Project title: Glacier meltwater-tidal water interaction in Jökulsárlón, Iceland.

Project code: OU12

Host institution: The Open University

Theme: Dynamic Earth

Key words: oceanography, glacier, numerical modelling, Iceland

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Project Highlights:

- Collection and analysis of a high resolution field data set studying ocean driven glacier melt.
- Learn about and develop an ocean model based on a real world situation.
- Development of new ocean ice interaction physics.

Overview:

Jökulsárlón lagoon is an enclosed proglacial lake on the southeast coast of Iceland. It borders the retreating Breiðamerkurjökull (FIGURE 1) which flows down from the Vatnajökull ice cap and discharges into the lake. The lake itself is connected to the North Atlantic Ocean through a narrow channel only ~80 m wide and ~6 m deep and all tidal and residual flows in and out of the lake are through this narrow channel. The lagoon itself is a relatively new feature that was only formed in the 1930’s as the glacier began to retreat. As the glacier configuration is not stable it will continue to retreat and consequently the lake will expand. This excellent, beautiful and accessible field site is a perfect field “laboratory” for investigating the effect of the heat from the ocean on glacier ice.

In this project you will investigate the oceanographic drivers of the melt and retreat of Breiðamerkurjökull through: field measurements of water temperature, salinity and velocity; the development of a small scale ocean model of the system; and derivation of analytical models of glacier melt based on your observations. The configuration of the glacier and lagoon are very good for close range small scale measurements of physical parameters. The unique data set that will be collected has the potential to reveal significant insights into the retreat of ice driven by oceanic forcing (e.g. Motyka et al., 2013). Such physics is critical for understanding the observed retreat and decay of the ice sheets at the edge of Greenland and Antarctica (Inall et al., 2014; Straneo and Heimbach, 2013; Straneo and Cenedese 2015). But it is impossible to do this project in those regions because we can only rarely get in close proximity to an ice front and logistical constraints are formidable.

Figure 1: The ice front of Breiðamerkurjökull along which a unique hydrographic data set will be collected.

Methodology:

You will be trained in the design and collection of a high quality oceanographic data set after which you will then go into the field. You will also be trained in the analysis of the data you collect along with how to integrate that with information in the climate archives. Over three field seasons in the lagoon you will collect a data set to both understand the environment, and investigate the near ice ocean physics. To support your analysis you will work with historical climate data and MODIS satellite imagery. Once you have extracted and mapped the glacier meltwater signal close to the ice face, you will test...
and develop analytical and computer models of the physical processes.

Training and skills:

For this project you will learn and develop both numerical and field techniques to support your research. You are required to be physically fit to undertake the field work in what could be potentially poor conditions. A background in physics or oceanography will be advantageous and you should have experience of computer programming. The Open University is world leading in distance learning, and online teaching opportunities via the Open University Virtual Learning Environment are also available including teaching on Massive Open Online Courses (MOOCs).

CENTA students are required to complete 45 days training throughout their PhD including a 10 day placement. In the first year, students will be trained as a single cohort on environmental science, research methods and core skills. Throughout the PhD, training will progress from core skills sets to master classes specific to CENTA research themes.

Partners and collaboration (including CASE):

The project will be based at the Open University and additional supervision will come from Dr Richard Hodgkins (Loughborough University) on glacier hydrology.

Possible timeline:

Year 1: Initial analysis of oceanographic data and field measurements in Jökulsárlón Lagoon. Initial testing of theoretical models of glacier ocean interaction. Development of forcing fields for a numerical ocean model of the system.

Year 2: Set up of a small scale ocean model of Jökulsárlón lagoon, and initialisation. Two visits to the lagoon in spring and autumn to collect two oceanographic data sets at the beginning and end of the melt season. Analysis of this data and writing up of observational paper. Development of theoretical models of melt plume physics.

Year 3: Analysis of model output and continued development of an analytical model of the processes observed in the environment. Writing up of journal articles and thesis.

Further reading:


Further details:

Students should have a strong background in physics or oceanography; and an enthusiasm for collecting your own data, numerical analysis and computer programming. You should also have a driving licence and enjoy working in remote field areas. Please contact Mark Brandon (mark.brandon@open.ac.uk) for further information.

Applications should include:

- a cover letter outlining why the project is of interest and how their skills match those required,
- an academic CV containing contact details of three academic references
- a CENTA application form, downloadable from www.centa.org.uk/media/1202/centa-studentship-application-form.docx
- and an Open University application form, downloadable from: http://www.open.ac.uk/students/research/sites/www.open.ac.uk.students.research/files/documents/Application%20form.docx

Apologies that some bits of information are requested multiple times on different forms. Please fill in everything requested.

Applications should be sent to STEM-EEES-PhD-Student-Recruitment@open.ac.uk by 5 pm on 25th January 2017