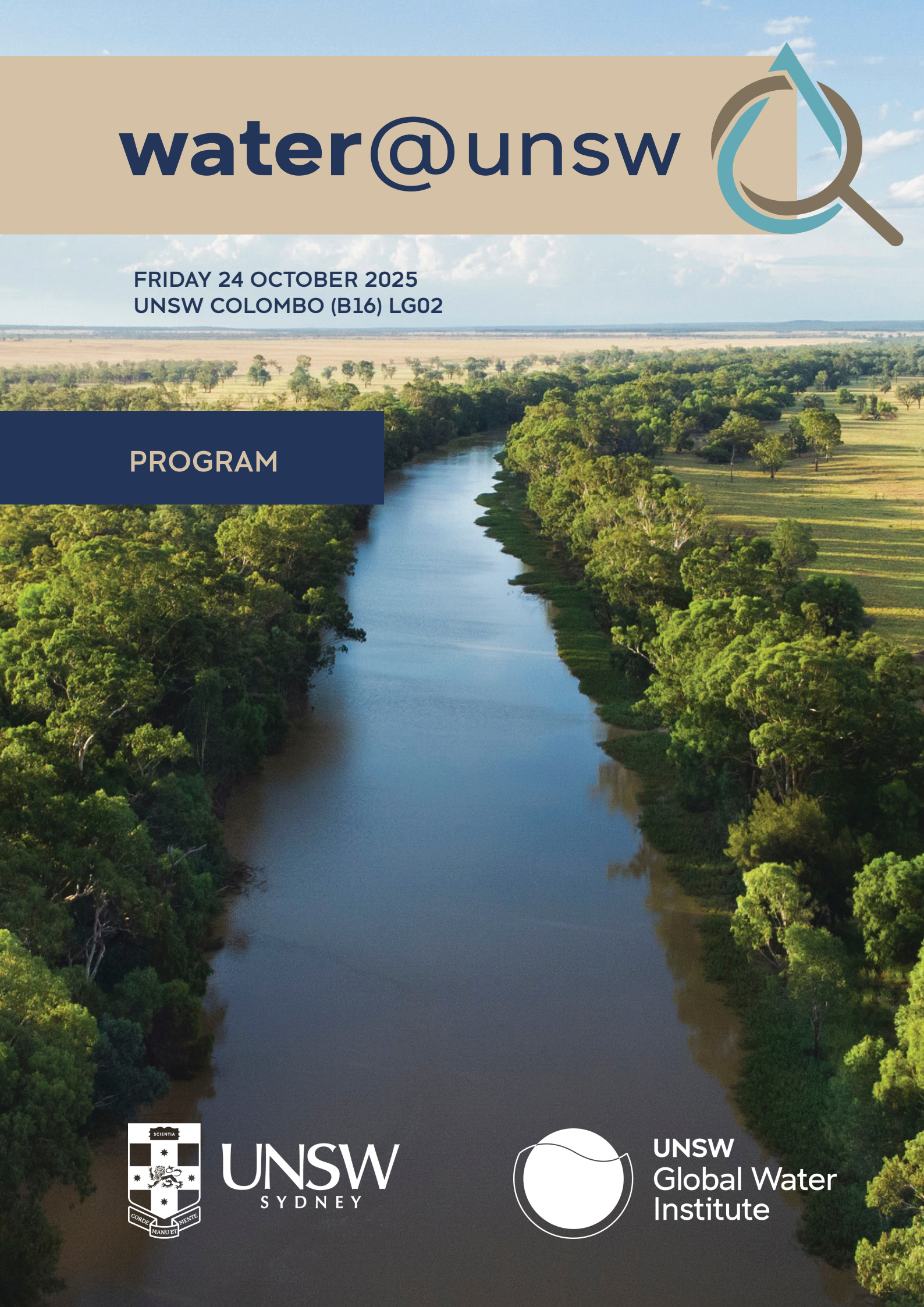
water@unsw

FRIDAY 24 OCTOBER 2025
UNSW COLOMBO (B16) LG02

PROGRAM



UNSW SYDNEY

UNSW Global Water Institute

MORNING SESSION 1
SESSION CHAIR: DR NARAS RAO

Time	Activity	Presenter
9:00 A.M.	Arrivals and Registration	
9:20 A.M.	Welcome	Dr Naras Rao
9:30 A.M.	Keynote: The importance of First Nations involvement in all areas of water management	A/Prof Rene Woods
10:00 A.M.	Environmental burden of Per- and Polyfluoroalkyl Substances (PFAS) in global soils sediments and biosolids	Dr Yi Gao
10:10 A.M.	Understanding the Influence of Urbanization on Rainfall in Sydney Using High-Resolution Modeling and Satellite Datasets	Mr Shankar Sharma
10:20 A.M.	Genotypic diversity and presence of intracellular bacteria in Acanthamoeba strains isolated from ocular infections at a referral eye hospital in Sydney, Australia	Mr Yalewayker Tegegne Asrat
10:30 A.M.	**Morning tea**	

MORNING SESSION 2
SESSION CHAIR: DR NARAS RAO

Time	Activity	Presenter
10:50 A.M.	Enhancing the predictability of gravity variations for regional hydrology	Ms Dinuka Kankanige
11:00 A.M.	Innovative Solutions for Fish Passage	Dr Jimmy Jaghoro Hilly
11:10 A.M.	Restoring Sydney's crayweed forests: an update on Operation Crayweed	Dr Claudia Santori
11:20 A.M.	Shoreline modelling on embayed beaches using planform equations	Ms Bixuan Dong
11:30 A.M.	Kinetics and Mechanism of Copper-Mediated Fenton Processes for Pollutant Degradation	Dr Maximiliano Ferrer
11:40 P.M.	Odour emissions across the biosolids lifecycle	Dr Thais N. Guerrero
11:50 P.M.	What policy and institutional arrangements are needed for effective cyanobacterial management in a changing global environment?	Mr Theodorus Johannes (John) Verhoeven
12:00 P.M.	Seasonal to annual forecasting of shoreline change across Australia using statistical time series techniques	Ms Katie Wilson
12:10 P.M.	Design and Pilot Deployment of Floating Mangrove Wetlands in Australia and Fiji	Dr Dana Tothova
12:20 P.M.	Enhancing Turf Irrigation using Ultrafine Bubble Technology	Dr Amr Omar
12:30 P.M.	**Lunch break with e-Poster session**	

