Hydro-JULES Education

**Project 3 - Understanding the impacts of climate variability on global near-natural river flows**

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The Sixth Assessment Report of the Intergovernmental Panel on Climate Change highlights that the sustainability of many communities worldwide could face significant threats due changes in hydrological extremes (i.e., floods and droughts) and the transitions between them. Understanding observed and future trends and variability of water resources at the global scale is crucial for informing climate change adaptation. However, hydrological trends are often confounded by human disturbances, such as dams, abstraction for irrigation or domestic/industrial water use. The ROBIN project has assembled a global Reference Hydrometric Network (RHN), consisting of 3000+ near-natural catchments with quality-checked river flow measurements, some stretching back to the early 20$^{th}$ century. While studies have investigated the effects of large-scale climate variability on river flows, few studies have attempted to disentangle the complex influence of climate variability on hydrological regimes at near-natural catchments at the global scale.

UKCEH researchers have begun analysing the river flow observations within the ROBIN dataset to identify trends in low flows and hydrological droughts. This project aims to expand recent analysis to characterise general river flow and flood variability, identify the influence of different modes of climate variability on flood regimes and characterise transitions between floods and droughts. The project will have collaborations and expertise from scientists within UKCEH and beyond. The specific objectives of this project are to:

- Characterise seasonal river flow variability across all ROBIN catchments
- Identify flood events and transitions between extreme flood and drought events at near-natural river catchments and compute observed trends in flood and transition metrics following established trend detection frameworks (e.g. ROBIN code library)
- Understand statistical relationships between river flows and modes of climate variability (e.g. El Nino Southern Oscillation, Atlantic Multi-decadal Variability) at varying time lags

The output of this project will expand our understanding of global flood variability and contribute to evidence that would provide baseline data to help constrain future river flow and flood projections. During this project, the student will gain an understanding of hydro-meteorology, established trend detection methods, R/python programming and a flavour of academic research. The successful candidate for this project should possess:

- Strong numeracy/statistical skills and effective oral and written communication abilities. Proficiency in the Python/R programming language is essential
- Candidates should either hold or be actively pursuing an undergraduate degree in earth/environmental sciences or a related scientific discipline.
- Some experience using high-performance computing (HPC) would be beneficial, but not mandatory.