

# GRANDE

## News Letter

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## A Great Project for now and for the future Teacher-Researcher Francisco Bellot Alarcón

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When I attended the second technical workshop on September 26, 2011, Project GRANDE which presented the progress made by Tohoku University and the Universidad Mayor de San Andrés (La Paz, Bolivia), in the “Auditorium” in the city of La Paz, Bolivia, I was struck by the name of Project: “GRANDE” (in Spanish GRANDE = Great, big), one year after the Institute of Sanitary and Environmental Engineering at the Universidad Mayor de San Andrés happened to be part of it, and then saw a better way than to large problems caused by climate change, it was necessary to bring great solutions and so confront and mitigate the effects in the cities of La Paz and El Alto, which together total more than 2.000.000 inhabitants



Big problems they already feel in Bolivia, melting glaciers, hydrometeorological changes, land use changes, reduced quantity and deteriorating quality of water intended for human consumption, difficulty in equitable distribution of water resources and as a final effect very difficult to manage water resources.

Almost immediately I get the chance, I consider it a privilege to participate in the activities of the project in October 2012: Symposium and poster session training course at Tohoku University, days when you had a Teachers role Tohoku University, scholars and Bolivian researchers, how much knowledge and know how it looks and feels when one is in the Third Imperial University of Japan, know that it gets locked at the University and is considered exclusive but leaves teachers, shared, and to act in the approach of the major solutions for the cities of La Paz and El Alto in Bolivia, as a fulfillment of the words of Albert Einstein: “Those who have the privilege to know, have an obligation to act”.

After the field work, to generate information to analyze both behavior changes that are occurring and models through analyzing the future and devise strategies to mitigate the effects of climate change as knowledge and application of research results.



Thanks for the example, the experience and knowledge transmitted, for all that, I feel that with all the knowledge transformed into knowledge, to reflect it and appropriate it, we must act to in the near future and be prepared to face the great changes that come with great solutions. Then I realize that pun named as Project GRANDE.

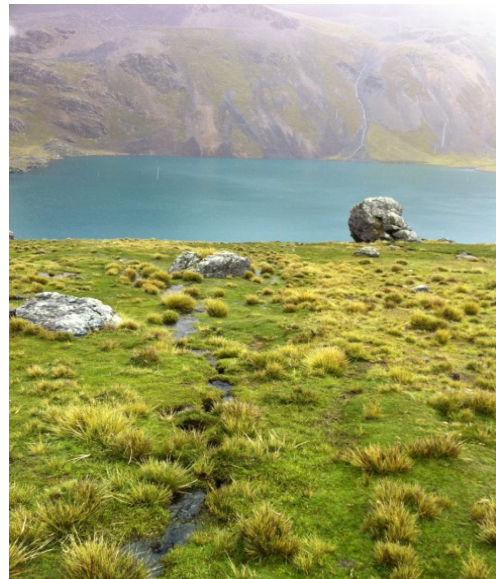
Thank you very much



## Activity Report

### Two sources of stream, Dr. Kinouchi, Tokyo Institute of Technology

The objective of my stay from 12 to 17 March was to conduct field measurements and sensor installations, as well as meetings with our colleagues from UMSA. Sensors were installed at station MH1 to measure soil moisture and ground temperature variations responding to seasonal meteorological conditions. Soil samples were collected to analyze physical properties. Possible sites for monitoring the effect of glacier lakes were observed and determined after the discussion with Mr. Javier Mendoza. Some ideas for more accurate precipitation measurements were also discussed.



As we have been developing a simple yet reliable model for predicting glacier/snow melt and runoff in the future, a better understanding of this climate-sensitive region is so important. This time, I observed two sites with different hydrological settings. One day, we visited the Condoriri catchment and came across the mysterious landscapes viewed from the highland, almost 5,000m in altitude. We found small streams and sources in the wetlands, which are likely to contribute to the streamflow during the wet season. Although this was not the view initially anticipated, this experience gave me the feeling that we found Shangri-La in the highland of the Andes.

On the other day, we visited the Huayna Potosi glacier to observe the snow and glacier conditions during the wet season. It was snowing on the glacier and solid precipitation was observed. Snow depth became thicker as we went up, which made it very hard to reach the weather station.



These two field visits were the hardest work during the stay, but motivated me for further improving our model. Many thanks to Ms. Okamura, Mr. Mendoza and Mr. Rojas. Through this visit, I was convinced that the reliable runoff modeling based on the better understanding of hydrological and meteorological situations is still challenging under such an unique climatic and geographic conditions.