AFTERNOON SESSION 1
SESSION CHAIR: DR DAISY CHU

Time	Activity	Presenter
1:20 P.M.	Keynote: Opportunities and challenges in transitioning between academia and industry	Dr Yulia Shutova
1:50 P.M.	A National Risk Management Framework for Biosolids	Ms Marilyn Braine
2:00 P.M.	Influence of Bubble Size on Ozonation Efficiency on C. vulgaris Cell Inactivation	Ms Kanruethai (Amy) Charoensook
2:10 P.M.	Hook, Light and Sinker – Increasing fish attraction in Pipe Fishways using fish phototactic response to coloured light	Ms Emma Hu
2:20 P.M.	Fishing for Data: Closing Coastal Gaps through Industry–Science Partnerships	Dr Veronique Lago
2:30 P.M.	What Do We Know About the Environment Sustainability of Biosolids Processing Systems in Australia?	Mr Jingwen Luo
2:40 P.M.	Thirsty Data Centres: How digital infrastructures could drain NSW's water future	Dr Amr Omar
2:50 P.M.	Integrating cyanotoxin detection using LC-MS Triple Quadrupole with cell viability assessment	Dr Fitri Widhiastuti
3:00 P.M.	Rethinking Weirs: Insights from Indonesia's River Basins	Mr James Zulfan
3:10 P.M.	Beyond Source Water: Diagnosing and Controlling Algal Accumulation within DWTPs	Ms Mengxi Zhang
3:20 P.M.	**Afternoon tea with e-Poster session**	

AFTERNOON SESSION 2
SESSION CHAIR: DR DAISY CHU

Time	Activity	Presenter
3:40 P.M.	Current knowledge of traditional use of mangrove ecosystems in Pacific Islands	Dr Laura Montano
3:50 P.M.	Feasibility of Inland vs Coastal Green Hydrogen: Cost, Risk, and Water Sourcing Challenges	Ms Weizhi Zhang
4:00 P.M.	Quantifying Groundwater Contributions to CO_2 and CH_4 Emissions in Manly Creek, Sydney	Ms ZeinabBano AhaniAmineh
4:10 P.M.	Optimising Coagulation and Flocculation for Improved Water Treatment Under Dirty Water Conditions	Dr Nashwa Eltahhan
4:20 P.M.	To scale: Investigating historical extreme rainfall scaling rates in Greater Sydney using radar	Mr David Bee Olmedo
4:30 P.M.	Decades of Change: High-Resolution Observations of the East Australian Current	Dr Marina do Valle Chagas Azaneu
4:40 P.M.	Future-Proofing Coastal Cities: How Solar-Driven Desalination Can Secure Water in a Changing Climate	Mr Yingfei Huang
4.50 P.M.	**Awards ceremony and closing remarks**	

KEYNOTE SPEAKERS

A/PROF RENE WOODS

ASSOCIATE PROFESSOR OF PRACTICE, UNSW SCHOOL OF BIOLOGICAL, EARTH AND ENVIRONMENTAL SCIENCES

Rene Woods, a Nari Nari man from southwest New South Wales, Growing up on the banks of the Murrumbidgee River, Rene deeply understands the significance of water to his family, community, and way of life. With extensive involvement in Gayini (water) issues for Aboriginal people across the Murray-Darling Basin, Rene is a steadfast advocate for First Nations rights in the region. Now based on Ngunnawal and Ngambri country in Canberra, ACT, Rene is employed as the Associate Professor of Practice in the Faculty of Science at UNSW

Rene has played a pivotal role in advancing recognition of First Nations land and water practices in the Murray Darling Basin, engaging with Aboriginal and Torres Strait Islander communities for many years. Notably, he has held positions such as Chairperson of the Murray Lower Darling Rivers Indigenous Nations (2018 to 2020), Vice-chair of the Nari Nari Tribal Council, and has served with organisations including the New South Wales Department of Primary Industries Aboriginal Water Initiative (2013 to 2016). His contributions extend to various advisory roles, including the Murrumbidgee Valley Water New South Wales Customer Advisory Group (2018 to 2020) and the National Cultural Flows Research Committee (2013 to 2018), as well as serving as a panel member for former Minister Littleproud's Independent Panel for the Assessment of Social and Economic Conditions of Murray-Darling Basin communities.

In December 2020, Rene made history as the first Aboriginal person appointed as a Murray Darling Basin Authority Board Member. Rene believes in the collective effort to achieve a strong, healthy river system and healthier communities. He envisions Australia leading the world in developing water management arrangements in partnership with First Nations peoples that address both present needs and future aspirations.

DR YULIA SHUTOVA

MANAGING DIRECTOR, AQUALUKYA

Dr Yulia Shutova is an engineer and researcher with almost 20 years' experience in both Drinking Water treatment, Wastewater treatment, Recycled Water and Ground Water treatment.

Through her career she worked in various roles, including water treatment plants management and operation, postdoctoral research, water engineering consultancy and water treatment, water quality and public health advisory.

Yulia is specialising in development and implementation of strategic water quality related program of works, water quality and public health risk assessments, Catchment to customer risk assessment, Health Baste Targets assessment (HBT), integrated treatment planning, asset management and optimization, infrastructure design, operational troubleshooting, project management in Australia and globally.

