# GRANDE
## News Letter
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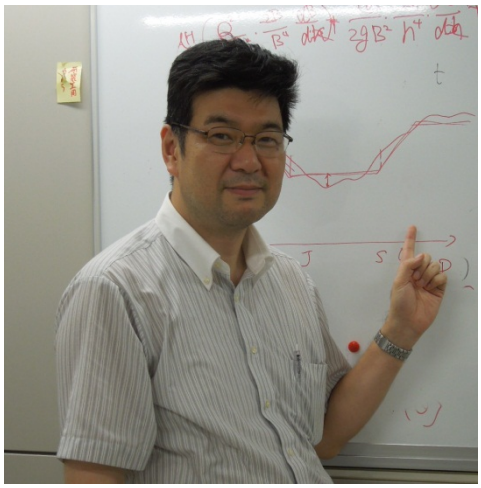
# Learning not a solution, but a management process



An ultimate goal of the GRANDE project is building a comprehensive water resource management model for Bolivian society. It is important to understand that management is not a complete solution, but an endless process of improvements made in response to changes in natural conditions and societal demands.

Water resource management must cope with various changes, such as shrinking glaciers, relocation of households and industries, water quality deterioration, and more. These changes require rebuilding of the current water management plan, including infrastructure and water distribution plans. It is not feasible to fund a new project using international aid every time the Bolivian water management plan is rebuilt: donor countries may not come forward, the plans that donor countries create may be independent of the existing infrastructure built previously, and foreign water company may profit unfairly with the information investigated by donor country.

The important thing for Bolivians is to gain the competence and power to detect changes in conditions and then to revise their water management plan by themselves. The GRANDE project does not aim to provide a complete black box model applicable only to the present situation, but to produce a human resource — people who can understand the mechanisms in the model and alter it in response to the new conditions and demands in the future Bolivia.

Makoto OKUMURA
Professor, Tohoku University


SATREPS For the Earth, For the Next Generation

# Activity Report

## Field campaign in a late summer wet season, Dr. Umeda, Tohoku University

The main purpose of my visit to Bolivia in March 2012 was to make thorough observations of water quality in the Condoriri and Huyna Potosi in the summer wet season as well as Tuni Lake and the Compuerta area. Tani Keisuke, a student from our laboratory who had just completed his bachelor thesis titled “Prediction of water quality in a reservoir in the Andes affected by global warming,” accompanied me for the field studies. Our stay was from March 11 to 22, during the first week of which Prof. Seiki Kawagoe was also there.

This visit was my first fieldwork during the summer rainy season, and the study sites were quite different from what I had seen during the winter dry season. The main characteristics was, of course, the abundant water in the streams and in Tuni Lake, which was at its full storage. But what impressed me in the field was the abundance of algae and aquatic plants, especially submerged plants, in streams and wetlands. We found it interesting that the stream water seemed clear and clean with little anthropogenic pollution, yet it still contained enough nutrients to sustain the growth of plants and algae. We hope to elucidate nutrient cycling and the processes of water quality in our target basins during the next several years.

Tani & I in Condoriri

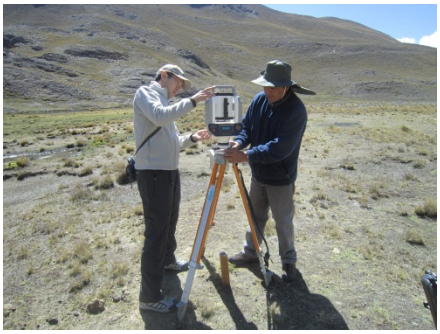
We collected water samples in the major streams of Condoriri and Huayna Potosi basins, and then deployed turbidity meters in the upper Huayna Potosi basin and began continuous measurements of turbidity. Turbidity is an indicator of nutrient concentration (especially total phosphorus) as well as that of sediment load. Therefore, monitoring turbidity can lead to a better management of river basin and dam reservoir. Thanks to dedicated help of the counterpart and staffs in Bolivia, data acquisition is now being conducted adequately.

