NZHS Technical Workshop

2025 Technical Workshop Abstracts

25th – 28th March 2025 – Hamilton

Our Evolving Relationship with Water: Drawing on the past as we explore the Future

Tuesday 25th March

KEYNOTE SESSION

An Overview of Hydrological Survey in Korea

Jaehyun Song – Korea Institute of Hydrological Survey

Due to climate change, the frequency and intensity of water-related disasters, such as floods and droughts, have increased globally, making their prediction more challenging. Korea has also experienced significant floods and droughts, emphasizing the necessity of efficient water resource management through hydrological surveys.

The history of hydrological surveys in Korea dates back to 1441 with the invention of the Cheugugi, the world's first rainfall gauge, and Supyo, a water level gauge. Over time, hydrological surveys have evolved with political, social, economic, and technological advancements, including modernization efforts during the Japanese colonial period, the post-war era, and economic development phases. Major milestones include the establishment of HSC(Hydrological Survey Center) in 2007 and its successor, KIHS(Korea Institute of Hydrological Survey) in 2017, leading to the modernization and expansion of hydrological surveys.

Key policies shaping Korea's hydrological survey system began with the 1961 River Act and evolved through various legislative and institutional reforms. The 2007 amendment of the River Act strengthened hydrological survey provisions, followed by the 2017 transfer of hydrological survey responsibilities to the Water Resources Investigation and Management Act. The Second National Hydrological Survey Plan (2020~2029) focuses on improving data quality, reliability, and utilization.

Korea’s hydrological survey infrastructure(as of 2023) includes 6,878 observation stations, covering rainfall(3,146), water level(2,868), discharge(694), sediment transport(32), evapotranspiration(30), and soil moisture(108). Advanced technologies, such as real-time discharge measurement systems (IRDiMS, Intergrated Real time Discharge Management System), radar-based precipitation monitoring, remote sensing using satellites, and drones for flood monitoring, are being actively integrated.

To ensure data quality, a national hydrological data certification system has been established, alongside mandatory verification of hydrological measurement instruments. International cooperation is actively pursued through ISO TC 113, WMO, ESCAP Typhoon Committee, and KOICA(Korea International Cooperation Agency), contributing to global hydrological research and capacity-building in developing countries.

Future advancements in hydrological surveys will focus on automation, non-contact measurement methods (e.g., Microwave Surface Velocity Meter, Space-Time Image Velocimetry, satellite imagery, AI-based systems), and the expansion of integrated water quality and quantity monitoring networks. The launch of Korea's water resources satellite in 2025 is expected to further enhance spatial hydrological observations.

The Little Things All Add Up

Mic Clayton – Cooma, Australia

The National Environmental Monitoring Standards (NEMS) in New Zealand and the National Industry Guidelines for Hydrometric Monitoring in Australia, provide guidance on how things should be measured and monitored in the hydrometeorological space.

It might be argued that, in the past, obtaining hydrological data was potentially a 'Boy's Own Adventure' with local folklore governing the mysteries of hydrological data collection passed from an elder of the valley to the future generations of that valley. What happened in the neighbouring valley was not necessarily the way to do things if you wanted to do them right – by your valley's standards at least!

This way of the Past thus provides the necessary hindsight that can be used to improve the Future of how hydrological data is collected and managed.

The Evolution of NEMS and NIGLs provide frameworks to assist in obtaining nationally consistent data and information across the valleys, enabling users of these data and information outputs to hopefully compare apples with apples.

Sprinkled throughout these standards and guidelines are references to accuracies, tolerances and uncertainties to apply to data, instrumentation, systems and all manner of hydrological relationships that might be derived from the various data collected.

BUT the standards do not provide guidance on every possible if/but/maybe situation when data is being collected in the field, due to the wide variety of instrumentation or data collection process or the defined data requirements for a specific monitoring site. This falls back onto the monitoring entity having documented work instructions and procedures that can incorporate the nuances of specific instrumentation, data processes and sites into their own quality frameworks that assist with meeting the desired outcomes of the NEMS.