ABSTRACTS

Yi Gao (Water Research Centre, Civil and Environmental Engineering)

Environmental burden of Per- and Polyfluoroalkyl Substances (PFAS) in global soils sediments and biosolids

PFAS are persistent chemicals released into the environment during production, use, and disposal, raising concerns about their potential risks to both the environment and human health. In this study, we compiled data from soil and sediment samples worldwide to assess the extent of global PFAS contamination based on regulatory thresholds and guidance values. A substantial fraction of soil and sediment samples exceeded regulatory limits, with contamination observed at sites with both known and unknown sources, with the extent of contamination depending on regulatory thresholds, PFAS species, and sources. Identifying the original sources of PFAS is critical for effective remediation and source control efforts. Using machine learning techniques, we identified wastewater treatment plants and landfills as pollutant collectors, serving as secondary sources of PFAS release to the environment. PFAS levels in global sludge and biosolids samples from WWTPs revealed concentrations several times higher than those found in soil, emphasizing the potential for soil contamination through biosolid land application and disposal. Combined with the high concentrations of PFAS observed in wastewater effluent, these findings highlight the need for improved PFAS treatment technologies and eliminating the source of PFAS to WWTPs. This study provides highlights the likely future PFAS environmental burden of PFAS and the urgent to develop mitigation and source control strategies.

Shankar Sharma (Climate Change Research Centre, Biological, Earth & Environmental Sciences)

Understanding the Influence of Urbanization on Rainfall in Sydney Using High-Resolution Modeling and Satellite Datasets

Urbanization modifies land surface properties, influencing local and regional climates and increasing vulnerability to extremes such as heavy rainfall and heatwaves. High-resolution, long-term urban land cover data are essential to quantify these effects. We developed a scalable method to produce the first multi-year Local Climate Zone (LCZ) maps for Greater Sydney (1990–2020, five-year intervals). These maps show reveal significant urban densification after 2005, with expansion of mid- and high-rise LCZs and reductions in open low-rise areas. The maps were integrated into the Weather Research and Forecasting (WRF) model by replacing the default single-density urban category, enabling more realistic urban morphology. Simulations for 1990–2020 were run under two scenarios: constant 1990 LCZ land cover and time-varying LCZs. As a first step, we validated the model and found that the simulations reproduce observed temperature and rainfall patterns reasonably. Following this, sensitivity tests compared simulations using the default land cover with LCZ-based land cover, revealing substantial differences in rainfall distribution within and downwind of urban areas and, daily mean surface temperature differences of ~1 degree Celsius. Next, we are exploring satellite-based datasets to investigate how urbanization can influence various aspects of rainfall, including intensity, spatial distribution, temporal trends, and extreme events.

Yalewayker Tegegne Asrat (School of Optometry and Vision Sciences)

Genotypic diversity and presence of intracellular bacteria in Acanthamoeba strains isolated from ocular infections at a referral eye hospital in Sydney, Australia

Background: Acanthamoeba species are widespread free-living amoebae. Clinical data and animal studies have shown that the presence of bacteria living within the Acanthamoeba can lead to worse outcomes during infection. The data on AK in Australia are limited. Objectives: This study evaluated the prevalence of AK, assessed circulating Acanthamoeba genotypes, and identified bacterial endosymbionts with in the Acanthamoeba strains. Methods: A prospective case series study was conducted at the Sydney Eye Hospital, Australia. Corneal swabs from AK patients were collected for culture, and their domestic water samples were also analyzed. The presence of intracellular bacteria was studied by in situ fluorescence hybridisation and electron microscopy. Results: A total of 21AK patients (41 ± 12.3) years, were recruited. Among the 21 corneal swabs collected and cultured, only six (28.6%) grew Acanthamoeba. Out of nine tap water samples collected from the domestic water supply of AK patients, four (44.4%) were Acanthamoeba species culture positive. Closely related corneal and water isolates were observed in the phylogenetic tree for patients AK16 and MK1. Acanthamoeba genotype T4 was the only genotype cultured, with strains belonging to sub-genotype T4A, T4D, T4E and T4F divisions. Conclusions: In Sydney, the prevalent genotype of Acanthamoeba among AK patients and tap water was T4. A few strains also contained intracellular bacteria, which may contribute to more severe outcomes.

MORNING SESSION 2

Dinuka Kankanige (Civil and Environmental Engineering)

Enhancing the predictability of gravity variations for regional hydrology

The Gravity Recovery and Climate Experiment (GRACE) mission offers significant insights into understanding the Earth's hydrological, glaciological, and geophysical processes. However, the constraints in mission design led to large measurement and systematic noise which is a fundamental challenge in utilizing GRACE data. The geopotential solutions retrieved by GRACE, exhibit strong temporal persistence, a key characteristic that creates pathways for improved predictability of geoid coefficients. We leverage this statistical property, to investigate a predictive framework and characterize the link between monthly and higher frequency uncertainties in geopotential solutions. The uncertainties at sub-monthly and weekly timescales can be taken down closer to the uncertainty levels observed in monthly geopotential solutions. This feature is profound in higher spherical harmonic degrees. By mitigating the high uncertainty of geopotential solutions at finer temporal resolutions, this framework supports regional hydrology applications in capturing short-term water storage variations.

Dr. Jimmy Jaghoro Hilly (Civil and Environmental Engineering)

Air Quality Monitoring in the Pacific: Strengthening Data, Policy, and Community Action

Air pollution is a growing but under-measured health and environmental challenge in the Pacific. Our Air Quality Monitoring Project addresses this gap by establishing and strengthening national monitoring networks in Fiji, Solomon Islands, Vanuatu, and Tonga. The initiative is a collaboration between UNSW, Pacific government agencies, and regional partners, integrating low-cost sensor technology, capacity building, and policy engagement. Since 2020, we have deployed PM2.5 and PM10 monitors across key urban and rural locations, producing the first continuous datasets for many sites. This data has revealed persistent exceedances of the 2021 WHO Air Quality Guidelines, particularly during biomass burning, other anthropogenic processes and dust events, highlighting significant public health risks. Beyond data collection, the project emphasizes skills transfer through local training, equipment maintenance support, and regional data sharing platforms. Findings are being integrated into health and environmental policy discussions, enabling evidence-based decision-making and targeted interventions. By linking scientific evidence with community awareness and government policy, this project builds regional resilience to air pollution's health impacts. Our approach demonstrates how collaborative, low-resource monitoring systems can drive measurable environmental health improvements in small island developing states.

