

HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM

RESEARCH PROJECT #: HPCMP-HIP-24-017

FODDER - Feasibility of Oceanographic Drifter Data for Environmental Research

About NIWC Pacific:

NIWC Pacific provides development, basic and applied science, test and evaluation, system engineering and integration, installation, and support of fielded Information Warfare systems from seabed to space. (Informally: NIWC provides the Navy with experts on software/cloud, sensors, signal analysis, data science, machine learning, and uncrewed vehicles).

RESEARCH LOCATION: San Diego, CA

PROJECT DESCRIPTION:

During FY17-22, DARPA spent tens of millions of dollars on the Ocean of Things (OoT) program to design and deploy thousands of small, low-cost drifting sensor platforms. (<https://oceanofthings.darpa.mil/>). Consisting of over 500 million individual reports at 100 million unique timestamped locations across a dozen different sensor types, the dataset is orders of magnitude richer than any previous in situ collection event. Despite the program's size, some of the ancillary environmental data has not been examined thoroughly (priority was given to tactical/operational/METOC applications). The intern will get hands-on experience with a unique dataset not yet available to the public and help make it available for others to study.

Under the guidance of a mentor, the intern will examine the Chl-a, VOC, and mag data and compare them to both terrestrial and satellite sources of ground truth, including AIS, to assess their reliability. The intern will look for both environmental/ecological utility as well as Navy/Ship detection. When Chl-a is measured via satellite it has continuity gaps and limited spatial resolution by comparison. The intern will look to understand ocean primary productivity (plant life) particularly during and after hurricanes and storm events and will look for ship tracks. With VOC the intern would look to detect emissions from both passing ships as well as leaks from oil platforms in the Gulf of Mexico. Surface oil contamination may also be detectable in the Chl-a data. The mag data reports both anomalies and background levels. The intern will look at the background levels and see if they have utility for PNT or if geomagnetic storms can be detected. The anomalies are supposed to correspond to ships and the research will look to validate that via AIS.

The intern will gain experience with accessing public (state and federal) weather/climate/oceanography data via formal APIs. The intern will learn how to collect and organize geospatial information. The intern will learn how to clean, display, interpolate, and analyze data that is both continuous (e.g., the measure of chlorophyll-a in the ocean) as well as discrete (e.g., a ship trajectory).

Week 1 - Gain access to HPC resources. Learn about AIS (Automatic Identification System) used by large ships worldwide. Access NIWC's database of AIS data and float position data, make trajectory plots of one or more vessels &/or floats.

Week 2 - Learn about fluorescence sensor, download NASA/NOAA satellite/ground truth data

Week 3- Compare float-measured range to notable ground truth events

Week 4 - Compare float-measured range in bulk to all ground truth baseline

Week 5- Learn about VOC, download ground truth

Week 6 - Compare VOC and Mag anomalies to oil platform locations

Week 7 - Compare VOC and mag anomalies to AIS ship trajectories

Week 8 - Compare VOC to coastal emissions

Week 9 - Start final report. Regenerate most interesting plots with fonts/scales/legends appropriate for publication

Week 10 - Participate in the removal of any CUI-sensitive data points, prepare data for release as Distro-A. Finalize Report

NIWC usually hosts 20+ NREIP interns with events held specifically for them. In FY23, our HPC Intern was able to participate in all these activities (e.g., formal welcome by our commanding officer & executive director, guest/faculty talks, social after-hours, 'field trips' such as touring NIWC's marine mammal program or helping NIWC host their annual RoboSub competition (for high school and college teams - <https://robonation.org/programs/robosub/>)).

ANTICIPATED START DATE:

May 2024 – Exact start dates will be determined at the time of selection and in coordination with the selected candidate.

QUALIFICATIONS:

The ideal candidate will have experience and a high level of skill with data science software such as Python, Matlab, or R is essential. Previous experience generating graphics, images, and figures is strongly desired. (e.g., scatterplots, maps, heatmaps,). Knowledge of basic statistics, such as an undergraduate course, is preferred but not required. Previous experience with geospatial data (e.g., kml, GIS, GeoPandas, CartoDB) is preferred but not required. An interest in physical science/oceanography is preferred but not required. Familiarity with Unix is preferred. Previous high performance computing experience is not required.

ACADEMIC LEVEL:

Degree received within the last 60 months or currently pursuing:

- Bachelor's
- Master's
- Doctoral

DISCIPLINE NEEDED:

- Computer, Information, and Data Sciences
- Earth and Geosciences
- Environmental and Marine Sciences
- Mathematics and Statistics
- Physics
- Science & Engineering-related