

# GRANDE

## News Letter

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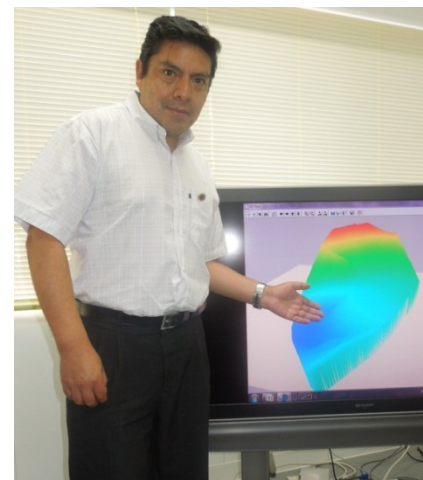


## New technologies for the study of tropical glaciers Prof. Edson RAMIREZ

Institute of Hydraulics and Hydrology, Universidad Mayor de San Andres, Bolivia

Techniques for monitoring tropical glaciers over time have improved. Within the framework of the GRANDE project, new tools have been used in Bolivia since 2010 to determine volumetric changes in glaciers as a result of climate change. One major development is the application of LIDAR (light detection and ranging) systems and remote-sensing techniques.

In the Andean region, the GRANDE project is pioneering the use of terrestrial LIDAR systems to obtain digital terrain models. This innovation is important for the advancement of glacier science in South America. Terrestrial laser scanners have proven applicability in not only glaciology but also other research areas such as watershed erosion and landslide-associated risks.



Another important development has been the use of high-resolution satellite images with 3D stereoscopic capability. In collaboration with the Ministry of Environment and Water of Bolivia, we have used these types of images from the Japanese Advanced Land Observing Satellite (also called Daichi) to characterize the watersheds studied in the GRANDE project, namely Condoriri, Tuni, and Huayna West.

These two techniques, combined with the establishment of meteorological stations on high-altitude Andean glaciers (>5000 m above sea level) and of gauging stations at the outlets of the study watersheds, have allowed us to calibrate models that can simulate glacier behavior in the Bolivian Andes. These models that we are developing are important tools for planning water resource management and developing strategies for adapting to climate change in the cities of La Paz and El Alto.



# Activity Report

## GRANDE international workshop

The GRANDE international symposium was held on 20 October 2012 at Center Hall, Tohoku University. Participants included researchers, students, and members of the public from Bolivia, Japan, and other countries. Distinguished attendees included Mr. Carlos Ortuño, Vice Minister, Ministry of the Environment and Water; Professor Carlos España, Vice President of Universidad Mayor de San Andrés (UMSA; the Higher University of San Andrés); Mr. Hideki Mizuma, Director of the Japan Science and Technology Agency (JST), and Mr. Katsuyoshi Sudo of the Japan International Cooperation Agency (JICA). The symposium was convened in the middle of the GRANDE project period (April 2010 to March 2015) to confirm the latest results from each GRANDE group and to discuss Bolivian water resource management in the face of glacier retreat and climate change.



Project leader Professor Hitoshi Tanaka, of Tohoku University, summarized the project's purpose and activities. Dr. Edson Ramirez of the glacier group gave a presentation on the current condition of the Huayna Potosi West glacier, as measured with a 3D laser scanner and differential global positioning system. Ms. Fabiola Ledezma of the runoff group presented a runoff simulation in the glacier and its lower catchment, based on a distributed runoff model. Her simulation showed that seasonal contribution of glacier melt to water resources. Ms. Ledezma is an exchange student from Bolivia and has just finished her Master thesis under the supervision of Dr. Tsuyoshi Kinouchi of the Tokyo Institute of Technology. Ramiro Pillco Zola of the sediment group gave a presentation on erosion in the Tuni Lake catchment, and Dr. Makoto Umeda explained water quality monitoring and modeling in Tuni Reservoir. Dr. Umeda also gave an example of the influence of climate change on the water environment in both Bolivian and Japanese reservoirs. Carlos España summarized water resource management in La Paz and El Alto.



At the poster session, Bolivian and Japanese students presented their current research. Topics included monitoring of long-term changes in glacial areas and sediment transport and water quality in the Tuni Lake catchment. They also included simulations of glacier melt, runoff, and sediment production in the catchment and of water quality in the reservoir. Further topics were the evaluation of water resource management, reservoir function, and alternative water resources. Vladimir Moya, a PhD student at Tohoku University, received the prized Best Student Poster Award. The title of his presentation, which was selected from among 14 posters, was “New Approaches for Estimating Snow Glacier Melt, Precipitation and Evapotranspiration in Scarce Data Areas: the Case of the Andean Condoriri Basin.”