Claudia Santori (Biological, Earth & Environmental Sciences)

Restoring Sydney's crayweed forests: an update on Operation Crayweed

Operation Crayweed is an ongoing restoration project that aims to restore underwater forests of crayweed (Phyllospora comosa) along the Sydney coast. Crayweed forests dominate exposed, shallow rocky reefs along the NSW coastline, where they provide valuable services. However, crayweed disappeared from the Sydney coastline in the 1980s, likely due to poor water quality at the time. Despite significant improvements in water quality since the 1990s, crayweed forests have not re-established in Sydney. Since its inception in 2012, Operation Crayweed has successfully reintroduced self-sustaining and expanding crayweed populations at six sites in Sydney, including Manly and North Bondi. This presentation will provide an update on Operation Crayweed, showcasing its progress in recovering lost marine habitats through science and community engagement. We will discuss the importance of collaboration between scientists, indigenous groups, artists, industry and local communities for safeguarding and restoring coastal ecosystems.

Ms Bixuan Dong (Civil and Environmental Engineering)

Shoreline modelling on embayed beaches using planform equations

Nearly half of Australia's 30,000 km coastline comprises embayed beaches, where complex alongshore and cross-shore dynamics make shoreline modelling challenging. While previous modelling methods typically use cross-shore transects or one-line approaches, there is potential to simplify this by using geometric equations that capture the planform of embayed beaches. This study evaluates three widely used equations—the logarithmic spiral, parabolic, and hyperbolic tangent—based on ~35 years of satellite-derived data from Narrabeen Beach (NSW). For each shoreline, parameters from each equation were compared with two shoreline change indicators: the beach orientation index (BOI, a proxy for rotation) and the alongshore-averaged shoreline position (ASP, a proxy for cross-shore change). Results show that log-spiral parameters strongly correlate with BOI, and their residuals correlate closely with ASP, whereas the parabolic and hyperbolic equations show weaker associations. Correlation analyses with wave conditions indicate that sub-seasonal averages best explain parameter variability, while residuals are linked to weekly fluctuations. These findings highlight the log-spiral's suitability for predictive modelling of embayed beaches and underscore the importance of incorporating multi-scale wave forcing into such models. Overall, this study contributes to advancing shoreline change modelling for embayed beaches and offers insights to enhance shoreline prediction and coastal management.

Maximiliano Ferrer (Civil and Environmental Engineering)

Kinetics and Mechanism of Copper-Mediated Fenton Processes for Pollutant Degradation

Copper-based Fenton systems offer promising potential for pollutant degradation, but their broader application in advanced oxidation processes (AOPs) is hindered by uncertainties in reaction mechanisms and the identity of key oxidants. In this study, the Cu/H_2O_2 system was examined at circumneutral pH through kinetic modeling and experimental validation. System efficiency was enhanced by employing reducing agents and ligands, with particular focus on ascorbic acid (AA) as a Cu(II) reductant and chloride ions (Cl^-) for Cu(I) stabilization via complex formation. The potential of copper in heterogeneous Fenton systems was also assessed, emphasizing zeolite-supported catalysts and their performance in continuous-flow column setups. This approach highlights practical pathways for implementing copper-based processes in real water treatment scenarios. Overall, the findings provide new mechanistic insights and strategies to optimize copper-mediated Fenton reactions, advancing their use in both natural and engineered systems.

Thais N. Guerrero (Civil and Environmental Engineering)

Odour emissions across the biosolids lifecycle

Odour emissions from biosolids continue to impact surrounding communities, posing a persistent challenge for regulators and the wastewater industry. The processes driving these emissions, and their sensory impacts, across the biosolids lifecycle remain poorly understood. This presentation explores how stabilisation operations, post-treatment handling, and soil application practices influence biosolids odour profiles. The growing interest in co-digestion adds further complexity; while it may offer operational and energy benefits, it can also introduce new odour challenges. Combining sensory and chemical assessments provides critical insights into odour dynamics, helping inform the development of standardised best practices for process optimisation and odour mitigation – key to ensuring the long-term sustainability of biosolids reuse.

Theodorus Johannes (John) Verhoeven (Civil and Environmental Engineering)

What policy and institutional arrangements are needed for effective cyanobacterial management in a changing global environment?

Freshwater cyanobacterial blooms and cyanotoxins have significant adverse social, environmental, economic and cultural impacts which are being compounded globally by accelerating climate change and population pressures. Blooms are managed using policy processes within policy frameworks operating from national/basin to sub-catchment levels. This research examines what policy and institutional arrangements are needed for effective cyanobacterial management. Using the case study research method, four cases in Australia, the USA, Scotland and South Africa are analysed to obtain qualitative data from semi-structured interviews with 26 participants. Key findings include the importance of policy coordination by governments across jurisdictions, sectors, and across all stages of the policy process; and the development of statutory, resourcing and institutional policy instruments to achieve cyanobacterial management goals. Given amplifying global pressures, governments need to monitor and model coupled natural-human systems, identifying system changes and their causes early in the policy process, to develop bloom management responses. An important research outcome is a simplified cyanobacterial policy management framework for the guidance of governments and policymakers. Research needs are identified.

