

# Ecuadorian Glacier Program



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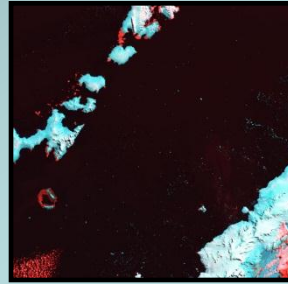
The Ecuadorian Glacier Program, started in the year of 1997, mass balance studies have been carried out on Glacier 15 of the Antisana in this period (21 years) with a monthly frequency finding an average value of 610 mm of water equivalent, the equilibrium line altitude in average was placed for the Ecuadorian Andes at 5120 meters above sea level. The first systematic inventory for the glaciers of Ecuador was made in the early nineties. For that time the ice coverage corresponds to 92 km<sup>2</sup>. The second systematic inventory made for 1997 corresponds to an area of 60 km<sup>2</sup> of ice. In 2010 a new evaluation carried out showed a value of 48 km<sup>2</sup>. During the years 2016-2017 a new inventory was made for glacier coverage using the latest aerial photographs. At the present time the glacier coverage for the glaciers in Ecuador is approximately 43,5 km<sup>2</sup>. INAMHI in collaboration with INAE conducts studies over a small glacier (Quito Glacier) in the South Shetland Islands near the Pedro Vicente Maldonado Ecuadorian Station since 2010 in the way to establish a program for mass balance measurements in Antarctic Peninsula.

## Study Area

The Andes in Ecuador have two mountain chains of which seven have glacier covers: Cayambe, Antisana, Cotopaxi, Ilinizas, Chimborazo, Carihuayrazo and Altar, positioned between 1° north to -3° south latitude. All glaciers are located upon the summits and flanks of Pleistocene Holocene age volcanoes.



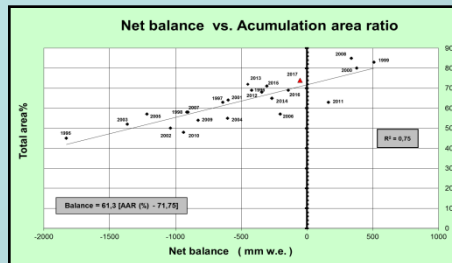
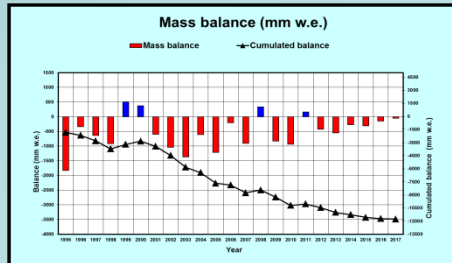
Ecuadorian Andes



Quito Glacier -Antarctic Peninsula  
 (62° 26' 57" S, 59° 44' 32" W)

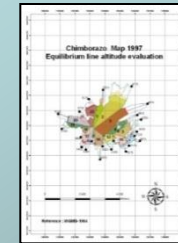
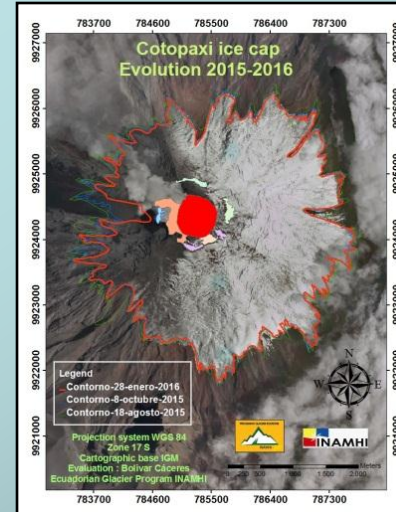
## Methodology

Mass balance measurements were made each month over a network of stakes placed at Antisana 15 glacier since 1994 to the present (23 years). Aerial photographs were taken between 1977-2016 and were analyzed using digital photogrammetry. Bench marks were measured at the field using DGPS and Orthophotos for each cover were obtained. The equilibrium line altitude (ELA) was placed using the accumulation area ratio (%AAR) that was established for Ecuadorian glaciers using the data compiled over twenty three years by the Ecuadorian Glacier Program at INAMHI.



## Results

The glaciers cover in 2017 had a value of 43,5 square kilometers a reduction of 55,2% between 1960 to 2017 was observed. The reduction of ice coverages Cotopaxi and Chimborazo during the last five years was affected by ash falls which produce a drastic coverage loss corresponding to an average of 4,1 %. Carihuayrazo glacier lost 91% of his coverage by 2017, probably disappear in the next five years. The other ice caps (Antisana, Cayambe, Iliniza, Altar) have had a normal evolution mainly affected by climate conditions in the Tropical zone. Accumulation area ratio (AARo) for Antisana 15. Value defined: 63,5% of the total glacier cover (23 years).



Cordillera Oriental ( Eastern Cordillera)

Mountain	Glacier tongues	Area (Km <sup>2</sup> )
Cayambe	20	8,9
Antisana	17	11,7
Cotopaxi	19	10,5
Altar	6	4,4
		35,5

Western Cordillera

Mountain	Glacier tongues	Area (Km <sup>2</sup> )
Iliniza	2	0,31
Carihuayrazo	2	0,07
Chimborazo	22	7,63
		8,0

## References:

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 Cáceres B. Mediciones de Balance de masa, Glaciar 15 del Antisana 2017

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