

The World is Our Campus

At the entrance to the BYU campus you can find both “The World is Our Campus,” and the “Enter to Learn, Go Forth to Serve” signs that have inspired students and faculty for decades. Ongoing work with NASA and a recent trip to Washington DC as part of the Group on Earth Observations to present their pilot project has given a group of students that form the BYU World Water (<http://worldwater.byu.edu/>) project team in the BYU Civil and Environmental Engineering Department the ability to experience firsthand what this means.

SERVIR

For the past year, the BYU World Water Team has been involved in a project funded by the NASA applied science SERVIR Program (<https://www.servirglobal.net/>). SERVIR is a joint project between NASA and USAID with the goal of connecting “Space to Village” by developing local capacity in the use of earth observations for the benefit of society. SERVIR has hubs in Kathmandu (Hindu Kush Himalaya), Bangkok (Mekong), Nairobi (East & South Africa), and Niamey (West Africa) that are supported by USAID and NASA funds researchers that help apply scientific know-how to solve important water and environmental challenges. The BYU project is helping develop capacity at the International Centre for Mountain Development (ICIMOD <http://www.icimod.org/>) to better forecast and model streamflow in support of floods, droughts, and overall water resources management. This work, which builds on the powerful and global medium range forecasts developed by the European Centre for Medium-range Weather Forecasts (ECMWF <https://www.ecmwf.int/>) and has greatly expanded the coverage for streamflow monitoring across the region. An unanticipated, but important result of the project is that they also end up with a 35-year historical simulated record of streamflow for all of the streams in their region. This is used to put current forecasts in context to previous extremes, but goes beyond the forecasting to provide a valuable resource since there are very few gaged streams that provide this important historical record needed for just about every type of water resources project. There are three additional projects assigned to the hub in Nepal and twelve others across the SERVIR network. At the recent annual meeting the BYU team received the award of excellence (among the sixteen NASA funded projects) for not only the work being done in Nepal, but for the way in which the BYU team is collaborating and extending their work throughout SERVIR. Their colleagues at ICIMOD also received an award for the way in which they are extending the use of the BYU project to different hydrometeorological services in the region.



Figure 1 Dr. Nelson receives the Excellence in Applied Sciences SERVIR Award for 2017 from the NASA and USAID leadership. (b) Dr. Nelson with Deo Raj Gurung of ICIMOD with their SERVIR awards.

Group on Earth Observations (GEO)

Joseph Smith once said, “A man filled with the love of God, is not content with blessing his family alone, but ranges through the whole world, anxious to bless the whole human race.” In many ways, this is the underlying mission and sentiment of the Group on Earth Observations (GEO), and because of satellite technologies we now have information that can truly be a blessing to all mankind. GEO is an intergovernmental organization, organized under the United Nations, that works to improve the availability, access and use of Earth Observations for the benefit of society. In the BYU Civil and Environmental Engineering, we have worked with the AmeriGEOSS group for a few years in capacity building on hydro-informatics and water resources management and thanks to the student mentoring program that flows from the Inspiring Learning charge given by President Worthen, our BYU World Water team has been working the past 6 months to expand the NASA-SERVIR forecasting and information project globally as part of the new Global Water Sustainability (GEOGLOWS) initiative. The pilot demonstration has included working with agencies in the Dominican Republic, Nepal, Brazil, Thailand, Africa and Argentina. The BYU team presented the project at the 14th GEO Plenary held in Washington DC Oct. 23-27 where they were accompanied by representatives from three of the countries, including Israel Acosta, the head of the hydrology department in the Dominican Republic national water resources agency INDRHI, the director of Brazil’s disaster management agency Osvaldo Moraes, and Basanta Shrestha a senior leader and GEO delegate from ICIMOD, the Nepalese agency we are working with in our SERVIR project. Here is a video overview: <https://www.youtube.com/watch?v=FFx92ztEezA> and a more detailed interactive story map <http://arcg.is/0mW18q> provides an overview to the project, including additional stories about the local agencies in the various regions of the world we have been working with.