Katie Wilson (Civil and Environmental Engineering)

Seasonal to annual forecasting of shoreline change across Australia using statistical time series techniques

As coastal populations grow, so does the need for improved disaster risk reduction measures to mitigate erosion hazards. Generating coastal early warning systems with forecast lead times of up to one year gives coastal managers time to assess risks and inform decisions. As such, there is a need for seasonal forecast models that are scalable, computationally efficient and require only forecastable variables. In this study, a dataset of 25+ years of satellite-derived shorelines were used to benchmark the performance of statistical time series techniques. This involved three types of method: linear regression and statistical models SARIMAX and Seasonal VARX, with inputs including: no exogenous input, two climate indices (ENSO and IOD), and indices with a variable for cumulative offshore wave height (HS). These models were trialled at 10 beaches representative of sandy shorelines throughout Australia, assessing performance over a one-year forecast. The highest scoring combination was the SARIMAX_waves model, with a median RMSE over the forecast horizon of 7.7m (lower than the CoastSat error in Australia of 8.2m). On average, SARIMAX and Seasonal VARX approaches outperformed linear regression, but did not differ statistically from each other. These results highlight that statistical models provide a robust method of operational long-range forecasting of shoreline erosion risk, scalable to the continental scale.

Dana Tothova (Civil and Environmental Engineering)

Design and Pilot Deployment of Floating Mangrove Wetlands in Australia and Fiji

Coastal urbanisation and climate change are driving demand for innovative nature-based infrastructure that enhances resilience while supporting biodiversity. This study presents the design and piloting of floating mangrove wetlands in two sheltered coastal sites: Manly Lagoon, Australia, and Walu Bay, Fiji. Both sites are relatively protected from wind and wave exposure, but differ in climate and mangrove species. The Manly pilot has been deployed, with over 200 Avicennia Marina plants established across two floating platforms, designed to evaluate feasibility and study the impact of variations in planting depth and water retained in the substrate on mangrove growth and survival. Early deployment has provided insights into survival under storm events, structural integrity, and anchoring performance in a dynamic lagoon environment. Preparation for the Walu Bay deployment focuses on adapting the design to a different mangrove species—Rhizophora Stylosa, strong tidal currents, and extreme tropical weather events. Beyond studying mangrove establishment, the pilots aim to advance methods for monitoring and enhancing ecosystem service delivery, including shoreline stabilisation, biodiversity enhancement, water quality improvement, and socio-economic services. These initiatives represent the first field-scale trials of floating mangrove wetlands and highlight both opportunities and challenges in advancing mangrove-integrated coastal infrastructure.

Amr Omar (EnviroLabs, Chemical Engineering)

Enhancing Turf Irrigation using Ultrafine Bubble Technology

This study explores the application of ultrafine bubble (UFB) technology in turf irrigation to improve water use efficiency and resilience under drought conditions. UFBs (i.e., gas bubbles smaller than 100 nm) remain suspended in water for extended periods, enabling oxygen concentrations above saturation. Two controlled glasshouse trials were conducted using Kikuyu, Buffalo, and Couch grasses across sandy loam, light clay, and heavy clay soils. Irrigation treatments included control water and oxygen-enriched UFB water (~48 mg/L dissolved oxygen). Results showed statistically significant improvements ($p < 0.05$) in turf performance under oxygen-UFB irrigation. Dry biomass increased by 54–68% for Kikuyu, 36–87% for Buffalo, and 67–148% for Couch. Water use efficiency improved by 99–307% for Kikuyu, 37–156% for Buffalo, and 110–141% for Couch. These gains were most pronounced in sandy and light clay soils. Field demonstrations are currently underway to test the effect of the UFB technology when retrofitted into an existing irrigation infrastructure under real farm conditions. The findings suggest that oxygen-rich UFB irrigation can offer a scalable, cost-effective solution for improving turf health and water productivity, with broader implications for sustainable water management in agriculture.

AFTERNOON SESSION 1

Marilyn Braine (Civil and Environmental Engineering)

A National Risk Management Framework for Biosolids

Population growth, technological advancements, increased wastewater treatment, and rising demands for food, clean water, and energy have escalated, with the potential for harm to both the environment and human health through the introduction of contaminants. We need a collective management strategy to address the interdependencies of these drivers and their associated risks. This work proposes a national risk management framework for biosolids. The research employed in the framework's development formed a triangulation of methodologies, technologies, and times to achieve an in-depth understanding of the topic, encompassing current practices, new research, and industry engagement. Using the key findings of this research and established risk management frameworks in other areas of the water sector, a risk management framework for biosolids was developed.

Kanruethai (Amy) Charoensook (EnviroLabs, Chemical Engineering)

Influence of Bubble Size on Ozonation Efficiency on C. vulgaris Cell Inactivation

Harmful algal blooms (HABs) threaten water supplies by degrading quality and releasing toxins and taste and odour compounds. Ozonation is widely applied an oxidant globally, including for algal control, yet the efficiency is constrained by its low solubility and rapid decomposition in water. Optimizing ozone delivery is therefore essential. This study investigated the role of bubble size in enhancing ozone transfer by comparing micro–nanobubbles (MNBs) with conventional bubbles for the treatment of Chlorella vulgaris (C. vulgaris, CS-42/7). Bubble diameters were quantified using high-speed camera and image processing technique, enabling calculation of bubble concentration, total interfacial area, and rising velocity. MNBs exhibited approximately 9.69-million-fold higher bubble concentration and 364-fold greater interfacial area, while rising velocity was reduced by 93% relative to the conventional bubbles. Consequently, MNBs ozonation achieved approximately 97% C. vulgaris cells reduction within 10 minutes, compared to 61% for conventional bubbles at the same ozone dose of 0.2 mg·L-1. The superior performance of MNBs is attributed to their larger gas–liquid interfacial area and prolonged bubble residence time, which collectively improve ozone mass transfer and contact with algal cells. These findings underscore bubble size as a key parameter for advancing ozone-based algal bloom management.

