

# 2022 Global Change Youth Research Program

## Research Projects offered by the School of Mathematics and Physics (SMP)

### How to apply:

- The [2022 Global Change Youth Research program](#) is offered by the School of Mathematics and Physics (SMP) and UQ Student Employability Centre.
- **Application Conditions and information**
  - The projects will run intensively (20-36 hours a week) for 4 weeks in the Winter Vacation period, and then for the equivalent of one day a week during semester 2, 2022.
  - Scholars will be under the age of 25, and
  - Students must be enrolled in a program of study at UQ at the time of application and maintain ongoing enrolment in a program at UQ for the entirety of Semester 2, 2022

Below you will find the list of available SMP projects for students undertaking mathematics, statistics, and physics.

- (1) Browse the list of projects.
- (2) Contact the supervisor in the area of your interest, or the contact person listed, to discuss your interest and eligibility to undertake their research project. Gain the research project supervisor's tentative approval and include this with your full UQ Winter Research Program application.
- (3) Applications open on **Monday May 9** and close by **Sunday 29 May**
- (4) Important dates:

June 20 – 25	'Getting started week' ( <i>Welcome Event, Research Skills Sessions, etc</i> )
June 27	Research projects commence
October 29	Research projects concludes
December 9	Student project report due to supervisor.
February 2023	UQ Youth Research Showcase Event
April 2023	Student Researchers 2022 will present at the Youth Forum in 2023.

### IMPORTANT NOTE TO APPLICANTS:

- Check your eligibility for the program.
- Read the Conditions of Participation before applying.
- Late applications will not be accepted.

## 2022 Global Change Youth Research Program -Research Project Description

<b>Primary Supervisor:</b>	<b>Mahdi Abolghasemi</b>
<b>Primary Supervisor's contact details:</b>	m.abolghasemi@uq.edu.au
<b>Project title:</b> SMP-GCYRP-22-01	<b>Food supply chain risk management, investigating the role of digitalisation</b>
<b>Description:</b>	<p>COVID-19 has imposed a great risk to the supply chains across the world and disrupted the operations in an unprecedented way locally and globally. Several important supply chains such as food were largely affected by surge in demand during the pandemic. Since these supply chains are often built upon a usually predictable demands, they were unable to respond to the unforeseen pandemic request. There were other disruptions in manufacturing, distribution of supply chains locally and globally that caused lacking essential and non-essential items like rice, bread, and spaghetti, just to mention a few. Researchers, practitioners and governments, initiated ideas, and proposed solutions for resolving the problems at least temporarily. Others suggested longer-term solutions like digitalizing supply chains, dual sourcing and diversifying suppliers, localizing supply chains, increasing visibility in the supply chain, improving the forecasting and risk management practices, and so forth.</p> <p><i>This project will investigate the methodologies and technologies for digitalising supply chains and their impacts for avoiding disruption to future food supply chains.</i></p>
<b>Expected outcomes and deliverables:</b>	<p>You will learn:</p> <p><i>What is food supply chain and what are the problems threatening food supply chains.</i></p> <p>How to gather data for a research project.</p> <p><i>Digitalisation tools such as Decision Support Systems and Forecasting techniques that can be used for food risk management.</i></p> <p><i>There is an opportunity to:</i></p> <p><i>Present in national or international conferences.</i></p> <p><i>Writing an article for international journals.</i></p> <p><i>Collaborate with other researchers in the UK universities.</i></p>
<b>Project duration, hours of engagement (Fixed Term)</b>	<i>Student researchers engage in project work between 20 – 36 hours per week, for four consecutive weeks (Winter vacation break – June 27 to July 22); and during semester 2, student researchers engage with the project one day a week.</i>
<b># Scholarship Positions Available</b>	1
<b>Which Youth Research Priority does your project align to?</b>	Food Future
<b>Suitable for:</b>	<i>Bachelor(honours) and master students</i>
<b>COLLABORATORS?</b> If you are collaborating with an external organisation on this, please state which organisation?	n/a

## 2022 Global Change Youth Research Program - Research Project Description

<b>Primary Supervisor:</b>	<b>Mahdi Abolghasemi</b>
<b>Primary Supervisor's contact details:</b>	<b>m.abolghasemi@uq.edu.au</b>
<b>Project title:</b>  SMP-GCYRP-22-02	<b>Renewable energy generation forecasting</b>
<b>Description:</b>	<p>Renewable energies such as wind and solar powers are extremely important not only for the future of energy market but also for protecting the environment and ensuring a sustainable growth. The intermittent nature of renewable energies poses a big challenge to users and market to take the full advantage of these resources. Accurate prediction of the potential power that can be generated from wind and solar farms is important for the stability of electricity network. <i>In this project, we will investigate datasets for solar and wind farms and aim to build forecasting models that can predict the power in short and medium terms.</i></p> <p><i>To be successful for this project you would need to be familiar with data analytics, be proficient in programming with R or Python and have a knowledge of statistical, machine learning or deep learning models would be great.</i></p>
<b>Expected outcomes and deliverables:</b>	<p>You will learn:</p> <p><i>Time series analysis of energy data</i> gathering data for a research project. <i>Time series statistical and machine learning that can be used for renewable energies forecasting</i></p> <p><i>There is an opportunity to:</i> <i>Present in national or international conferences.</i> <i>Writing an article for international journals.</i> <i>Collaborate with other researchers in the UK universities.</i></p>
<b>Project duration, hours of engagement (Fixed Term)</b>	<p><i>Duration Requirements for this program is 6.2 weeks.</i> <i>Student researchers engage in project work between 20 – 36 hours per week, for four consecutive weeks (Winter vacation break – June 27 to July 22); and during semester 2, student researchers engage with the project one day a week.</i></p>
<b># Scholarship Positions Available</b>	<i>1</i>
<b>Which Youth Research Priority does your project align to?</b>	Sustainability and Environment
<b>Suitable for:</b>	<i>Bachelor(honours) and master students</i>
<b>COLLABORATORS?</b>  If you are collaborating with an external organisation on this, please state which organisation?	

