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## Plymouth Marine Laboratory Oceanographic AI Researcher TINDSG-007

#artificialintelligence #machinelearning #datastudygroup

### About the Organisation

The [Plymouth Marine Laboratory](#) is an International Centre of Excellence in Marine Science & Technology and a Collaborative Centre of NERC. The research at PML contributes to the issues of global change, sustainability and pollution delivering solutions for national and international marine and coastal programmes. PML has an outstanding reputation at a national and international level for its capabilities in marine biogeochemistry and satellite Earth Observation.

### Role Description and Responsibilities

**Project title: Global decadal shifts in coccolithophore bloom distribution**

### Background Information

The only planktonic functional type that can be unambiguously detected from space are coccolithophores. This is because they are coated in thin calcite (calcium carbonate,  $\text{CaCO}_3$ ) plates or liths. When these are shed into the water, they reflect incident light like tiny mirrors making them uniquely visible not just at the sea surface but also from satellite sensors, giving the water a turquoise, milky white appearance. Using satellite Earth Observation (EO) data these calcifying 'blooms' of coccolithophores are known to occur over large areas of the global oceans.

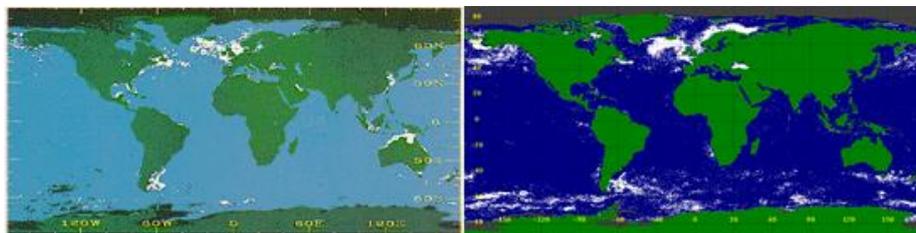


Fig 1. Presence (white) / absence of coccolithophore blooms from global analysis of satellite sensors CZCS (left) and SeaWiFS (right).

### Primary Data Sources

We have previously constructed a global 40-year timeseries of these blooms (<https://doi.org/10.5194/essd-10-2043-2018>), but now need to describe their distribution and attribute any shifts in their patterns to other system drivers such as temperature, salinity, nutrients, circulation patterns, wind fields etc.

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## Analysis Methods Required

Solving the question of what the primary driving factors are behind global coccolithophore bloom distribution is a long-standing problem in marine ecology, which various investigators have sought to answer for the past 10 – 15 years. The main difficulties are that the datasets showing their distribution globally (consistently) are relatively recently available (last 5 years). We know that they are likely driven by changes in physical and chemical forcing, but finding these patterns and linkages is difficult. Therefore, this internship will investigate the changing patterns using skills in handling Big Data and employing statistical techniques within a framework of Artificial Intelligence and Machine Learning.

## Team and Responsibilities

The intern will be part of the Marine Biogeochemistry and Observations group at PML and will work closely with the satellite EO group via the NERC Earth Observation Data Acquisition and Analysis Service (NEODAAS). They will be responsible for:

- Coding and implementing the various algorithms on the PML compute infrastructure (Python, Jupyter Notebooks)
- Keeping a high-quality record of their research and progress whilst at PML

## Expected Outcomes

The outcomes of the internship will be a well-documented investigation into the shifts in coccolithophore bloom distribution in the global ocean. The intern will be expected to deliver high-quality, well commented and documented code showing the steps taken in the project including the investigations which were not ultimately successful.

The ultimate goal of this internship is a publication in a peer-reviewed journal, which the intern will be an integral part in delivering. If successful, this internship could help settle a 15-year debate on the changes to ocean ecology driven by climate change.

The internship will also be instrumental in the preparation for a Data Study Group challenge that will follow on and expand the intern's work with the organisation. The intern will have the opportunity to represent the organization during the Data Study Group.

## Supervision and Mentorship

The intern will be directly supervised by Dr. Tim Smyth who is Head of Science for Marine Biogeochemistry and Observations at the Plymouth Marine Laboratory. There will also be collaboration and mentorship with other groups within the laboratory, in particular with NEODAAS.

## Ideal Intern

The ideal candidate will have:

- Experience in handling multiple large datasets and implementing algorithms in Python/ Jupyter notebooks
- Familiarity with self-descriptive data formats such as netCDF, HDF and have skills with their manipulation within a coding framework.

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- Experience of various AI / ML techniques, ideally using GPU technology; AI / ML techniques to include pattern recognition, neural networks and Bayesian reasoning
- Knowledge of Big Data standards and interoperability and have an ability to design a coding framework in order to address scientific questions
- Good organisational and time management skills and be well motivated to work independently as well as part of a wider team.
- An aptitude of turning their skills towards answering a long-standing question in oceanography and biogeochemistry.

### **Internship Logistics**

The location for this internship will be at the Plymouth Marine Laboratory with the option of remote or hybrid working.

The start date will be early November 2022 with a duration of 4 months and will be full-time.

The salary is £30000 p/a pro rata.

The point of contact for technical queries: Dr. Tim Smyth (tjism@pml.ac.uk).