31st IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Earth Observation Missions (4)

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NANOSATELLITES AND VOLCANO MONITORING: GXIBA-1'S CONTRIBUTION TO MEXICAN RISK MANAGEMENT

Abstract

The Popocatépetl volcano is classified as one of the most dangerous volcanoes in Mexico, given its high level of activity directly threatening 25 million people, constituting 19With the aim of contributing to this task, UPAEP University presented the GXIBA-1 project in the sixth edition of the KiboCUBE program, and upon winning, the project is now in collaboration with JAXA and UNOOSA. This project involves a low Earth orbit nanosatellite designed to monitor volcanic activities and ash movement through optical observation. To achieve this, a hyperspectral camera is employed to capture images in different bands, maximizing the collection of information about gases emitted from the crater. Data reception will be conducted through UHF amateur radio frequencies to ground stations, with a Payload that will transmit information to other satellites, such as AztechSat-1, also developed by UPAEP University, which became the first Mexican nanosatellite to reach the International Space Station, facilitating efficient data exchange between a nanosatellite and a satellite constelation. This strategy is implemented to reduce the number of obsolete photos due to climatic conditions and minimize the energy expenditure associated with sending such images. The collected information will be processed through neural networks that will classify images and assign values based on the captured data. Analyzing trends in sulfur dioxide or carbon dioxide levels can provide clues about a potential increase in volcanic activity, crucial for authorities to make decisions regarding civil, structural, and public health safety. The nominal success of the mission will be achieved with images of the Popocatépetl volcano, while extended success will be considered if a processed image depicting the dispersion of surrounding ash is obtained. The advantage of using nanosatellites lies in their quick design, production, and lower budget, allowing for in-depth analysis of events that require observation from space, such as monitoring natural disasters as volcano activity can be. Currently, the project is in Phase 3 as established by JAXA, corresponding to the testing stage. Delivery of the cubesat to JAXA is expected to take place during the last quarter of 2024.