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Volcanic response planning in areas of distributed volcanism: An Auckland case study

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With 1.7 million people, Tāmaki Makaurau (Auckland) is the largest city in New Zealand. It contains a third of the national population and is responsible for 38% of the national GDP. The city is situated around the remnants of the 53 volcanic centres of the Auckland Volcanic Field. The boundaries of the Auckland Volcanic Field encompass the central business district and central suburbs, the main port, airport and nationally important transportation and lifeline utility routes and assets. This makes any future eruption in the Auckland Volcanic Field a high risk, not only for the resident population, but also the country, even if the likelihood of an eruption is low.

Developing a multi-agency volcanic response plan is essential to ensure any future eruption, an event that has never been experienced in recorded history, is met with a unified response. The Auckland Civil Defence and Emergency Management (CDEM) Group is responsible for coordinating emergency management and inter-agency planning activities for key hazards in the region, including volcanic hazards.

Volcanic response planning in the Auckland Volcanic Field is complicated by the high degree of uncertainty. This uncertainty extends from whether unrest may result in eruption, through to the location of future vents and timeframes of magma ascent and eruption processes. Identifying response activities by eruptive phase and agreeing critical actions for response functions (e.g., movement of people, emergency welfare, command and control, health) allows for a 'lift and shift' plan that can be implemented wherever the next eruption occurs.

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Lava flow hazard assessment on Bioko Island (Equatorial Guinea)

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Bioko Island consists of three coalescing shield volcanoes where lava flows are the primary volcanic hazard. The last documented effusive eruption on the island occurred at Pico Basilé in 1923, and the 2012 opening of steam vents at the summit demonstrates the volcanic system remains active. However, lava flow hazards on Bioko have not previously been studied, and thus need to be assessed.

We use field observations and synthetic aperture radar data from the TerraSAR-X and TanDEM-X satellite instruments to map the existing lava flows and geologic features. We then use the Q-LavHa model to simulate lava flow inundation probabilities for different scenarios.

We identified 437 cones, from which we compute a Kernel Density Estimation and estimate the spatial probability of future vent opening. From this, we simulate different scenarios for variable flow heights (2-8 m) and lengths (2.9-12 km). To estimate flow height limitations, we rely on field observations of stacked flow units (~2 m each) and individual ‘a‘a flows of up to 8 m. To constrain flow lengths, we mapped six lava flows of unknown age from source to front (1.9-4.0 km). Field observations confirm that some flows were long enough to reach the sea (>12 km).

Results indicate that the volcano-tectonic and erosional features are the primary controls on lava flow pathways. The capital city Malabo is located in the least threatened area of the island, whereas potential eruptions southwest of the summit of Pico Basilé are likely to interfere with the island’s major transportation infrastructure.

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Quaternary explosive eruption of Mt. Baekdu assessed by widespread volcanic tephras

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In the results of research on submarine drill cores of East Sea(Japan Sea) seafloor and the Japanese archipelago sediments conducted by Japan, Russia, and the Republic of Korea, a number of tephra (volcanic ash/volcanic glass) at a distance of 200 km to 1,000 km that can be interpreted as the origin of Mt. Baekdu volcano were recognized. They are interpreted to have originated from fallout ash that fell in the atmosphere as the volcanic ash cloud and plume created by the explosive eruption of Mt. Baekdu spread toward the East Sea via jet streams and westerly winds. The tephra known to date from the East Sea and the Japanese archipelago, believed to have originated from Mt. Baekdu, are B-Og (448 ka), B-Ky2 (196 ka), and B-Ky1 (130 ka), B-Ym(85.8 ka), B-Sado (67.6 ka) B-J (50.6 ka), B-Sg-42 (42.5 ka), B-Un1 (38.3 ka), B-V (24.5 ka), B-Sg-08 tephra (8.1 ka), B-Tm (946 AD), etc. are known. Most of these tephra are felsic in chemical composition range from trachyte to rhyolite. In the Al_2O_3-(Fe_2O_3+FeO) diagram, most of them are shown in the domain of comendites (comenditic trachytes), but some (B-Sado, B-J, B-V, etc.) are also shown in the pantellerites (pantelleritic trachytes). It is interpreted to indicate an explosive eruption with a Volcanic Explosivity Index of 4 or higher on Mt. Baekdu during the Quaternary period.

ID: 401

Una propuesta para el monitoreo de la región Paricutín -Tancítaro en el campo volcánico Michoacán-Guanajuato.

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El análisis de la evolución temporal de los eventos sísmicos ocurridos durante la reciente actividad símica en la región Paricutín-Tancítaro en los años 2020 y 2021 evidenció la necesidad de mejorar la infraestructura de monitoreo volcánico existente en la zona. En este trabajo discutimos las limitaciones principales de la actual red de monitoreo sísmico, que tuvo como principal consecuencia que no se pudiera determinar con precisión si hubo migración espacio-temporal en los hipocentros de los eventos ocurridos durante los enjambres sísmicos en 2020 y 2021, así como la ausencia de una red permanente de estaciones geodésicas limitó nuestra capacidad para detectar deformaciones en la región de los enjambres. Ambos factores son de gran importancia para interpretar con mayor precisión la naturaleza del fenómeno magmático subyacente, tal como se ha demostrado en la experiencia del monitoreo previo a erupciones monogenéticas como la ocurrida en la Palma, Canarias en 2021. En ese contexto y tomando en cuenta el historial eruptivo de la región, obtenido en base a características morfométricas de los conos de escoria, presentamos una propuesta de distribución para la red de monitoreo sísmico y geodésico que podrían dar la cobertura necesaria para entender el proceso detrás de probables futuros enjambres sísmicos en la región, y su posible culminación en una erupción volcánica.