Research Experience Placement (REP) Scheme 2026

Supervisor Project Proforma

Project title:	From Space to Streamflow: Monitoring River Discharge Dynamics Across Great Britain Using Remote Sensing
Host Institution:	University of Warwick
Project supervisor (name, department):	Feng Mao, School for Cross-faculty Studies
Project enquiries (supervisor email):	Feng.Mao@warwick.ac.uk
Co-Supervisor, if any (name, department):	
Proposed start date and weekly hours: (please note project must be of 6 weeks duration)	Monday, 29 June 2026 to Friday, 7 August 2026 6 weeks, 36 hours per week

Please provide a short paragraph or couple of sentences summarising the project to encourage potential applicants to apply (max 75 words)**:**

This project will explore how satellite observations can be used to monitor river discharge across Great Britain, combining geospatial analysis in Google Earth Engine with field-based observations in the West Midlands. You will gain hands-on experience in remote sensing, quantitative analysis, and hydrological research while contributing to an emerging approach for water monitoring.

Project description (max 700 words, 1-2 figures may be included):
Proposed projects must:

- Have a clearly defined objective
- Be within the science remit of NERC
- Be feasible for a student to complete within the timescale of the placement
- Include more than purely a computer/modelling component i.e., some element of fieldwork, data collection, activity to give an understanding of the wider context including participation in lab/team meetings, networking, and training etc.
- Give scope for thought and initiative on the part of the student and should not use the student as a general assistant
- Be based at an eligible UK research organisation (remote placements from within the UK are also an option for enabling inclusivity)

River flow is fundamental to water resources, freshwater ecosystems, drought preparedness, and flood risk management. Yet direct monitoring of river discharge still relies heavily on gauging stations, which are costly to install and maintain and do not provide complete spatial coverage across catchments. Remote sensing offers an important complementary approach by enabling surface water dynamics to be monitored consistently over large areas. Recent research (Mao et al, 2025) has shown that changes in relative surface water extent derived from satellite observations can provide a simple and effective way to capture river discharge dynamics. This project will build a Great Britain-focused case study to test and extend this approach.

The overall aim of the placement is to investigate how changes in satellite-observed surface water extent relate to river discharge dynamics across catchments in Great Britain, with a particular focus on a West Midlands case study for local validation. The student will explore whether the relationship between discharge and relative surface water extent differs between catchments, and whether these differences can be explained by factors such as topography, river size, floodplain setting, and land cover. In doing so, the project will contribute to understanding how remote sensing can support hydrological monitoring in gauged, poorly gauged, and potentially ungauged river basins across Great Britain.

During the placement, the student will work with remotely sensed surface water data, river discharge records, and catchment-scale geospatial data. With training and supervision, they will use Google Earth Engine and GIS-based workflows to derive time series of relative surface water extent for selected catchments, link these data to observed discharge records, and test simple statistical relationships between the two.

A key part of the project will be to move beyond identifying correlations and to consider the hydrological mechanisms behind them. For example, the student will examine why some catchments may show a clearer or more linear response than others, and how river and floodplain characteristics may influence the signal detected from space. By comparing catchments from different environmental settings within Great Britain, the project will also provide insight into how climate, landscape, and catchment form shape the usefulness of remote sensing for river monitoring. There will be genuine scope for the student to shape the project by helping select comparison catchments, testing explanatory variables, and suggesting how the workflow could be improved.

To ensure that the placement includes more than desk-based analysis, the project will also involve a small field-based component in the West Midlands. The student will visit selected river sites to observe channel and floodplain conditions, discuss how local morphology and landscape setting influence remotely sensed water patterns, and collect site notes and photographs to support interpretation of the analysis. These observations, together with independent gauge data, will be used to evaluate how well the remote-sensing-based approach represents on-the-ground water dynamics.

By the end of the six weeks, the student will produce a Great Britain-based case study dataset, a set of exploratory analyses linking discharge and relative surface water extent, and a short report or presentation summarising the main findings, limitations, and next steps. Depending on progress, the student may also help identify a prototype workflow for applying the method more widely in future research on river monitoring and water risk.

