Mayon volcano, Philippines: change of monitoring strategy after microgravity and GPS measurements from 1992 to 1996.

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Abstract:

Mayon volcano is part of the Bicol volcanic chain on the island Luzon, Philippines. During this century there were ten activity periods distributed almost regularly. Because of the density of population (about one million people living in the vicinity of the volcano) three seismological observatories are in operation.

Measurements of gravity changes started in 1992, just before the eruption of February/March 1993. Two profiles at the slope were established, connected to a regional network around the volcano. In order to enable the determination of mass changes between the campaigns the height control was provided by parallel GPS measurements. In all, the network consists of 26 points which were remeasured with three gravimetres at least three times within one campaign.

During five campaigns within 4 years the differential GPS gives no significant changes of the elevation (within 4 cm). Nevertheless, the gravity increased significantly by up to 1500 nm/s(2) (equivalent to 150 mu Gal).

As no significant change of elevation is observed (GPS), no extended shallow magma chamber system below the volcano can be proved. This is in accordance with geochemical results indicating a rather undifferentiated magma. The youngest lava which is of interest for the eruption dynamics belongs to the medium-K basaltic andesite field of the K2O VS SiO2 diagram.

A rather qualitative check of groundwater level changes reveals that these cannot be the sources for the observed gravity changes. Thus, the increase of gravity after the eruption of February 1993 can be explained by a mass redistribution in the volcanic vent from above the level of the gravity points to

below.

Practical conclusions of these results lead to changes in the monitoring strategy: Deformation measurements did not reveal any volcanic activities;, at least for the eruption of 1993 no significant deformation was observed. Gravity could be an indicator for long-term changes. Thus, repeated gravity measurements/GPS, at selected points could be used in parallel to seismic monitoring to detect slow mass movements prior to changes in seismicity.