Finally, we had a panel discussion on Bolivian water resource management, with Professor Tanaka as host facilitator. Although there are currently many other water resource management projects in Bolivia, most of them have not evaluated issues with scientific approach. Edson Ramirez pointed out that one of the big advantages of the GRANDE project is that Bolivian researchers can improve the models by themselves using the observation data we have obtained. Vice Minister Mr. Ortuño emphasized how important the results of the GRANDE project are, because they provide scientific insight into the effects of glacier melt and climate change on water resources. Vice president Mr. España also pointed out that Bolivian society needs to foster human resources who can take a scientific approach to water resource management. We expect that our GRANDE students will help to fulfill this role after their study in Japan.

## Model seminar for water management

Bolivian researchers and students attended a model seminar from 22 to 27 October at Tohoku University. The models covered estimations of glacier melt, runoff, sediment production, and water quality in the Tuni reservoir and of the water demand of La Paz and El Alto. They were developed by the Japanese side of the project. The seminar aimed not only to share details of the latest models but also to discuss the application of the models in the Tuni Lake catchment and their further development. When the models have been fully developed and validated, they will be offered by Bolivian researchers to Bolivian water resource management agencies.



On 19 October, at Tohoku University's Kawatabi Seminar Center, we held a field excursion to a full-scale experimental constructed wetlands (CWs) to understand comprehensive water management. Water treatment techniques are attracting attention in La Paz, which has no water-treatment system. CWs use natural water purification systems such as sedimentation, adsorption, biodegradation, biooxidation, and bioreduction to treat wastewater. They are suitable for developing countries because of their low capital cost and low operational and maintenance costs. Dr. Kazunori Nakano of Nihon University demonstrated and explained the effects of water treatment at the experimental CWs.



## Mid-term review of the project in Bolivia

From 15 to 30 November a mid-term review of the GRANDE project was held in Bolivia. The Joint Mid-Term Review Team was organized by JICA, JST, UMSA, and the Ministry of Environment and Water. During its stay, the team and the relevant Bolivian authorities and institutions held a series of discussions and exchanged views on the project. As a result of this intensive analysis of the project's activities and achievements, the team prepared the Joint Mid-Term Review Report and presented it to the Joint Coordinating Committee (JCC) on 30 November 2012. After discussing recommendations for successful implementation of the project, the JCC approved the Report. The JCC also approved the addition of UMSA's Instituto de Ingeniería Sanitaria y Ambiental (IIS-UMSA) to the project team, along with a revision of the project's master plan and the setting of indicators for goal.



## GRANDE Students

### Kairi MORIZAWA, Master course student, Tohoku University

I'm currently a second-year Master's degree student at Tohoku University, and in April I will be starting work in private company. I was only 15 when I started studying civil engineering, and I never imagined I would go on to graduate school and study glaciers! Civil engineering is interesting because it's such a vast, broad field. After I graduate, I am going to join a construction company: I've always wanted to work for one, ever since I started studying civil engineering. Civil engineering work hasn't much in common with glaciers, so I don't think that I'll be directly applying the things I've learned in my tropical glacier research to my job. Nevertheless, I've learned a lot in the past 2 years.



The title of my Master's thesis is "A new simplified method for estimating temporal and spatial albedo by using satellite images." Albedo maps are needed to estimate glacier melt, because the amount of heat energy absorbed depends on the albedo on the glacier. I have been using satellite images to estimate albedo distributions on glaciers, and I visited Bolivia last July to conduct observations of surface albedo.



I took the long way: from Sendai to La Paz, Bolivia, via Sydney! This very long trip tired me out and made me realize how far it was between Bolivia and Japan. But I truly feel that the time I spent in Bolivia—about a week—was meaningful. I made observations on Salar de Uyuni (the world's largest salt flat) and on glaciers. I stayed 2 days in Uyuni. The contrasting landscape of bright blue sky and crystal-white salt changed continuously as time went on, and I never tired of it in my short time there. The scenery became more even more beautiful when flocks of pink flamingos appeared. The birds arrived in a flash, and it was a real feast for the eyes. I still regret the fact that I couldn't capture that moment on film. On the negative side I suffered from sunburn! In Bolivia, the sun's rays are strong and sunblock doesn't seem to have much effect. Surprisingly, I even got sunburn under my chin from light reflected from the ground of salt. Nevertheless, I was able to witness firsthand the high albedo on Salar de Uyuni.



I found the trek on foot to the Condoriri and HuaynaPotosi glaciers really long and tough. An extraordinary vista opened up in front of me after I had walked for about 3 hours, but I couldn't soak up the atmosphere because of how tired I was.

These experiences are really precious to me. I got to know the problems faced by Bolivia today and to experience the local climate and culture with all of my senses. In my mind this has shortened the distance between me and Bolivia, a country on the other side of the Earth that has become special to me through my research.



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