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SSIO 2015 Internship Opportunity Position

Internship Information

Project title: **Understanding geodesy and water level trends in the Great Lakes in preparation for the International Great Lakes Datum update**

NOAA mission goal: **Resilient Coastal Communities and Economies**

Hypothesis or objectives: **The student will be part of a team at the NOS Center for Operational Oceanographic Products and Services (CO-OPS) that is working toward updating the International Great Lakes Datum (IGLD). The Datum is updated every 30 years mainly due to differing rates of vertical land movement. Coordination of the Datum update is accomplished through a bilateral committee between the United States and Canada. The Datum update requires the use of new survey techniques and technology; GPS/GNSS measurements; determining vertical velocity rates across the Great Lakes region; the use of specialized state of the art survey equipment to reference the Datum at CO-OPS water level stations; and the use of new water level data collection methodologies, Microwave Water Level sensors, to measure the lake level surfaces. Water level data will be collected from 2017-2023 using short term gauge installations and are used in conjunction with GPS measurements that will be taken in 2015 and 2020 and a new North American GRAVD geoid model from the National Geodetic Survey (NGS) to determine the new Datum. As preparations continue for the Datum update, there are several technical questions that remain unanswered that are important to the final product. The student will work closely with the team to investigate some of these questions.**

Please note: Academic Status could be Undergraduate or Graduate

Academic status: **Undergraduate**

Area(s) of discipline: **Earth Science, Engineering, Environmental Science Studies, Geography, Marine And Aquatic Sciences, Mathematics, Oceanography, Physics**

Internship location: **Silver Spring, MD**

Duties and responsibilities: **There are several topics related to the International Great Lakes Datum update that the student can work on.**

In one topic, the student will work alongside oceanographers to determine the best practices for defining Low Water Datum (LWD)

in the Great Lakes. Presently each Lake has a LWD value assigned relative to the IGLD 1985. Subject Matter Experts report that an analysis was performed using historical monthly mean data for the Master Reference Stations to come up with a conservative elevation for navigation purposes. However, during the recent low water stages, the water levels were often below the existing LWD elevations for Superior, Huron and Michigan. LWD needs to be updated relative to the new IGLD2020, but the methods have to be established and documented first. This will require the student to assist in analyzing historical Great lakes

require the student to assist in analyzing historical Great Lakes water levels.

One of the other topics the student will work on is to help calculate and define the hydraulic correctors associated with both long and short term water level installations, utilizing test data sets that are being collected in FY14 and FY15. Hydraulic correctors are small offsets used to relate a subordinate water level gauge's value of Mean Water Level to the Master control station's value on each Lake. Determining the hydraulic correctors for new subordinate gauging locations will require investigating new methods for implementing an interpolation model across the Great Lakes. There is an existing spatial interpolation model, based on a NAVD88/IGLD85 model developed by NGS, being used for interpolation of hydraulic correctors in the NOAA VDatum tool. However, the model is known to have inaccuracies in some areas, is not well understood, and needs further documentation. An updated approach using existing expertise and experience with the TCARI spatial interpolation tool used mainly in NOS hydrographic and shoreline surveys has been proposed. The TCARI methodology is well documented, well understood, well tested, and is being used for several NOS operational purposes. In order to fully implement this interpolation scheme, a better understanding of historic data is needed. While learning about TCARI implementation, the student will enter a backlog of bench mark leveling data and other metadata into a database that is owned by the National Geodetic Survey and the Center for Operational Oceanographic Products and Services, and used to deliver the information to private sector, public and federal agencies. Due to the large amount of data in backlog, the student would most likely focus on one Lake to work on.

The student will also help create a published bench mark sheet for the Lakes bench marks. The Lakes do not have published bench mark sheets such as the coastal tidal bench marks do, and we do not expect the sheets to contain the same information. <http://tidesandcurrents.noaa.gov/benchmarks.html?id=8594900>. However, there is some location information and hydraulic corrector information that could be included in a published sheet that would link to NGS data sheets. This information is helpful for the many coastal engineers and resource managers in the region.

Lastly, the student could possibly participate in a field trip, if funds are available and if the timing aligns well, to the Great Lakes to assist with install or removal of water level sensors as part of the FY15 Coastal Storms Program project in the Lakes. Also, it is possible that the student could participate on a National Geodetic Survey trip to assist with GPS measurements in the summer of 2015.

- Special skills/training required:
- Preferably some knowledge of tidal or geodetic datums
 - Preferably knowledge of statistics
 - Some knowledge of interpolating schemes
 - Ability to work independently after being provided guidance
 - Good organization skills and ability to meet deadlines
 - Good interpersonal and communication skills
 - Demonstrated analytical skills
 - Training will provided in datum and hydraulic corrector determination based on the 1985 method
 - Training will be provided in the input formats and specifications of the National Geodetic Survey's data base known as the NGS "Bluebook."

Expected outcomes: The student will have an opportunity to work on a project that will help create the future International Great Lakes Datum, with implications for regulations on navigation and construction along the Great Lakes. While working with scientists with diverse

the Great Lakes. While working with scientists with diverse backgrounds, the student will gain experience in the practical application of scientific and engineering data analyses to operational observing systems. The student will gain knowledge in several areas including project planning, long-term lake level trends and variations in the Lakes, geodesy, geodetic and water level datums, interpolation methods, and water level and GPS measurement technology. The student will take away knowledge of a few of NOAA's programs missions and goals to protect the environment and serve the public.

Guidance and supervision: **The student will be given guidance by multiple CO-OPS personnel, including the Chief Scientist, Technical Experts, Engineers, and Oceanographers that are familiar with the Lakes. The student will learn about the International Great Lakes Datum and how it differs from coastal tidal datums. The student will learn about geodetic datums including NAVD88. The student will be part of the Engineering Division at CO-OPS and report to the Engineering and Development Branch Chief. The student will also work closely with the Oceanographic Division.**

Posted or modified date/time: **Thursday, October 09, 2014 - 6:51:00 AM**

Internship Travel Information

Purpose (student's role): ---

Mode of transportation: ---

Date(s): ---

Destination: ---

Estimated cost: ---

Source of funding: ---

Mentors Contact Information

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Agency or organization: **NOAA/NOS/CO-OPS**



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