Evolving Multi-Parameter Monitoring Network in Mayon Volcano, Philippines

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Mayon is the most active Philippine volcano, having erupted 49 times since its first recorded activity in 1616. Its gamut of eruptive behavior spans small but hazardous hydrovolcanic eruption (e.g. 1993), quiet lava effusion (e.g. 1993, 2006 and 2009) and explosive pyroclastic flow-forming (e.g. 1928, 1984, 2000-01) and deadly Plinian (e.g. 1814) eruptions. In the past two decades, a combination of seismic, geodetic, gas, hydrologic and visual observation techniques have been employed with variable successes. Nonetheless, constraining the long- to short-term behavior of Mayon's magmatic system that contributes to highly precise eruption warning services remains a challenge.

In partnership with the Philippine Institute of Volcanology and Seismology (PHIVOLCS) Japan- and Singapore-based institutions have been developing multi-parameter monitoring systems in Mayon in support of enhanced eruption warning and volcanic systems research. The evolving network to date consists of a 16-station distribution of seven broadband seismographs, five tiltmeters, two infrasonic sensors, nine continuous GPS, two infrasonic sensors, two scanning mini-DOAS, two hydrologic sensors, six soil CO2 sensors, six all-weather stations and one microbarograph. Most seismic, tilt and GPS data are currently transmitted in real-time via spread-spectrum transceiver (SST) or GSM telemetry to Mayon Volcano Observatory (MVO) for archiving, processing and retransmission in near-real-time via satellite and DSL links to the PHIVOLCS Main Office (MO). All stations are targeted for SST telemetry by sometime 2013, enabling individual systems to be fully integrated in MVO and MO operations and other applications, such as automatic earthquake source location programs.

Data from the enhanced multi-parameter network are hoped to shed light on the dynamics and timescales of, among others, magmatic recharge, degassing, convection and eruption; magmatic and hydrothermal forcing of ground deformation and near to distal seismicity; and tectonic contribution to overall unrest. The integrated methodologies are ultimately expected to provide highly-constrained warning criteria for the next eruption, which can subsequently be reformulated into the five-tiered Alert Level Scheme for the eruption crisis response guidance of local disaster authorities.