SPITFIRE Doctoral Training Partnership (DTP)

Research Experience Placement Project 2018

Lead Supervisor:	France Gerard
Email:	ffg@ceh.ac.uk
University/Research Organisation:	Centre for Ecology and Hydrology
Department:	Climate System Group
Project Title:	Exploiting high spatial resolution Radar time series to map land cover in Shimoga, India

Total Student Support Costs: £	£2000 (£200 for 10 weeks)
Based on a minimum of £200/week full time for a minimum of 8 weeks and maximum of 10 weeks and a £500 Research and Training Support Grant.	

Proposed Start Date: 25 June 2018	Proposed End Date: 31 August 2018
Projects should run over the summer vacation and we recommend that projects will have terminated by 21 September 2018.	

Brief Summary – please provide a brief summary (maximum 300 words) of the project.
This should include:
- *Project outline;*
- *Links to staff/School/Centre activity as appropriate;*
- *Supervisory arrangement;*
- *How space/equipment/supporting resource demands will be met;*
- *Elements of the project that will incorporate elements other than computer/modelling e.g. fieldwork and data collection;*
- *How the project will enhance the skills of the appointed student;*
- *Any intellectual property rights concerns that may arise from the work.*

A Global Change Research Fund Project is investigating the environmental and human drivers of Kyasanur Forest disease (KFD), an emerging vector borne disease in India. An important hypothesis is that changes in the landscape structure are facilitating the spread and exposure risk of this disease. To prove this hypothesis the project has mapped the land cover of the study areas using optical imagery (Landsat TM). A field campaign to validate these maps is planned in May'18. A high incidence of cloud in the area is expected to have influenced the accuracy of the maps. Radar observations are not affected by cloud and the information they contain is different from optical observations. We have developed a processing chain that enables us to automatically download and pre-process recently available Sentinel-1 radar data, so there is scope to re-visit and improve the mapping using Sentinel-1 radar data.

Earth Observation is the perfect vehicle to expose individuals with quantitative skills to environmental sciences: The processing, analysis and interpretation of radar data, requires a strong background in mathematics and physics. While the derived variables provide insights into

environmental processes. Also in CEH, research groups are multi-disciplinary and research is very much a team effort. As a result the student will experience a variety of environmental research, have access to a wide range of expertise and experience a team based research organisation. The student will gain specialised understanding of radar imagery and how it interacts with vegetation. The project will allow the student to investigate, take initiative and develop problem solving skills. The student will learn how to write code to manipulate multi-dimensional binary data. The student will be given the opportunity to present their work as it progresses at group meetings. This will help increase their confidence and improve their presentational skills.

The main supervisors will be Dr. France Gerard and Dr. Beth Purse with further support from EO expert Charles George.
The student will have a desk and desktop in a shared office (max 3 people) with access to local Linux cluster and JASMIN.

Please give an indicative timescale for the student's work over the length of the project: (maximum 150 words).
This should include:
- *The broad tasks the student will undertake;*
- *An indicative timescale for these tasks.*

The objective of the internship is to map land cover for the Shimoga district using Sentinel-1 time series of radar. The work will consist of:

- Familiarisation with the sentinel 1 radar, how it is produced and how it interacts with the land surface, sequence of pre-processing steps and code and cloud environment used. Week 1 -2
- Build time-series of radar data with more recent sentinel-1 acquisitions. Week 3
- Engage in discussions with project team to establish mapping requirement of project. Week 3
- Review options available to classify radar data into land cover. Week 3 - 5
- Develop and implement classification algorithm. Week 5 - 8
- Interact with Indian collaborator to optimise training and validation of algorithm. Week 6-8
- Compare the radar derived map with existing Landsat TM derived map. Week 8 - 9
- If time allows: Investigate options combining Radar with TM imagery for improved mapping. Week 9-10

Proposed procedure for appointing students, including selection criteria:

Please identify specific criteria that should be considered for the selection of placement students e.g. specific quantitative skills that may be required, subject knowledge etc. If a student has been pre-selected, or the research area has been led by the student, please provide the student's contact details, and a summary of their suitability for the SPITFIRE DTP REP programme.

A good background in Physics and Math (e.g Physical Geography, Physics)
Evidence of some programming experience in R, Python or C
An interest in remote sensing