Emma Hu (Civil and Environmental Engineering)

Hook, Light and Sinker – Increasing fish attraction in Pipe Fishways using fish phototactic response to coloured light

Instream barriers such as dams and weirs pose a threat to the fragmentation of freshwater ecosystems by obstructing natural water flows and disrupting fish movement. Pipe Fishways provide an effective solution to reintegrate fish movement through bodies of water obstructed by barriers in a cost-effective and reliable manner. Relevantly, a key biological underpinning of the fishway operation is the voluntary movement of fish into the piped entrance. However, there are currently limitations in the effectiveness of attracting a range of fish species into the pipe entrance. Herein, this research investigated how coloured light in the pipe can be used as a mechanism to improve fish attraction into the fishway entrance. Experiments were conducted in a laboratory setup at the Water Research Laboratory to examine the phototactic responses of four Australian freshwater species (Golden Perch, Silver Perch, Olive Perchlet and Spangled Perch) under a range of coloured lights in an arena choice experiment. Colour preference was calculated by fish cumulative dwell time. The outcomes of this research provide promising insight into informing the scalable solutions for restoring ecological connectivity in fragmented freshwater ecosystems to support the recovery of freshwater fish populations. Colour preference, as calculated by fish cumulative dwell time, could be integrated into pipe fishway entrance designs to enhance fish attraction and facilitate passage.

Veronique Lago (Biological, Earth & Environmental Sciences)

Fishing for Data: Closing Coastal Gaps through Industry–Science Partnerships

Sustained observations of ocean conditions are critical for understanding how marine environments respond to climate variability and for supporting the sustainable use of marine resources. Yet, subsurface data in coastal and shelf seas remain sparse. The IMOS-FishSOOP program, based at UNSW, addresses this gap by partnering with the fishing industry to collect near real-time ocean data in a mutually beneficial way. Fishing vessels are equipped with sensors on their gear that record temperature, depth, position, and time during normal operations. Data are transmitted to the cloud in near real-time, automatically quality-controlled to internationally endorsed standards, and made openly available through the Australian Ocean Data Network. In return, fishers receive real-time visualisations that improve efficiency, reduce fuel costs, and support sustainable practices. FishSOOP focuses on Australian waters and the South Pacific, including the Southern Ocean and marine parks. In marine parks, the program works with First Nations communities to support sea country stewardship. These observations are already providing insights into marine heatwaves and local dynamics in under-observed regions (e.g. the Top End), and they have strong potential to enhance ocean and weather forecasting. By combining industry engagement, rigorous science, and open data, FishSOOP delivers benefits across research, industry, and society.

Mr Jingwen Luo (Civil and Environmental Engineering)

What Do We Know About the Environment Sustainability of Biosolids Processing Systems in Australia?

Australia is undergoing a significant transition in biosolids processing systems due to regulatory responses to emerging contaminants. Evaluating the environmental implications of these technological changes is essential for guiding policy and promoting sustainable waste management. This study uses life cycle assessment (LCA) to compare the current business-as-usual scenario with future national-scale scenarios that incorporate emerging technologies. The LCA quantifies impacts across global warming potential, toxicity, and other indicators, covering biosolids generation, treatment, transport, and final disposal or reuse. Technology mixes are differentiated by state to reflect regional variations. An Australian-specific life cycle inventory tool for biosoids processing systems is established with primary data inputs from industry partners. Findings show that emerging technologies can reduce carbon emissions but involve trade-offs across other indicators, with outcomes strongly influenced by the fate of final products. Key data gaps remain, particularly on the performance of emerging technologies and region-specific parameters. Addressing these gaps is critical for robust and context-specific assessments. This first national-scale LCA of biosolids management in Australia underscores the importance of multi-indicator evaluations to inform evidence-based and sustainable biosolids practices.

Amr Omar (EnviroLabs, Chemical Engineering)

Thirsty Data Centres: How digital infrastructures could drain NSW's water future

Data centres are rapidly expanding across NSW, driven by demand for AI, cloud computing, and digital infrastructure. While essential, these facilities are highly resource-intensive, particularly in their cooling systems. Evaporative cooling, widely used for its energy efficiency, consumes significant volumes of water-posing growing risks to regional water security. Cooling systems count for up to 40% of a data centre's energy use, with evaporative cooling consuming 1.6 litres of water per kilowatt-hour (L/kWh) of IT energy. With NSW's ICT energy demand expected to reach 16.7 terawatt-hours (TWh) by 2040, water use for cooling along could exceed 30 GL annually, equivalent to 10% of Sydney Water's total demand. While at present (2025), NSW data centres consumed an estimated 5 GL of water annually. As such, urgent measures, including performance-based standards, incentives for dry or hybrid cooling systems, and introduction of regulatory NABERS water ratings, are essential to ensure NSW's digital infrastructure grows sustainably. Without these, the sector's growth could strain water supplies, especially during heatwaves and droughts.

Fitri Widhiastuti (EnviroLabs, Chemical Engineering)

Integrating cyanotoxin detection using LC-MS Triple Quadrupole with cell viability assessment

Cyanobacterial blooms are a growing concern in freshwater due to their ability to produce harmful toxins that pose a threat to public health and water safety. This study presents a robust and highly sensitive LC-MS/MS (triple quadrupole) method for quantifying 12 key cyanotoxins, including microcystins, cylindrospermopsin, anatoxin-a, and nodularin. Solid-phase extraction was optimised to enhance toxin recovery from water samples, achieving >70% efficiency at pH 9. The method quantification limits (MQLs) were consistently below 10 ng/L, enabling reliable detection of low-level toxins in environmental waters. Laboratory cultures of three cyanobacterial species, including Microcystis aeruginosa (MA), Raphidiopsis raciborskii (RR), and Raphidiopsis mediterranea (RM) were analysed for toxin production. Cell viability was assessed using flow cytometry for MA and fluorescence microscopy for the filamentous RR and RM. MA (84% viable, 1×10^7 cells/mL) produced 0.5–350 µg/L of toxins, while RR and RM (60–70% viability, 1×10^3 cells/mL) yielded up to 200 µg/L. By integrating toxin quantification with viability data, this approach provides a clearer understanding of the risks associated with cyanotoxins. It also helps explain discrepancies between cell counts and toxin levels, offering practical insights for water treatment and public health monitoring.