This presentation does not intend to delve into the complexities of uncertainties, accuracy or tolerances. Rather it will take some simple examples of the things field hydrologists might do or observe in the field that can potentially start the uncertainty train rolling into data and subsequent water information processes.

Understanding potential ‘vectors for uncertainty contamination’ in our processes should enable us to continually benchmark, review and evolve our processes to further improve confidence in our water data and water information outputs.

It’s the little things that add up that can potentially impact the outcomes. Being aware of them and understanding how to improve upon them should lead to improved performance outcomes, at your local valley level and across the wider national perspective.

TQ-Tracer: Tracer dilution as the better alternative to Current meters

Christoph Sommer – Sommer

Currently, current meters are among the most widely used field instruments in hydro-technology. However, many technicians know that current meters are not always the optimal choice for every situation. The effectiveness of these instruments depends on various factors such as water level, site conditions, and cross-sectional features like stones, turbulence, and bends, all of which can vary with the water level at the time of measurement.

Despite the common belief that there are no alternatives to current meters or ADCP boats, suboptimal measurements are often accepted. However, tracer dilution measurement presents a valuable alternative. This method effectively bridges the gap between current meters and ADCP boat measurements, particularly in challenging cross-sections where obtaining accurate measurements is difficult. Therefore, it is worth considering tracer dilution as a viable alternative to current meter measurements.

TQ-Tracer: AI to help in tracer dilution measurements

Christoph Sommer – Sommer

Tracer dilution measurements are a powerful and reliable method for collecting discharge data in smaller streams and rivers. This technique is particularly effective in streams with challenging cross-sections, where other methods may fall short. However, evaluating tracer dilution measurements can be a daunting task, especially for beginners.

By leveraging AI in the form of a bot, this process can be significantly simplified, making it accessible for both novices and professionals. In this talk, we will explore an example of how

AI can be integrated into software to facilitate the evaluation of tracer dilution measurements.

Interagency and Public Data Dissemination

Klaus Kisters – KISTERS

Interagency and Public Data Dissemination
Klaus Kisters[1], Dirk Schwanenberg[1], and Paul Sheahan[2]
[1]KISTERS AG, klaus.kisters@kisters.de
[2]KISTERS PTY, Canberra

Organizations in the hydrometeorological (hydromet) sector collect vast amounts of environmental data based on their spatial and domain-specific responsibilities. Effective management of this data is crucial for applications such as integrated river basin management, urban water cycle monitoring, disaster preparedness, and climate research. While internal data solutions aim for seamless integration within an organization, the need for interagency data sharing and open data provisioning to the public, private sector, and academia is growing. We will explore the latest advancements in data standardization, interoperability frameworks, and open-access strategies that enhance collaboration and maximize the societal impact of hydromet data. Key topics include:

- Cross-agency data exchange and interoperability standards
- Open data platforms and public accessibility
- Use cases in private sector applications and scientific research
- Policy frameworks and governance models for data sharing

The presentation will showcase recent real-world KISTERS system implementations in the UK, Ireland, and Germany, highlighting key achievements and lessons learned. Additionally, it will provide an outlook on future developments and innovations in hydrometeorological data management and integration.

New high frequency water quality guidance

Lucy McKergow[1], Andrew Hughes[1] and Juliet Milne[2].
[1] NIWA Hamilton
[2] Traverse Environmental, Wellington.

High frequency or continuous water quality monitoring can provide detailed insights into water quality dynamics but is frequently challenging and resource hungry. Monitoring projects are more likely to succeed if they have: (1) clearly defined objectives, (2) a robust data collection system which includes standards and SOPs, and (3) well thought out methods for converting raw data to knowledge for decision-making. Two projects which support high frequency water quality (HFWQ) monitoring are nearing completion: updates to Continuous WQ NEMS and the HFWQ Monitoring Guidance Envirolink Tool.