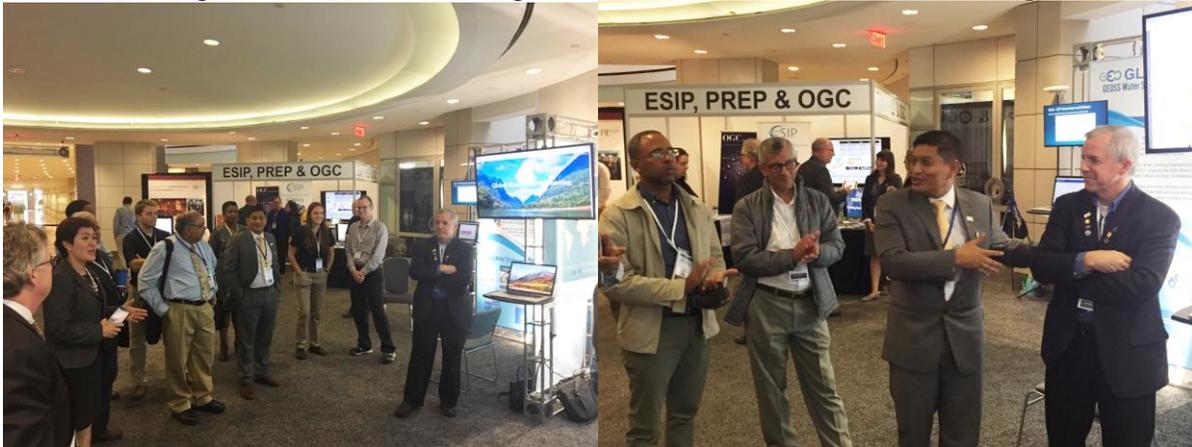


Figure 2 (a) Angelica Gutierrez-Magness (NOAA) introduces BYU’s GEOGLOWS Global Streamflow Forecasting Pilot. (b) International Collaborators left to right: Israel Acosta (INDRHI), Osvaldo Moraes (CEMADEN), Basanta Shrestha (ICIMOD)



Figure 3 (a) Sarva Pulla former BYU student working with SERVIR (b) Spencer McDonald and Corey Krewson (c) Michael Souffront wins the USGEO Earth Observations Quiz.



Figure 4 (a) BYU World Water Team left to right Michael Souffront, Spencer McDonald, Dr. Nelson, Elise Jackson, Wade Roberts, Marco Rosas, Jared Lillywhite, Curtis Rae, Corey Krewson (b) Students in DC left to right Marco Rosas, Jared Lillywhite, Elise Jackson, Corey Krewson, Spencer McDonald.

The work by the BYU World Water Team received further recognition earlier this month when they were awarded two additional NASA Applied Science projects (totaling ~\$200,000/year in funding for the next three years) to continue their work using the Tethys web based water resources application platform to provide decision support tools for the food, water, and health sectors. Dr. Nelson represented the team at the awards ceremony held during the Geo Plenary.



Figure 5 (a) Dr. Nelson receives an award for NASA GEOGLOWS Applied Science Grant. (b) Dr. Nelson receives a sub-award to work with Johns Hopkins for NASA Health Applied Science Grant.

Observations from GEOGLOWS co-chair Angelica Gutierrez-Magness

When at the first GEOGLOWS business meeting in May of 2017 Dr. Nelson came forward and volunteered to lead the Global Hydro forecasting project as a contribution to GEOGLOWS, I was confident that six months later we would have a demonstration at the GEO Plenary in Washington D.C.

My surprise came when the demonstration included six (6) worldwide pilot projects and a team of 8+ experts (students) who knew the application cases by heart. Seeing the student's presentations and engagement at the GEOGLOWS booth during the Plenary, reminded me of a passage in the bible that says "Work with enthusiasm, as though you were working for the Lord rather than for people." At that moment, I understood why this mighty achievement had been possible, and how fortunate the GEOGLOWS Initiative was to have the group from BYU among its leadership.

This global project represents prosperity for those who don't have access to information derived from a hydrological forecast (e.g., warnings and alerts), and it provides institutional strengthening by adding value to the activities of user organizations with a mandate for water information.

The achievement of this project is an important priority for the GEOGLOWS community, and we will continue working towards providing this as an open service to the water communities throughout the world.



Figure 6 Angelica Gutierrez-Magness co-chair of GEOGLOWS.

Observations from Dr. Nelson

For the past several years our BYU World Water team has been successful developing tools that allow us to create water resources decision-support web applications. I attribute the success we have had to the talented and faithful students that are a part of our program and are here at BYU striving to develop their full potential as world class civil engineers and leaders who are committed serving others. I often think about their hopes and dreams and their many prayers, and those of their parents, and know that as faculty we have a responsibility to provide the kind of Inspiring Learning opportunities that university leaders have challenged us to do. I am so grateful for the emphasis on mentoring at BYU and the resources that provide opportunities to be involved with the GEO, but more importantly to be a part of the development of such outstanding young men and women. I am also grateful for my colleagues at NASA, NOAA, ICIMOD, and ECMWF for their support and confidence in us.