James Zulfan (Civil and Environmental Engineering)

Rethinking Weirs: Insights from Indonesia's River Basins

What if the weir structures designed to secure water in Indonesia are silently eroding the rivers and communities they were meant to support? Across the country, more than 1,200 conventional weirs provide irrigation, water supply, and energy. However, they have also become a double-edged sword, causing sedimentation, water pollution, blocking fish migration, and triggering local conflicts. With hundreds of new weirs planned, the risks of continuing "business as usual" will only amplify these problems on a larger scale. The aim of this study is to understand how stakeholders perceive current practices and how these insights can inform the implementation of the low-impact weirs. Focus group discussions were conducted in three representative river basins in Java, East Nusa Tenggara, and Borneo Island. These locations reflect Indonesia's major socio-ecological settings to capture perspectives from the government, communities, and the private sector. Results revealed shared needs on sediment continuity, water quality protection, and flexible designs alongside local priorities such as fisheries, irrigation, and flood management. Turning the low-impact weir concept into practice remains challenging due to technical gaps, high costs, and top-down planning. As the research continues, these insights are essential to ensure future weir projects align with stakeholder needs and socio-environmental requirements.

Mengxi Zhang (EnviroLabs, Chemical Engineering)

Beyond Source Water: Diagnosing and Controlling Algal Accumulation within DWTPs

Algal blooms and their metabolites present ongoing challenges for drinking water utilities. While monitoring programs typically focus on source waters, many breakthrough events actually originate inside treatment plants. These arise from clarification or filtration inefficiencies, and from the recycling of backwash water or sludge supernatant, which can reintroduce viable cells and algal-derived organics. Current monitoring frameworks offer little early warning of such in-plant risks, leaving operators with limited guidance on how recycled flows affect treatability and coagulant demand. This project investigates algal risks within drinking water treatment plants through three connected streams: (1) the assessment and enhancement of floc stability under representative conditions will be evaluated to both minimise breakthrough to downstream processes and reduce the likelihood of floc breakage in sludge lagoons; (2) the evaluation of algal viability in waste streams including backwash water and sludge supernatant return; and (3) the impact of supernatant return on the optimisation of coagulant conditions. Expected outcomes include practical options for return handling, pre-treatment, and chemical dosing; an evidence base with improved indicators to guide sludge supernatant management; and ultimately a more stable treated-water quality.

AFTERNOON SESSION 2

Laura Montano (Civil and Environmental Engineering)

Current Knowledge of Traditional Use of Mangrove Ecosystems in Pacific Islands

Mangrove forests are valuable ecosystems that provide a wide range of ecosystem services globally. In the Pacific Island Countries and Territories (PICTs), mangroves play a crucial role in supporting subsistence livelihoods, offering food and housing, as well as providing protection against sea level rise and storm damage. Mangrove forests play also a critical role in traditional practices in the PICTs, supporting traditional medicine, spiritual practices and social cohesion. Despite the widespread recognition of the mangrove ecosystem services in the PICTs, a systematic review of these services is still missing. This paper presents a review of traditional uses of mangrove ecosystem services in the PICTs, highlighting common practices, subsistence importance as well as data gaps, and compares regional findings with global trends. Traditional provisioning services include the use of mangroves for food, ceremonial purposes, traditional medicine, and ornamental items. Use of mangroves for spiritual purposes and community gatherings was also identified but are less frequently documented. Many of these traditional practices were recorded decades ago, whereas recent research has tended to focus on more Western-oriented uses, often overlooking traditional and Indigenous knowledge systems.. The findings of this research highlight the need for more inclusive and culturally focused research to inform effective policy and management strategies for mangrove conservation in the PICTs.

Weizhi Zhang (EnviroLabs, Chemical Engineering)

Feasibility of Inland vs Coastal Green Hydrogen: Cost, Risk, and Water Sourcing Challenges

Green hydrogen production requires not only renewable electricity but also significant volumes of high-purity water. Coastal regions benefit from abundant seawater but face weaker solar irradiance, whereas inland basins offer strong solar potential but rely on freshwater contested by agriculture and industry. Both contexts must manage climatic variability and financial uncertainty that shape the feasibility of large-scale deployment. We apply a Monte Carlo techno-economic framework coupling solar PV with seawater reverse osmosis (SWRO) at Port Kembla and brackish water reverse osmosis plus zero-liquid-discharge (BWRO+ZLD) at Moree, both integrated with alkaline electrolysers. This approach produces probability distributions of the levelised cost of hydrogen (LCOH), and calculates value-at-risk (VaR-LCOH) to capture downside cost exposure. Results show inland hydrogen is ~30% more cost-competitive than coastal systems (5.3 vs 7.5 USD/kg H_2), reflecting higher solar capacity factors (≈21–23% vs 14–16%). Inland projects also demonstrate tighter distributions (σ = 0.40 vs 0.59 USD/kg H_2) and narrower downside risk (VaR-95 = 6.2 vs 8.7 USD/kg H_2). Yet both require ~30–50 L of water per kilogram H_2: while coastal hubs rely on seawater desalination, inland projects face freshwater entitlement constraints and environmental and social impacts from water diversion.