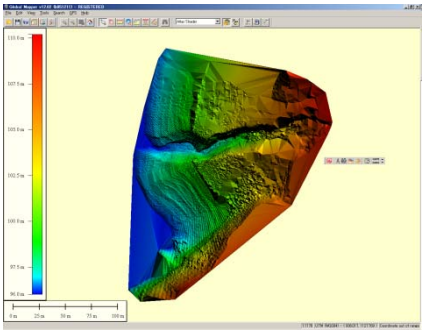
Aquatic plants and algae in Condoriri

Turbidimeter installation in Huayna Potosi

## 3D Measurement of glacier and river mouth

Glacier group and sediment group use a 3D laser scanning system to measure the glacier shape and river mouth topography. It allows for 3D measurements by the 700m ahead with high accuracy and at a short time. Bolivian researcher and staffs monitor glacier tongue topography and river mouth morphology with a this device at a regular schedule. Results are going to be utilized for validation of glacier melt model or sediment transport model.





# GRANDE Students

## Vladimir Moya, Ph. D student, Tohoku University

Last year I began my Ph.D. project at the Disaster Potential Research Laboratory of Tohoku University under the supervision of Prof. Akira Mano. I extend special thanks to the SATREPS program by JST and JIAC for study in Japan. I am also grateful to Prof. Mano, my laboratory mates, and my friends for their support at Tohoku University.

Because water is the most vital element for life, I believe that development of good water management policies is very important. A key step toward achieving this goal is development of a model that can be used to simulate various scenarios. Although traditional "lumped" hydrologic models are practical and easy to use, they have two main problems that limit their applicability:

- Their output is a prediction of discharge at a given point. Thus, it is not possible to analyze how hydrological processes are related or their spatial distribution within the catchment.
- Because they lump all catchment characteristics into one conceptual model, they are suitable only for the given situation. In reality, a catchment's characteristics change with time from both natural and human causes, and traditional lumped models fail to represent such changes.

Therefore, it is important to consider the spatial distribution of the catchment. Although there are many distributed models (both fully distributed and semi-distributed), they have some main limitation that difficult their applicability to the present study.

- They require large amounts of data, including detailed spatial information on natural parameters and human impacts, which are difficult and expensive to obtain, especially in developing countries.
- Those models were not designed for glacier basins, where glacier area both contribute and stores water. Besides, tropical glaciers is common to have frozen and non-frozen conditions that influence the hydraulic response of the catchment. Moreover, in my field area it is important to consider the interaction of wetlands and water impoundment.
- Finally distributed modeling approaches have been strongly criticized because of their uncertainties. They often aggregate complex properties and adjust processes by calibration methods that neglect temporal changes and possible inaccuracies arising during data collection or from the numerical methods or the use of simplified physical processes. Therefore, uncertainty analysis has recently been recognized as a key step in hydrological studies.

I plan to overcome these difficulties in this research. First, the semi-distributed model Supertank will be improved by a new approach to evapotranspiration and by including the influences of frozen conditions. Second, I plan to introduce input data obtained by remote sensing and to apply artificial neural networks to process the input data. Third, I will employ a novel approach to estimate uncertainty. Finally, I plan to run the improved model and use climate change predictions to analyze future water scenarios.

# Award

## Liu Tong wins gold medal in student competition award at the 18th IAHR-APD 2012

Liu Tong, a Ph.D. student at Tokyo Institute of Technology, was the gold medal winner in the student competition at the 18th Congress of the Asia and Pacific Division of the International Association for Hydro-Environment Engineering and Research (IAHR-APD 2012), held August 19–23 at Jeju Island, Korea.

She, whose Ph.D. research is supervised by Dr. Tsuyoshi Kinouchi, has been a member of the runoff group in the GRANDE project since April 2010. Her award-winning paper was “Glacier mass balance and catchment-scale water balance in high altitude regions.”

She analyzed the water balance in the tropical Andes catchment , a test catchment for the GRANDE project. This catchment is unique and complicated environment because of glacier, glacier lake, wetland, semi arid and tropical region and elevation of over 4500m Her results have great scientific value and expected to bring major advances in the application and validation of runoff model in our test catchment.

## Dr. Asaoka wins academic incentive award

The Tohoku Branch of the Japan Society of Snow and Ice gave its academic incentive award to Dr. Yoshihiro Asaoka, Tohoku University, on May 18 for his accomplishments in snow hydrology, which includes some results of the GRANDE project. The award is presented to young researchers who are expected to contribute to the development of glaciology and snow hydrology.



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