Figure 7 Dr. Nelson explains the global streamflow pilot at the GEO Plenary.

Student Observations

Being able to attend the GEO Plenary was a wonderful experience for me. It was so interesting to see both the technological as well as the political side of the research that we are doing, and the work that I have been a part of. It was interesting to hear the perspectives from individuals and agencies from around the world, and how people are able to work together to achieve common goals from very different backgrounds. Understanding the impact that our research has had, as well as being approached by different agencies with ideas for future research was both gratifying and humbling. I am so grateful for this opportunity, and the added depth it has added to my studies. – *Elise Jackson*

First and foremost, I would like to thank Dr. Nelson and everybody else involved that made this trip possible for us undergraduate students. I believe that this was a fantastic experience. Working along with grad students in the preparation, implementation, and presentation of the project was something very beneficial for me. Also, being able to be in this kind of meetings and learning firsthand about the global impact of our research and how other organizations are closely related to us was really interesting. Now I can appreciate the networking experience in civil engineering in a more profound way. I have a different perspective about this major and its influence in the world. I can say that this was an incredible experience and I would highly recommend it for students in the future. – *Marco Rosas*

Going to the GEO Week 2017 conference was a great opportunity to showcase our research and learn more about the current state of the science regarding water resources and earth observations in general. The interest shown by the many delegates and scientists that came to talk to us gave me a sense of the real importance and need for the type of work that we are doing. Learning about other research at the conference helped me find areas where there is overlap with our own work and also gave me an idea of the things that we can improve using some of the state-of-the-art technologies that were demonstrated in the conference. Finally, this was a great opportunity to expand my network both for future job opportunities, and for immediate collaboration. – *Michael Souffront*

Attending the GEO Plenary has been a perfect example of what a mentored research experience ought to be. For me, the benefit was not only in presenting the work that our research group has been doing, but in connecting with professionals from across the globe in our field of research. I gained both technical insight from the various meetings and presentations, and personal development as I learned the process of professional networking. Watching Dr. Nelson and some of the graduate students present their work and make connections was an educational experience that can't be had at a lab on campus. Following their lead, I was able to connect with a representative from the Ecuadorian embassy to create a new working relationship between our research group and water resource managers in that country. I want to send a thank you to the department for supporting activities like this that so thoroughly meet the aims of a BYU education. - *Jared Lillywhite*

Being a part of this research group and then traveling to the GEO Plenary to present our work was an incredible learning and networking opportunity for me. This coming February, my wife and I will be moving to Bangkok, Thailand for a Boren Fellowship that she received from the U.S. Government. The connections I made with NASA and the World Bank at the GEO Plenary have led to an amazing employment opportunity in Thailand. This new job will allow me to continue working on projects similar to the Global Streamflow Forecasting Initiative which strives to improve water forecasting abilities in the developing world. – *Spencer McDonald*

I really appreciated the opportunity to go to DC. We are doing a lot of work here at BYU that feels important. It is not until we can get out and connect with the users, can we see that it is important! GEO is a large organization with very broad goals. I am grateful that we were able to go and see what part we are playing here at BYU. – *Curtis Rae*

The opportunity I had to go to Washington DC and participate in the GEO Plenary was eye opening. It was amazing to see so many people from around the world come together to develop and enhance global services. It was even better to see how we, as undergraduate and graduate students, could still provide help with our limited experience. I learned that it is never too early to get involved in these types of projects and we can make an impact in our field even when we are new or learning. I also loved learning about the new technologies and methods in

Earth observations through satellites. There is so much work to be done and so much service to be provided in these fields. I am grateful for this wonderful opportunity to apply my school experience in the real world. – *Corey Krewson*

Although I did not attend the GEO Plenary, I have had a great experience collaborating with the BYU World Water Team on our research project with GEO. While working with Nepal, it has been great to see the applications of the streamflow prediction tool app for them and how it can benefit their country and the surrounding region. I have learned so much already by working with the team in the hydroinformatics lab, and it's great to know that what we are trying to accomplish can benefit millions of people worldwide. So, I would just like to thank the department and Dr. Nelson for making this experience possible and for continuing to support this great project that is going on. – *Wade Roberts*