contributing especially in the development of geothermal resources and the exploration of rare earth resources.

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Geological aspects in earthquake engineering

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Geological aspects play important roles in determining seismic hazard of a region. Seismic hazard in Malaysia is associated with the geological conditions of faults movement and seismicity originating from seismically active faults in neighboring countries such as Indonesia and Philippines. Being situated on the stable Sunda plate, most people perceive that Malaysia is free from the life-threatening seismic crisis. The Malaysian Network of Seismological Stations have been recording distant ground motions from the two most active plate tectonic margins in the world, which are the 1650 km long Sumatran fault and the Philippines plate. In addition, several earthquakes due to local active faults with the maximum moment magnitude of 4.4 have also been observed within Peninsular Malaysia since 2007. Even though the local earthquakes were small, the epicenters were as close as 20 km to Kuala Lumpur, which a slightly higher value of magnitude could have remarkable effects on seismic hazard of the region. The big earthquake of 6.0 Magnitude occurred on 5th June 2015 at a depth of approximately 10 km, with its epicentre

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approximately 15 km north of Ranau, Sabah. The fact that the earthquakes have not yet inflicted any serious damage or collapse of buildings, historically, it should not be taken as an excuse for not considering the effects of earthquakes on the existing and future structures. Current design code for building structures in Malaysia widely adopts the British Standard (BS) 8110 code (BS 8110-1:1997) which has no provisions for earthquake-induced forces. In the interest of public safety, it is reasonable to comprehensively assess the seismic hazard and design of the region. Thus, the seismic hazard assessment provides Peak Ground Acceleration (PGA) values to all regions in Malaysia for Malaysia National Annex of EC8 (NA-MS EN1998), and developes seismic zoning map for Malaysia so that zones with non-seismic regions can be identified and zones with no special steel reinforcement detailing requirement can be specified. In EC8, zone 0 is specified for ground accelerations of 0.0g to 0.04 g and 0.04 g to 0.08 g for seismic zone 1. It can be concluded that about 90% of Peninsular and Sarawak fall into zone 0 and 1, without any special requirement for steel detailing, and generally about 40% of the regions is not required to design for seismic. In comparison among the 3 regions, the ratio of zone 0, zone 1 and zone 2 and higher, are as follows; Peninsular (45:45:10), Sabah (30:40:30), and Sarawak (70:20:10). The highest Peak Ground Acceleration (PGA) values covering sizeable regional areas of Peninsular, Sabah and Sarawak are 9%g, 16%g, and 9.5%g, respectively.

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New ocean bottom seismometer exploration for crustal imaging in Arctic Ocean

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Due to the presence of ice floes, few studies have reported the velocity of crustal structures beneath the ultra-slow spreading ridge of Gakkel Ridge in the Arctic Ocean. In 2021, the "Joint Arctic Scientific Mid-Ocean Ridge Insight Expedition (JASMInE)" was conducted with international participation, utilizing the recently released Icebreaker "Xuelong 2" and innovative technology to adapt to concentrated sea ice. The expedition used 43 ocean bottom seismometer (OBS) deployments (42 recovered) at two profiles intersected at 85°E along and across the ridge axis, and a travel-time raytracing modeling method to derive P wave crustal velocity structures. The results show significant variations in crust thickness, from approximately 7.0 km beneath the 85°E volcanic spreading center to approximately 3.0 km beneath the surrounding non-volcanic zones.

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