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Three PhD positions available in project: 'Improving water quality prediction by addressing the flow pathway-water transit time-water quality nexus'

We are hiring three PhD positions funded through a grant from the Australian Research Council (DP230100618) starting in 2023: **'Improving water quality prediction by addressing the flow pathway-water transit time-water quality nexus'**

The selected candidates will join an interdisciplinary team of hydrologists, biogeochemists and modellers from the Australian National University (Dr Danlu Guo), University of Melbourne (Prof Andrew Western, Associate Prof Meenakshi Arora) and Monash University (Prof Ian Cartwright) and will be based at one of these universities.

Overview:

Poor stream water quality is a critical problem in Australia and globally. Stream water quality depends directly on pathways and time taken (transit time) for water to transport pollutants through catchments. Predicting these pathways and transit times is highly challenging and, despite their importance, they are rarely effectively incorporated in water quality models. This hampers our ability to accurately describe the transport of nutrients and other contaminants into streams, thus hindering water quality prediction.

There are 3 PhD positions available within the project. These studies will together improve the capacity to model the movement of water from rainfall to streams by making use of water quality data routinely collected in Australian catchments. Through these projects, we aim to improve stream water quality prediction by a step change in the modelling of transport pathways and transit times through catchments and then extend the modelling to incorporate the fate of nitrate in the catchment. The expected outcomes include improving planning and management of water quality in our rivers, lakes and estuaries, and improving the health of water bodies and water supplies.

We are seeking high-quality applicants with the following qualification and attributes, with further requirements listed in section 'Details on individual PhD positions':

1. A MSc or a BSc with 1st class Honours (or equivalent) in a relevant science discipline such as environmental science, hydrology or engineering.
2. Solid knowledge of earth sciences and hydrology especially in catchment hydrology and water quality processes.
3. Robust numerical and programming skills (MATLAB, R or Python).
4. Good verbal and written communication skills.

Selected candidates must also fulfill the eligibility requirements for the Postgraduate Research programs at the host universities (including English language proficiency for international students).

Application and enquiry:

All interested candidates should email the supervisor of the corresponding project describing their background, research experience and interest relevant to the overall project and the specific PhD position they are applying for (see the section below), along with transcripts, CV, English Language proficiency certificates, and any published papers.

Details of individual PhD positions:

PhD project 1:

Understanding transit times and the sources of stream water, based at Monash University, Melbourne. Supervisor Prof Ian Cartwright (ian.cartwright@monash.edu)

This PhD project will use tritium, stable isotopes, and major ions to understand changing transit times and sources of water in the study catchments at different flow conditions and timescales. The project will involve periodic sampling of streams, rainfall and water from within the catchments at different flow conditions. The geochemical data will be used to constrain dynamic models of transit times in these catchments.

In addition to the above general selection criteria, the student should have experience in collecting and interpreting environmental isotope data and have a current driver licence.

Benefits:

1. Full fee waiver
2. A tax-free PhD stipend of \$33,000 per year (2023 rate) for 3.5 years.
3. Health Insurance and relocation allowances

Further information on the Monash PhD program is available at

<https://www.monash.edu/graduate-research/study/apply>

PhD project 2:

Model development to predict the pathways and ages of stream flow, based at Australian National University, Canberra; Supervisor Dr Danlu Guo (Danlu.guo@anu.edu.au)

This PhD project will develop models to predict the pathways and ages of stream flow, thus help improving the modelling of stream water quality. The PhD project will also enhance the predictive power of the developed model across multiple catchments with various hydrologic, climatic and geologic features.

In addition to the abovementioned general selection criteria, the suitable candidate should have experience working with, and managing field monitoring data. Experience/knowledge in data-driven models and/or machine learning techniques is an advantage.

Benefits:

1. Full fee waiver
2. A tax-free PhD stipend of at \$34,000 per year (2023 rate) for 3 years with the possibility of a 6-month extension in approved circumstances.
3. Other ANU PhD benefits including Travel and Removal allowances, see: <https://www.anu.edu.au/study/scholarships/find-a-scholarship/anu-phd-scholarships>

PhD project 3:

Incorporating reaction times into transit time models to improve the prediction of non-conservative pollutants (nitrate) in catchments, based at University of Melbourne; Supervisors A/Prof Meenakshi Arora (marora@unimelb.edu.au) and Prof Andrew Western (a.western@unimelb.edu.au).

This PhD project will extend the EC-based transit time model to non-conservative pollutants, specifically nutrients, that are important from a management point of view. The key challenge to an accurate representation of non-conservative pollutants is to incorporate biogeochemical reactions. This project will use available data to determine the reaction rates for nitrification and denitrification in the catchment waters and hence both the understanding and representation of nutrient dynamics with improved transit time information.

In addition to the abovementioned general selection criteria, the suitable candidate should have an understanding of nitrogen cycling, experience working with, and managing field monitoring data. Experience/knowledge in physical water quality models (e.g., Source) is an advantage.

Benefits:

1. Full fee waiver
2. PhD stipend of at the \$34,400 per year (2023 rate) for up to 3.5 years, free of tax.
3. Health Insurance for the duration of the project

Further information on the Melbourne PhD program is available at

<https://study.unimelb.edu.au/find/courses/graduate/doctor-of-philosophy-engineering-and-it/>