ZeinabBano AhaniAmineh (Water Research Centre, Civil and Environmental Engineering)

Quantifying Groundwater Contributions to CO_2 and CH_4 Emissions in Manly Creek, Sydney

Streams are an important component of the global carbon cycle, acting both as pathways for terrestrial carbon transport to the ocean and as active sites of carbon transformation, storage, and greenhouse gas (GHG) evasion. Despite their significance, global estimates of stream CO_2 and CH_4 emissions remain highly uncertain, particularly in headwater systems where groundwater inputs may represent a dominant but under-quantified source. In this study, we quantified groundwater contributions to GHG fluxes in Manly Creek, a headwater stream in Sydney, Australia. Radon tracing was used to estimate groundwater discharge fluxes. Dissolved CO_2 and CH_4 were measured in the stream and groundwater to quantify their fluxes from groundwater inflows. Our results show that groundwater inflows substantially elevated both CO_2 and CH_4, with seepage zones averaging about five times more CO_2 and over two hundred times more CH_4 than upstream and downstream sections dominated by surface water flows. This identifies groundwater as a large source of localized outgassing. By directly coupling groundwater discharge estimates with dissolved gas measurements, this study provides rare empirical evidence of groundwater-driven GHG fluxes from streams, thereby reducing uncertainties in carbon budgets, highlighting the disproportionate role of headwater streams, and offering insights relevant to ecosystem management and climate change mitigation strategies.

Nashwa Eltahhan (EnviroLabs, Chemical Engineering)

Optimising Coagulation and Flocculation for Improved Water Treatment Under Dirty Water Conditions

Water treatment plants operated by our industrial partners play a critical role in delivering drinking water. These facilities have experienced 'dirty' water events that significantly impact treatment performance and operational capacity. To address these challenges, raw water samples were subjected to extensive jar testing to evaluate the performance of various coagulants and flocculants under different dosing regimes. Multiple water quality parameters were tested, including turbidity, true color, pH, UV254, dissolved organic carbon (DOC), alkalinity, and conductivity. Zeta potential was also monitored and used as a key indicator for optimizing coagulant dosing. The study aimed to optimize coagulation and flocculation to reduce turbidity and DOC, thereby lowering trihalomethane (THM) formation potential. It also assessed alternatives to alum, the conventional coagulant, which often requires increased dosing—and additional caustic soda for pH control—during dirty water events. Results showed that performance varied based on targeted water quality goals. However, maintaining zeta potential between 0 and +3 mV consistently improved turbidity and DOC removal. Among the coagulants tested, ferric chloride achieved the highest removal of UV254 and DOC, followed by polyaluminium chloride (PACl), indicating strong potential as alternatives to alum under challenging conditions.

David Bee Olmedo (Biological, Earth & Environmental Sciences)

To scale: Investigating historical extreme rainfall scaling rates in Greater Sydney using radar

The rate of change in extreme rainfall with temperature is known as thermodynamic scaling. Extreme rainfall, particularly when falling over short time periods, contributes to the formation of flash floods which have caused significant damage in NSW. In this study, historical scaling rates are approximated by applying a quantile regression analysis on rainfall rates derived from weather radar data with co-varying dewpoint temperature. For average land surface temperatures, a ~7% increase in rainfall intensity/amount is expected per degree Celsius increase; this is the Clausius-Clapeyron (CC) scaling rate. Past observational studies in Australia and in other regions around the world have found some evidence for scaling beyond the CC rate, referred to as 'super' CC-scaling. Here, we leverage the high spatio-temporal resolution of radars covering Greater Sydney to identify spatial patterns in historical scaling rates focusing on regions of super CC scaling. Eventually, our results may be used in developing future flood risk assessments.

Marina do Valle Chagas Azaneu (Biological, Earth & Environmental Sciences)

Decades of Change: High-Resolution Observations of the East Australian Current

The ocean has absorbed about 90% of the excess heat from human-driven climate change, with western boundary currents such as the East Australian Current (EAC) warming two to three times faster than the global average. Off southeastern Australia, these changes are driving unprecedented warming, shifts in ocean currents, and more frequent and intense marine heatwaves. Such changes affect fisheries, coastal ecosystems, and the communities that depend on them. Yet, our understanding of subsurface conditions—the "hidden" part of the ocean where many impacts occur—remains limited. To address this gap, Australia's Integrated Marine Observing System (IMOS) has established a network of coastal moorings that provide some of the longest continuous ocean records in the Southern Hemisphere, with data extending back to the 1940s. These high-resolution time series capture not only long-term warming trends but also the short-term extremes, including the depth and duration of marine heatwaves and cold spells. By documenting how ocean temperatures and currents vary across seasons, decades, and extreme events, this dataset offers an essential baseline for predicting future change. Ultimately, these observations support better management of marine resources, coastal resilience planning, and our ability to adapt to a warming climate.

Yingfei Huang (EnviroLabs, Chemical Engineering)

Future-Proofing Coastal Cities: How Solar-Driven Desalination Can Secure Water in a Changing Climate

Global climate change is reshaping weather patterns, with rising temperatures intensifying droughts and increasing water scarcity, while more frequent extreme weather events further threaten freshwater security, especially in rapidly growing coastal cities. This study focuses on large-scale solar-driven desalination based on concentrated solar power (CSP) with multi-effect distillation (MED), enabling energy-water cogeneration of green electricity and freshwater. A multi-scale framework was developed to map where CSP-MED is most feasible by integrating geospatial, climate change (including frequency of extreme weather events), and economic uncertainties. The study identified 2.13×10^5 km² in Australia as suitable for CSP-MED, with an average MCDM score of 54.65 and a payback of 19.08 years. Western and South Australia had the highest feasibility owing to strong solar resources and infrastructure, while Queensland shows potential mainly in the north. Most existing CSP plants are unsuitable for CSP-MED except the Sundrop CSP, as it is near the coastline. Also, results show that the southern and western coastal regions in Australia have the lowest uncertainty towards CSP-MED feasibility, since these regions have the minimum DNI changes (within ±2%) and mild temperature increases. Developed as a global-to-regional framework, this approach offers a practical tool to guide resilient water and energy infrastructure planning for drier and more energy-hungry coastal cities.