Recent activity of Taal volcano (Philippines) inferred by electromagnetic and other geophysical monitoring networks: 2009-2012

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Taal volcano in the Philippines is a particularly hazardous volcano in a very populated region near the capital, Manila. Repeated pyroclastic flows, base surges and violent phreatic explosions, such as experienced during the previous 33 historical eruptions, threaten the region. Since the last long eruptive episode in 1965-1977, Taal volcano has exhibited sporadic and intense seismic activity, ground deformation, and surface activity. The monitoring of the volcano is one of highest priorities of the Philippines Institute of Volcanology and Seismology (PHIVOLCS, http://www.phivolcs.dost.gov.ph/). Since 2004, the Inter-Association Working Group on 'Electromagnetic Studies of Earthquakes and Volcanoes' (EMSEV, http://www.emsev-iugg.org/emsev/) and PHIVOLCS have developed a joint research program for (1) understanding the interactions between the magma feeding system, the huge hydrothermal system located beneath the volcanic Island, and ground water recharge by seasonal rainfall in the inner Main Crater Lake and the external Taal Lake and (2) building up real-time monitoring networks based on electromagnetic and other geophysical methods.

We will focus this presentation on methods we use for monitoring the volcano and results we have obtained during the recent activity of Taal. In late April 2010, after a few years of relative quiet, the volcano experienced accelerated deformation and dramatically increasing microseosmicity. This caused PHIVOLCS to temporarily raise the volcano alert level to two on a five level scale. Four periods of high seismicity were recorded from April to July 2011. The 2010 seismic crisis was accompanied by ground deformation, and re-opening of active East-West fissures located on the northern flank of the volcano. Electric, magnetic and temperatures changes were associated with the 2010 seismo-volcanic crisis.

One hypothesis is that this crisis started as a result of magma intrusion at about 5-km depth under the north side of the Main Crater Lake. Injection of volcanic fluids into the hydrothermal reservoir could have caused the inflation and seismicity observed from April to June, 2010. As activity receded in the following months, some shrinkage of the reservoir could have occurred. No noticeable surface or deep activity was subsequently observed in 2011 but, after one year of low activity, the seismicity has been again increasing since October 2012.

Since 2011, EMSEV has focused on increasing the monitoring capability on the volcano. Continuous Self-potential, magnetic, tilt, ground temperatures, resistivity measurements are made every two seconds at four stations on the volcano and data are radio-transmitted in real-time to the local Buco observatory.