The Envirolink Tool will provide guidance on the use of HFWQ sensors, monitoring system design and resourcing requirements to support users when developing business cases and planning projects. The Use Cases chapter focuses on decision making around the use of HFWQ sensors. It outlines current uses for HFWQ sensing in New Zealand, compares WQ monitoring methods, and provides a high-level design framework for assessing whether HFWQ sensing is required, optional or not required for decision making. The guidance is supported by case studies on existing HFWQ sensing systems: ORC's Lake Hayes tributary and lake monitoring, WRC's integrated Firth of Thames monitoring programme, and WRC's anoxia risk dashboard using existing data. The Resourcing chapter supports regional council staff to create realistic budgets for HFWQ projects. HFWQ monitoring is resource hungry – it will always be more expensive than discrete sampling or field measurements. A common theme in the Resourcing task workshop was estimate your budget and multiply it by three to estimate the actual cost of operating HFWQ sensors to support decision making. Because of this mismatch between planned and actual budgets, the focus of the Resourcing chapter is on planning well for challenges (such as scheduling issues, staff training, equipment failure or loss), and ensuring contingencies are part of initial budgets.

The reviews of the National Environmental Monitoring Standards (NEMS) for Continuous Water Temperature and Continuous Dissolved Oxygen (DO) have progressed over the last year and are approaching completion, together with revisions to the relevant annexes of the NEMS Data Processing. Greater clarity has been provided around instrument calibration and validation requirements, supplementary measurements (for NEMS DO), record keeping and QC 600 requirements. Quality coding matrices are also now included to differentiate between data of different quality, particularly data that is QC 500 vs QC 400. In all cases, the matrices provide an initial quality code, and this may change once the collected data are processed via the NEMS Data Processing. The presentation will touch on some of the key changes from a data collection and processing point of view, including treatment of >100% saturation DO data.

Navigating the Challenges: A Field Technician's Journey with NEMS in Discrete Water Quality Monitoring

Rebecca Skansie – Environment Canterbury

The implementation of the Discrete Water Quality Rivers, Lakes, and Coastal NEMS presented a range of challenges for our Field Team. While we were already committed to producing reliable and high-quality data, aligning our processes with NEMS requirements involved significant preparation and behind-the-scenes work. During this process, several challenges and questions arose, both in the field and during data processing back in the office.

In this presentation, we will explore the obstacles faced during implementation and discuss the strategies and solutions we employed to overcome them and successfully integrate NEMS into our processes and now code our discrete water quality data for Rivers, Lakes, and Coastal sites.

NEMS Open Channel Flow Measurement Update on behalf of Steering Committee

Evan Baddock – NIWA

The NEMS - Open Channel Flow Measurement, has recently been revieiwed by Evan Baddock (NIWA), Alex Ring and Phil Downes (ECan) and a new version is, or will shortly be available for download.

This is an interim release of the document to allow new material relating to different gauging methods to be included. A further release of the document will follow. This will incorporate the same material, but in the new document structure adopted by the NEMS Steering Group. The latest version of the NEMS Water Level - Continuous Measurement of Water Levels for Environmental Monitoring Purposes, being the first example of this revised NEMS document format.

Much of the user feedback received relating to previous versions of the NEMS - Open Channel Flow Measurement has been considered for inclusion within this, and the planned subsequent release of this document.

The primary changes to the NEMS - Open Channel Flow Measurement, relate to the incorporation of additional sections relating to:

Site selection

Surface velocity gauging methods and the derivation of “Alpha”

Salt dilution gauging and the application of the SUNY software, which is now a compulsory requirement of the standard

The implementation of QREV, which is now a compulsory requirement of the standard

The removal of material relating to data processing and archiving, and the placement of this material within the NEMS Data Processing – Processing of Environmental Time-series Data. A further release of that document will occur in the near future.

