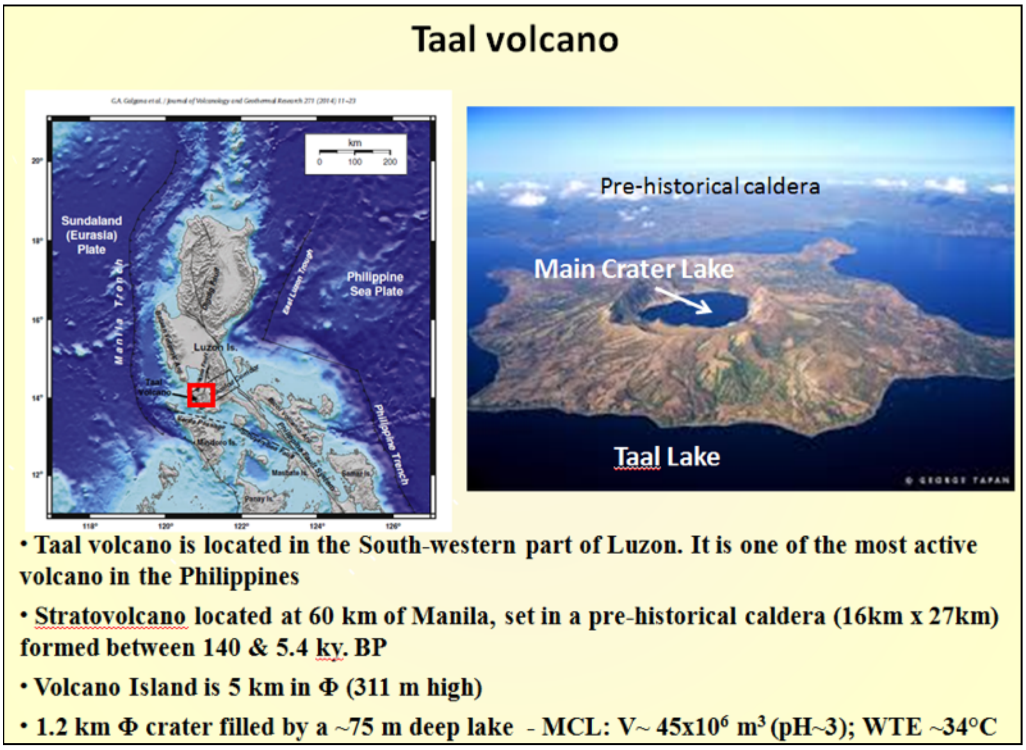
- **EMSEV activity on Taal volcano**

Since 2004, EMSEV and the Philippines Institute of Volcanology and Seismology (PHIVOLCS, http://www.phivolcs.dost.gov.ph/) tightly work together on the understanding of Taal volcano dynamism and on the monitoring of the activity by the means of electromagnetic and other geophysical methods. This is of critical importance since about 650,000 inhabitants are living in a radius of 20 km from the volcano summit.

At present, the cooperation involves a large international consortium with teams from Japan, France, USA, Greece, Italy, and Belgium. As far as possible, EMSEV and PHIVOLCS lead two field campaigns per year. The volcanic structure is now better known thanks to magnetic, self-potential, ground temperatures profiling, resistivity and magnetotelluric soundings, degassing mapping from the land and the Crater Lake. In addition, EMSEV has made a huge effort in installing real-time multi-parameters stations on the volcano. Four stations are now in operation recording electric and magnetic fields, tilt, seismic informaiton and ground temperatures. The local observatory maintains the data acquisition system and takes care of daily data transfers to PHIVOLCS-headquarter and VEML servers (http://www.phivolcs.dost.gov.ph/, http://virtual-electromagnetic-laboratory.com/etaal.html). A JICA program has also supported the installation of 3 magnetic and electric stations. These data are recovered by satellite transmission (http://vanpc02.iord.u-tokai.ac.jp/taalplot/).

During the last three years, the Japanese team educated a Filipinos young scientist in magnetotelluric methods.



The large seismovolcanic crisis of 2010-2011

The last eruption of Taal volcano in the Philippines began in 1965 and definitely stopped in 1977. None forecasted, the initial eruptive phase has involved pyroclastic flows and base surges which have devastated a large part of the volcanic Island and the South-Western part of the prehistorical caldera surrounding the volcanic Island, causing the death of about 200 persons. Since then, the volcano has continuously exhibited sporadic, and sometimes intense, seismic crises accompanied or not by ground deformation, opening of fissures, strong degassing, and surface activity. In the following years to 2005, the seismic activity slowly receded although almost annual seismic crises were observed. After several months of quietness, seismicity appeared again on April 19, 2010 and sharply raised up after April 29. The seismic crisis ended in March 2011. Since 2004, The international Inter-Association on

Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV), in cooperation with the Philippines Institute of Volcanology and Seismology (PHIVOLCS), conducted geophysical prospecting's and progressively implemented multi-parametric monitoring stations in order to track the activity. The study presents the observations made between 2007 and March 2011 of the electric and magnetic fields, ground temperatures, seismicity, and ground deformation. Most probably, the 2010 seismovolcanic crisis was preceded by unusual changes of several months duration in the electric and magnetic fields. But, the major signals were concomitant with the evolution of the crisis. Three periods of seismic activity, characterized by a way back to a zero level, modulate the crisis: From April 19 to August 8, August 8 to November 18, and November 18 to March 2011. Although only one tiltmeter was in operation, it also emphasizes three phases of deformation similar to those recognized in the seismic activity. But, Phase 1 can be divided in three sections corresponding to an inflation to the East from April 19 to June 11 (Phase 1a), a North-South inflation from June 11 to July 13 (Phase 1b), and the beginning of a long term deflation with a first North-South inflation-deflation process (Phase 1c). Phases 1a and 1b involve a deformation source positioned at least at 5 km depth or more while Phases 1c, 2, and 3 figure out the relaxation of the deep source and 3 North-South inflation-deflation processes caused by a source located in the heart of the hydrothermal system at 1.5 to 2 km depth. Phases 1c, 2 and 3 are clearly correlated with the largest amplitude electric signals recorded during the crisis, emphasizing that the source of deformation takes place inside the hydrothermal system after July 13, 2010. The inter-correlation between data allow to interpret the 2010 seismovolcanic crisis as follow. From April to June 11, 2010, a deep source of deformation took place to the West of the northern flank, at most at 5 km depth, giving rise to an Eastward inflation of the northern part of the volcano. On June 11, the source of deformation abruptly shifted to the northern part of the crater, generating a sudden inflation to the North and a progressive displacement of the inflating source upward reaching the hydrothermal system on July 13, and giving rise to three cycles of inflation and deflation, while the deep deformation source returned back to almost its pre-crisis level in March 2011. It is noteworthy that transient signals of some hours duration occur when activity abruptly changes. The results undoubtedly stress that the source of deformation can abruptly change in direction within one day or so, and rapidly moves up from depth into the hydrothermal system where phreatic explosions take birth.