Australian National University: The Geodesy Group

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The Research

- My work centered around software development in the field of geodesy
  - Geodesy - the mathematics and physics dealing with the shape of the earth
  - Software development- All of the code was written in Fortran (77 and 90) on a Linux terminal
The Research

- Glacial Isostatic Adjustment (GIA)
  - Areas of the world such as Canada and Scandinavia used to be covered by large ice sheets
  - These large masses caused the earth to deform down
  - Now that the ice sheets are melted, the earth is slowly rising back up in these areas.

Map showing glacial isostatic adjustment around the world.

Image citation- http://www.psmsl.org/train_and_info/geo_signals/gia/
The Research

- Hydrological Loading - Deformation of the earth caused by hydrology (oceans, water cycle, etc.)
  - Expressed in terms of coefficients of sines and cosines
  - Coefficients are determined by satellites measuring the earth's magnetic field.
- I wrote code that calculated the hydrological loading of the earth at given longitude and latitude adjusting for glacial isostatic adjustment

Hydrological loading for a site in Brazil. This deformation has a definite period of one year, which corresponds to the annual filling and emptying of the Amazon Basin, which causes the earth to deform up and down.
The Research

- **GLOBK** - Software consisting of a suite of programs to combine various geodetic solutions such as GPS to obtain various global parameters using a least-squares algorithm with statistical noise (Kalman Filter)

- **Degree 1 motion** - the motion of the center of mass of the earth relative to the center of the frame of the earth

My project consisted of subtracting the hydrological loading in my previous code from the geodetic positions and then writing code that introduces the degree 1 parameters into the least-squares inversion when calculating the center of the earth.
Results

Graphs of the degree 1 motion in the y (upper graph) and z (lower graph) directions. Red is the previously predicted motion based on satellite laser ranging (SLR) measurements. Yellow and green are our results, which are simulated using our software. The correlation between our simulations and the SLR measurements is significantly better than previous results.
The other intern and I traveled as much as possible. Our first weekend trip was to Sydney, where we saw tourist attractions such as the bridge, the Sydney Opera House, and the Taronga Zoo.
Auckland

Our biggest trip was to Auckland, New Zealand. The above photo is from the lava caves on the island volcano of Rangitoto.
Traveling: Great Barrier Reef (Airlie Beach)

We also travelled to the town of Airlie Beach, which is located near the Great Barrier Reef. From there we got to see some of the nicest beaches and snorkeling spots in Australia.
Reflection

- First real research experience working with software
- Solidified my interest in a field that is an intersection of math, computer science, and real-world applications
- Learned to live on my own (Airbnb), take public transportation to work every day, and travel in foreign countries on a budget
- Overall, would definitely recommend!