This version of the Open Channel Flow NEMS also revisits how gauging uncertainty is applied to quality coding of gauging data. The uncertainty associated with discharge measurements is currently the subject of further investigation internationally, and the outcomes from this work may result in further changes in how uncertainty is calculated and quality codes are assigned to discharge measurements. Any outcomes from these investigations are likely to result in a further version of this NEMS being released.

A noticable change to users will be a simplification of the quality coding matrix/methodology. This new format has been adopted by the NEMS Steering Group in response to feedback from practioners, in many discipline's, who have requested a simpler process to follow when assigning quality codes to data.

Minor changes have also been made to other sections of the document.

Wednesday 26th March

Community-based Monitoring (CBM) in Action

Courtney Bosse – EOS Ecology

Courtney Bosse, Shelley McMurtrie, Zoe Dewson, Annabel Barnden

Communities across the country are actively collecting valuable data to deepen our understanding of the freshwater environment. However, this data often is underutilised because of strict quality control standards imposed by the National Environmental Monitoring Standards (NEMS) created and maintained to ensure good quality data is collected. The Community-based Monitoring Quality Assurance (CBM QA) framework was developed in collaboration with various agencies, including regional councils to support CBM groups to collect stream data that are of known quality and fit for purpose. Since its launch in 2023, it has been embraced by numerous community and catchment groups nationwide, enhancing the reliability of their data. This increased credibility is expected to encourage regional councils and other decision makers to further utilise communitybased monitoring data.

As part of the 'Wai Connection – Tatai Ki Te Wai' project, EOS Ecology is able to support catchment groups in Waitaha/Canterbury, helping to refine or develop new monitoring plans. This includes offering expert guidance on site selection, determining key parameters, sampling frequency, and methods. Additionally, EOS Ecology provides hands-on streamside training and supports data interpretation. 'Wai Connection' coordinators collaborate with the catchment groups to ensure their unique catchment values and challenges are integrated into the monitoring process, which is then reviewed by a senior scientist. A key tool for these groups is the Focus Catchment Map Series (FCMS), which includes 30 detailed maps and serves as the foundation for creating effective monitoring plans.

In this session, you'll hear how the CBM QA framework is being put into action, featuring a case study from a Waitaha/Canterbury catchment

group. Our case study will explore the following:
1. An introduction to the group.
2. The development of a water quality monitoring plan using the CBM QA framework.
3. Streamside training workshops.
4. Data interpretation and insights.

In addition, through the 'Wai Connection' project, EOS Ecology was tasked with developing a citizen science data website for housing data collected by catchment groups monitoring waterways across Aotearoa. This will result in the creation of two websites:
1. The Community-based Monitoring (CBM) portal, connecting users to other Aotearoa-based websites with data on terrestrial, freshwater, and marine environments.
2. The Community-based Freshwater Monitoring (CBFM) website, designed to house, visualise, and interpret community-driven freshwater monitoring data from across the country.
As more groups look to monitor their local awa, and with the national CBM QA framework guiding their efforts, the development of the CBFM website is the perfect next step in advancing community-based environmental monitoring.

Processing Continuous Water Quality Data – Turning Dirty Data into Clear Trends

Ebi Hussain – Submerged Environmental LTD

Continuous water quality monitoring generates vast datasets that require careful processing to ensure accuracy, reliability, and meaningful interpretation. This presentation will provide a practical guide to processing continuous water quality data, covering fundamental concepts, common methods, and best practices for data handling.

Real world data will be used to demonstrate various methods of cleaning, filtering, and analysing time-series water quality data. Key processing techniques, such as data smoothing, outlier detection, and data gap handling will be discussed as well as, how to identify trends, anomalies, and patterns in water quality datasets.

A crucial focus of the presentation will be on ways to select and implement the appropriate processing methodology based on the specific parameter and the intended use of the data. By the end of this session, attendees will gain a better understanding of how to process, interpret, and visualise continuous water quality data to support informed decision-making in environmental monitoring.

This presentation will be followed by a workshop where open discussions can be had regarding various data processing objectives and requirements.

