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Application of one-dimensional land-surface model to tropical glaciers in Bolivia (16°S)

Gonzalo Leonardini (1), Takeshi Yamazaki (1), Yoshihiro Asaoka (2), and Edson Ramírez (3)

(1) Department of Geophysics, Tohoku University, Sendai, Japan , (2) Department of Civil and Environmental Engineering , Tohoku University, Sendai, Japan, (3) IHH, UMSA, La Paz, Bolivia

In the Bolivian Andes is distributed an important number of tropical glaciers. According to previous works, these glaciers have been characterized by an accelerated retreat and melting in the last years and its runoff has been used as water resources for many purposes for the local population. The main goal of this research is to estimate the amount of snow/ice melt in some specific glaciers and to find the main meteorological control-factors and differences using a land-surface model.

A one-dimensional multi-layer model has been adapted to the study of Bolivian glaciers in tropical conditions. In the model, the snow and soil components are considered, and the information of the ice component is introduced in the initial condition; the boundary condition is provided by the energy balance at the atmosphere-glacier and at the glacier-soil interphases. The model can calculate profiles of density, temperature and liquid water content as well as snowmelt and energy exchange between the atmosphere and the snow/ice surface. It has been applied to Zongo Glacier (16°S) in the southern part of the Bolivian Andes and it has been validated through the whole hydrological year 2005-2006 using the data provided by GLACIOCLIM (les GLaCIers un Observatoire du CLIMat). The surface temperature, the net radiation and the profile of snow/ice are simulated reasonably and the diurnal and seasonal changes of latent and sensible heats agreed with the previous works on the same glacier. We planned to extend this study to Condoriri and Huayna West Glaciers located in the same area of the study, and where we started meteorological observations at the end of 2011. This study is carried out by GRANDE (Glacier Retreat impact Assessment and National policy Development) project supported by JST/JICA, SATREPS (Science and Technology Research Partnership for Sustainable Development).