



Analysis of the relationship between glacier ELA with climatic and morpho-topographic parameters, for tropical glaciers in the Peruvian Andes

Edwin Loarte (1,2) and Antoine Rabatel (3)

(1) Autoridad Nacional del Agua-ANA / Unidad de Glaciología y Recursos Hídricos - UGRH, Huaraz, Perú , (2) Universidad Santiago Antunez de Mayolo-UNASAM / Facultad de Ciencias del Ambiente-FCAM, Huaraz, Perú, (3) UJF-Grenoble 1 / CNRS, Laboratoire de Glaciologie et Géophysique de l'Environnement, UMR 5183, France

In recent decades, climate change has produced an important glacier shrinkage in the Peruvian mountain chains, with accelerated melting of ice and snow masses and an increase in the equilibrium-line altitude (ELA). These changes have led to conflicts on water availability for local and regional populations and increasing glacier risks (proglacial lakes formation).

In this study we have determined the spatio-temporal variations of ELA obtained through the snowline altitude (SLA) for a total of 17 glaciers of the Cordillera Blanca (Peru, 9°S) during the period 2001-2010. These time series have been analysed in function to climate and morpho-topographic parameters in order to quantify their influences on the spatio-temporal variations of the ELA.

The investigation is based on optical remote-sensing images and geographic information systems (GIS). The relationship between the snowline measured on the satellite images recorded during the dry season and the ELA has been validated on four glaciers where mass balance field measurements are conducted since the early 2000s. For the study period, the average ELA at the scale of the Cordillera Blanca is about ~ 4920 m a.s.l. and an increasing trend (~ 11 m / year) is observed. The comparison with climatic and morpho-topographic parameters, shows that the average ELA over the study period is mainly controlled by morpho-topographic parameters, but the interannual variations are mainly driven by climate conditions (the best correlation being found when comparing ELA anomalies with temperature at 500 hPa anomalies).