AI-based Anomaly Detection in Stream Water Level Data

Chanwoo Kim – Korea Institute of Hydrological Survey

Reliable and high-quality water level data are essential for producing accurate discharge data at hydrological stations. The Korea Institute of Hydrological Survey (KIHS) provides quality-controlled water level and stream discharge data. The manual quality control, utilizing data correlations with neighboring hydrological stations and manually observed values, is the most common way for calibration and validation of anomalous behavior in stream water level data. It is not easy, however, to account for the lag time caused by varying flow rates depending on water level ranges.

In addition, the hydrometric network in South Korea, which consists of numerous hydrological stations, is expected to continue expanding from 1,213 stations in 2020 to 8,460 stations by 2029. This expansion of the network has driven up the demand for the way to alleviate the time-consuming and inefficient tasks involved in manual quality control. Advanced AI and statistical techniques have made it possible to quickly detect anomalies in time-series datasets by using deep learning to model data correlations. The AI-based anomaly detection approach could be a good alternative to address hydraulic issues related to lag time and meet the growing demand.

Thus, the KIHS aims to develop an AI-based anomaly detection model for the 10-minute interval time-series water level dataset of the target stream. We have also focused on the feasibility of simulating normal water level patterns at the target hydrological station using only the upstream and downstream water level data, as it is important that our hydrologists can easily run the model. Therefore, the most suitable model, which incorporates simulation performance and appropriate thresholds, was designed through a comparison of various tools and criteria.

First, an Extended LSTM (xLSTM) was used to capture the relationship between upstream and downstream water level data and to simulate normal water levels. Second, user-supplied (fixed) and dynamic thresholds for anomaly detection were set from the differences between the xLSTM data and raw data. Finally, the model's anomaly detection results were compared with manually identified anomalies to evaluate its effectiveness.

The model detected approximately 90% of anomalous points and patterns in the given water level dataset caused by the overturning of float-type water level meters and sensor calibration errors. However, some normal data, such as rapid increases in water levels and changes in base water level due to bed level fluctuations, were also detected as anomalies. These false detection points are expected to be reduced by combining threshold rules or inputting better parameters. When the model is enhanced with refined thresholds and adjustment coefficients, automated quality control and the production of higher-quality hydrological data will become achievable.

TQ-Tracer Workshop

Christoph Sommer – Sommer

Evaluating tracer dilution measurements can be challenging, especially for beginners. This workshop aims to help users of tracer dilution instruments improve their data analysis and evaluation skills. Both beginners and professionals need to accurately assess their measurements, and this workshop will provide practical examples to identify areas for improvement and achieve better data quality.

The software's implemented features offer numerous possibilities, making it crucial for users to understand their capabilities. Join us to explore these features and enhance your proficiency in tracer dilution measurement evaluation.

Thursday 27th March

Constructed wetlands treating farm runoff: performance and lessons learned measuring nutrient and sediment attenuation

Brandon Goeller – NIWA

Constructed wetlands treating farm runoff: performance and lessons learned measuring nutrient and sediment attenuation

NIWA researchers recently completed a four-year project funded by the Ministry of Primary Industries to demonstrate the performance of six surface flow constructed wetlands (CWs) for mitigating nutrient and sediment pollution in rural run-off. This presentation will highlight challenges faced and solutions developed to measure the fluxes of nutrients and sediment from flashy and intermittently flowing wetland inflows and outflows. NIWA worked alongside Tasman, Taranaki, Hawke's Bay, Bay of Plenty, and Canterbury councils and landowners to identify sites and design the wetlands, guide vegetation plantings, install monitoring equipment, and quantify contaminant removal. We developed a standardised monitoring programme based on NEMS and internal SOP guidance, providing a rigorous and adaptable approach for quantifying CW attenuation of diffuse pollutant loads. Intensive monitoring at the CWs included a combination of weir and pipe flow structures, high frequency sensors, autosamplers, piezometers, and discrete sampling.