## 2022 Global Change Youth Research Program - Research Project Description

<b>Primary Supervisor:</b>	A/Prof Cecilia González Tokman
<b>Primary Supervisor's contact details:</b>	<a href="mailto:cecilia.gt@uq.edu.au">cecilia.gt@uq.edu.au</a>
<b>Project title:</b> SMP-GCYRP-22-03	<b>Random dynamical systems analysis of quantitative and qualitative effects of rare but large disruptions in transport networks</b>
<b>Description:</b>	This project will investigate the effect that large and infrequent changes have on long-term features of dynamical systems. As a main example, the project will focus on Markov chain models of transport networks undergoing a variety of regular or accidental disruptions. Within a random dynamical systems framework, our approach will combine rigorous ergodic-theoretical tools with numerical simulations to gain an in-depth understanding of how and why abrupt and rare changes in the system's evolution rule affect relevant aspects of the long-term evolution of the system.
<b>Expected outcomes and deliverables:</b>	Identify and develop random dynamical systems models of transport networks with regular and random disruptions. Develop measures of 'disruption' which are both significant to transport networks and amenable to rigorous and/or numerical ergodic theory analysis. Prepare a written report and an oral presentation of their findings.
<b>Project duration, hours of engagement (Fixed Term)</b>	<i>Duration Requirements for this program is 6.2 weeks.</i>  <i>Student researchers engage in project work between 20 – 36 hours per week, for four consecutive weeks (Winter vacation break – June 27 to July 22); and during semester 2, student researchers engage with the project one day a week.</i>
<b># Scholarship Positions Available</b>	1
<b>Which Youth Research Priority does your project align to?</b>	Transport
<b>Suitable for:</b>	<i>Honours students with some background in dynamical systems and/or ergodic theory. Please note, as this program is fully funded by Qld Dept of Environment and Science, <b>Scholars MUST BE under 25 years of age AND currently enrolled in a UQ program for the entirety of Semester 2 2022</b></i>
<b>COLLABORATORS? If you are collaborating with an external organisation on this, please state which organisation?</b>	n/a

## 2022 Global Change Youth Research Program - Research Project Description

<b>Primary Supervisor:</b>	<b>Associate Professor Cecilia González Tokman</b>
<b>Primary Supervisor's contact details:</b>	<a href="mailto:cecilia.gt@uq.edu.au">cecilia.gt@uq.edu.au</a>
<b>Project title:</b> SMP-GCYRP-22-04	<b>Spectral stability, transfer operators and predictability for dynamical systems in a changing environment</b>
<b>Description:</b>	<p>Transfer operators play an important role in the study of complicated dynamical systems. Since the early XXI century, spectral decompositions of such operators have been used to study slowly-mixing regions of the oceans – for example responsible for phenomena such as the Great Pacific Garbage Patch. More recently, similar approaches have been employed to investigate and track similar structures in systems evolving in a changing environment (e.g. reflecting the presence of seasonal or random variations in temperature or other important model parameters). Examples include oceanic eddies, and other slowly decaying ‘modes’ in idealised models.</p> <p>This project aims to strengthen the connection between the concepts of ‘spectral (in)stability’ in transfer operator cocycles and ‘predictability’ of large-scale features of dynamical systems. In particular, it will explore the effect of various types of noise – e.g. reflecting model uncertainty and numerical errors – in spectral-type decompositions of various models of systems evolving in a changing environment.</p>
<b>Expected outcomes and deliverables:</b>	<ul style="list-style-type: none"> <li>• Implementation and analysis of numerical schemes to approximate transfer operators associated with systems evolving in a changing environment.</li> <li>• Development of connections between abstract mathematical concepts and significant modelling aspects, relevant for the global analysis of oceanic flows, or related settings.</li> <li>• Preparation of a written report and an oral presentation of the findings.</li> </ul>
<b>Project duration, hours of engagement (Fixed Term)</b>	<p><i>Duration Requirements for this program is 6.2 weeks.</i></p> <p><i>Student researchers engage in project work between 20 – 36 hours per week, for four consecutive weeks (Winter vacation break – June 27 to July 22); and during semester 2, student researchers engage with the project one day a week.</i></p>
<b># Scholarship Positions Available</b>	1
<b>Which Youth Research Priority does your project align to?</b>	Sustainability and Environment
<b>Suitable for:</b>	<p><i>Honours students with some background in dynamical systems and/or ergodic theory. Please note, as this program is fully funded by Qld Dept of Environment and Science, Scholars MUST BE under 25 years of age AND currently enrolled in a UQ program for the entirety of Semester 2 2022</i></p>
<b>COLLABORATORS? If you are collaborating with an external organisation on this, please state which organisation?</b>	n/a