The placement will provide training in hydrology, remote sensing, geospatial analysis, Google Earth Engine, quantitative data analysis, and research communication. The student will be embedded in an active environmental research environment and will participate in team meetings and relevant training activities. Overall, the project will offer a rewarding opportunity for a motivated student to gain valuable research experience in water science while contributing to new approaches for understanding and monitoring river systems across Great Britain.

Project timeline:

Over the six-week placement, the student will first be introduced to the project and key concepts in hydrology and remote sensing, and will conduct a brief literature review to familiarise themselves with the research frontiers and wider landscape. They will then compile and prepare satellite, discharge, and catchment datasets and develop a reproducible workflow to derive relative surface water extent time series from the Global Surface Water Explorer dataset for selected catchments across Great Britain. The middle stage of the project will focus on exploratory quantitative analysis, including testing relationships between surface water extent and river discharge, comparing patterns across catchments, and undertaking a field visit in the West Midlands to observe channel and floodplain conditions and support local validation. In the final stage, the student will refine and interpret the results, assess the influence of catchment characteristics, and prepare a short report and presentation summarising the findings, limitations, and recommendations for future work.

Candidate requirements:

Essential

- A strong interest in water science, hydrology, remote sensing, or environmental change.
- Good quantitative skills and confidence in working with numerical data, graphs, and basic statistical analysis.
- Some experience with statistical, geospatial, and remote sensing methods, and in applying them to real-world environmental questions.
- Ability to work carefully, independently, and in a well-organised manner.
- Willingness to take part in both desk-based analysis and a small field-based component.

Desirable

- Previous study in environmental science, geography, Earth and environmental sciences, hydrology, computer science, or a related subject.
- Demonstrated experience in data analysis, coding, or scripting, for example in R or Python.
- Working knowledge of GIS, remote sensing, or Google Earth Engine.
- Experience of interpreting scientific literature and presenting findings clearly in written or verbal form.

Background reading and references:

Mao, F., Shanafield, M., Ouellet, V., Hannah, D. M., & Krause, S. (2025). Assessing river discharge dynamics through relative surface water extent changes in river basins. iScience, 28(1). https://doi.org/10.1016/j.isci.2024.111598

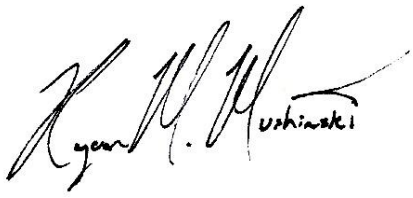
Junqueira, A. M., Mao, F., Mendes, T. S. G., Simões, S. J. C., Balestieri, J. A. P., & Hannah, D. M. (2021). Estimation of river flow using CubeSats remote sensing. Science of the Total Environment, 788, 147762. https://doi.org/10.1016/j.scitotenv.2021.147762

Google Earth Engine Tutorials. https://developers.google.com/earth-engine/tutorials/

To be completed by institutional CENTA PoC

I confirm that:

- The host institution takes responsibility for selecting a suitable undergraduate student and ensuring and confirming their eligibility under the NERC REP student eligibility criteria.
- This REP project falls within the NERC remit, is of suitable quality and meets the REP research project criteria.
- Appropriate supervisory arrangements are in place.
- The application processes used will be inclusive and accessible.
- Reasonable adjustments will be made for students that need them whilst undertaking placements.
- The placement will be carried out in accordance with all applicable ethical, legal and regulatory requirements including but not limited to relevant provisions of the General Data Protection Regulation, the Data Protection Act 2018, the Bribery Act 2010, the Fraud Act 2006, the Equality Act 2010 and the Modern Slavery Act 2015.
- The host organisation takes responsibility for identification, protection and exploitation of any intellectual property rights arising from the work.
- All facilities, agreements about access and collaborations necessary for the work will be obtained before the work commences and can be ensured through the period of the work.
- All costs awarded by NERC for the REPs will be used and accounted for appropriately.
- A report of the project by the student will be submitted no later than one week after the end date of the placement or Friday 25th September 2026, whichever falls first.
- A PhD interview (where possible) will be offered to all students who have completed a REP within the CENTA Doctoral Landscape Award.

Signed: 

Date: 13 March 2026

Position: Associate Professor