



Increased Melting of Glaciers during Cotopaxi volcano awakening in 2015

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Cotopaxi (5897 m), located about 50 km south of Quito (Ecuador), is one of the most active volcanoes in the Andes and its historical eruptions have caused a great impact on the population by the generation of lahars along its three main drainages (N, S, E).

Starting on April 2015 the seismic monitoring networks and the SO₂ gas detection network in May 2015 showed a significant increase from their background values, in June a geodetic instrument located in the NE flank started to record inflation; all this indicated the beginning of a new period of unrest. On August 14, five small phreatic explosions occurred, accompanied by large gas and ash emissions, ash falls were reported to the W of the volcano and to the S of Quito capital city. Three new episodes of ash and gas emissions occurred afterwards and towards the end of November 2015, the different monitoring parameters indicated a progressive reduction in the activity of the volcano.

Since August 18 almost weekly overflights were made in order to conduct thermal (FLIR camera), visual and SO₂ gas monitoring. Towards the end of August thermal measurements showed for the first time the presence of new thermal anomalies (13.5 to 16.3 °C) located in the crevices of the N glaciers, at the same time fumarolic gases were observed coming out from those fractures. On a flight made on September 3, the presence of water coming out from the basal fronts of the northern glaciers was clearly observed and the formation of narrow streams of water running downslope, while it was evident the appearance of countless new crevices in the majority of glacier ends, but also new cracks and rockslides on the upper flanks. All this led to the conclusion that an abnormal process was producing the melting of the glaciers around the volcano. Starting on September it was possible to observe the presence of small secondary lahars descending several streams and we estimated that many of them are due to increased glacier melting. Later observations made until the end of last year showed an increase of the phenomena already described.

Thanks to the collaboration of the Military Geographic Institute of Ecuador (IGM), orthophotos of the volcano made on August 18 and then again on October 8, shows a decrease in the area covered by glaciers of about 0.49 km² (annual projection of 3.51 km²), this value compared to the decrease of glacier areas since 1976, shows a very high rate of glacier melting, not explained exclusively by climate change phenomena.

It is estimated that small volumes of magma reached surface levels through the volcano conduits causing increased circulation of hot fluids inside the edifice, which are apparently reaching the basal area of the glaciers and producing a major melting thereof. It is necessary to further investigate hazard due to the instability in the melting glaciers of Cotopaxi and their eventual collapse which could lead to greater secondary lahars.