## GRANDE Students

### Pablo FUCHS, Master course student, Tohoku University

My name is Pablo Fuchs and I am from La Paz, Bolivia. Currently I am a Master's student at the Hydro-Environmental System Laboratory under the supervision of Prof. Kazama to whom I am very grateful. I would also like to thank JST/JICA SATREPS for their sponsorship during the development of my research.

Since I arrived to Sendai on July 2011 I have been studying melt, runoff and mass balance processes on two Bolivian glaciers using a simple temperature index model. In principle, this model would be useful for engineering purposes, specifically for the quantification of water resources in glacierized basins. However, this model is intended also for other applications, including but not limited to: glacier and snowmelt runoff predictions, temporal and spatial simulations of albedo and glacier dynamics, provided the limitations and basic assumptions of the model are known.

As this century might be marked by changes in the climate system, acknowledged in current climate change studies, it is crucial to understand the historical and future response of glaciers to the climatic forces. Andean cities, such as La Paz and El Alto in Bolivia heavily rely on glaciers, not only as sources of fresh water for different uses but as cultural symbols and unmistakable landscapes of the mountainous highlands.



The motivation of my research is to propose a simple model with a strong physical basis for such studies and to transfer it to the Bolivian scientific and technical bodies. Further, I would like to present my findings to the population so that it can be aware of the future challenges we would face.

My study is divided in three parts namely:

1) Estimation of glacier melt in the tropical Zongo glacier: in this first stage an enhanced temperature-index model including albedo and shortwave radiation has been applied to the Zongo glacier. The model satisfactorily simulated the daily discharges and their seasonal variations. The energy balance analysis revealed that three factors mainly control melt: incoming shortwave radiation, incoming longwave radiation and sensible heat flux. Accordingly, the model differentiates between temperature-dependent and temperature-independent components moving towards a more physically based but still simple model. Modelling was improved with respect to the traditional degree-day method in the wet season characterized by simultaneous accumulation and strong melting while capturing the low melt rates found in the dry season.

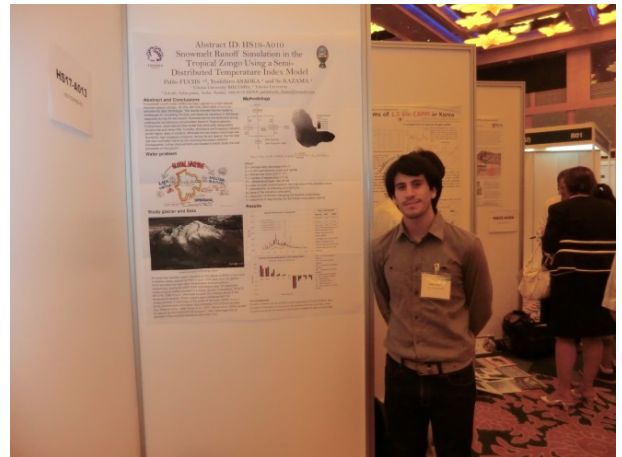
2) Parameterizations of albedo and incoming shortwave radiation to estimate the temporal and spatial variations of albedo over the ablation zone.

3) Applicability of the enhanced model: evaluation of the regional applicability of the model to find generalizations into the functioning of glaciated basins in the study region.

This time in Japan has been very rewarding not only for my academic life but as a personal experience. I met people from many countries and discovered diverse cultures and ways of seeing life. This has enriched my vision of the world and inspired me in many ways.

In the future I would like to pursue a PhD degree to further develop my research skills and contribute to the science of glaciers.

Thank you!



## Publication List 2012.04-2013.03

### Journal

- Keisuke TANI, Makoto UMEDA, Tsuyoshi KINOCHI, Yoshihiro ASAOKA and Marcelo GORRITTY, 2013: Assessment of aquatic environmental impact by a future climate change in a reservoir located in the Bolivian Andes, Journal of Japan Society of Civil Engineers, Ser. B1 (Hydraulic Engineering), Vol.69, No.4, pp.I\_1501-I\_1506 (in Japanese).

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- Yoshihiro ASAOKA, Yukari TAKEUCHI and Ranjan Sarukkalige, 2012: Temporal variations in acidity and ion concentrations of precipitation, snowpack and outflow from snowpack in a temperate snow area of Japan, Journal of Hydroscience and Hydraulic Engineering, Vol.30, No.1, pp.63-76.
- Freddy SORIA and So KAZAMA, 2012: Assessing the investigation of streamflow source areas through uncertainty evaluation of numerical experiments in small catchments, Hydrological Processes, Vol. 26, pp.907-931.

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