Challenges of Monitoring in the Whangamarino Wetland

Lee Boon and Morgan Harvie – Pattle Delamore Partners Limited

The Whangamarino Wetland, located in the Lower Waikato River catchment, is a 7,000-ha mosaic of peat bogs, fens, and lakes. It is the second-largest wetland in the North Island and holds significant cultural value as taonga to Waikato-Tainui and local hapū. Historically, the wetland has been used as a food source, for recreation, harvesting harakeke, and preservation of tools and waka in the peat.

The wetland is an internationally recognised Ramsar site, home to indigenous flora and fauna, including six threatened bird species. However, its hydrology was significantly altered in the 1960s following thew implementation of the Lower Waikato-Waipa Flood Protection Scheme. While this provided an increase in productive land and flood protection, it also led to biodiversity loss and a decline in water quality, primarily due to the decrease in water level and redirection of flow.

The Waikato Regional Council Integrated Catchment Management Group continues to operate several flood control gates throughout the Whangamarino Wetland. PDP plays a key role in monitoring its water quality and hydrology, maintaining nine continuous monitoring sites that measure turbidity, water level, dissolved oxygen, and flow. Our responsibility is to carry out routine flow gaugings, site validations, sensor calibrations, water quality sampling, and sediment gaugings at the various sites, providing water quality and quantity information to WRC to inform their ongoing resource consent compliance conditions. This includes data QA and QC of the continuous monitoring data, along with quarterly and annual reporting.

Poor water quality presents a range of issues for our sites. Challenges include:

- Stagnant water leading to stratification and problematic flow gauging conditions.
- High summer water temperatures causing excessive weed growth, algal blooms and extensive bio-fouling issues.
- Eroding banks creating site instability.
- Cows and extreme weather which can damage equipment.

This presentation will discuss PDP's role within the Whangamarino Wetland, the challenges faced and the strategies to navigate the complex monitoring conditions. We also welcome any ideas to improve our practices and equipment.

Making the most of our data for Drought Management – Lessons about Situational Awareness from the UK and NZ

Divesh Mistry – Gisborne District Council

This talk was presented at the Environmental Data SIG in late 2024. The content was focused on how hydrological data is central to situational awareness and reporting for all phases of dry weather / drought. Comparing approaches between the UK and NZ, the talk will highlight opportunities associated to utilising data across Local and Central government to help NZ to prepare for more extreme droughts in the future

E: Divesh.Mistry@gdc.govt.nz | **M:** 027 237 6379

Another Dimension to Hydrological Data

Daniel Wagenaar - Xylem

The integration of optical flow, machine learning and real-time stage-discharge rating development brings another dimension to hydrological data. The computer vision stream gauging (CVSG) system uses stereo cameras for the remote sensing of surface velocity and water level to develop adaptive stage-discharge rating curve. The rating curve is continuously assessed from surface velocity and water level measurements merging current and previous developed observations over consecutive flow events to provide an adaptive flow record within flow monitoring conditions.

There are several aspects that needs to be considered when designing a flow gauging solution to enhance flow monitoring, data management and operational efficiency. The biggest challenge for all organizations involved in flow monitoring from water resource management, flood forecasting, water infrastructure to environmental flows is available resources and retaining the required specialised skills within the organisation. The CVSG system was designed around the entire flow monitoring process and the results to date shows a matured system that can provide valuable flow data under a range of flow conditions. What makes this solution standout is the limited interaction required by operators to achieve the accuracy level currently obtained.

The performance and efficiency of the CVSG system was highlighted during recent flood events at a number of flow monitoring sites around the globe. The ability to provide flow results within 5% of existing rating curve without site calibration or post processing makes it ideal solution for water resource and flood monitoring applications.

The measurements performed by the system during the recent Cyclone Jasper event in Northern Queensland highlighted the dense data set obtained using the Farneback optical flow-based method. The adaptive stage-discharge rating curve developed during the flood event provided critical information on the complex flow conditions present at the monitoring site.

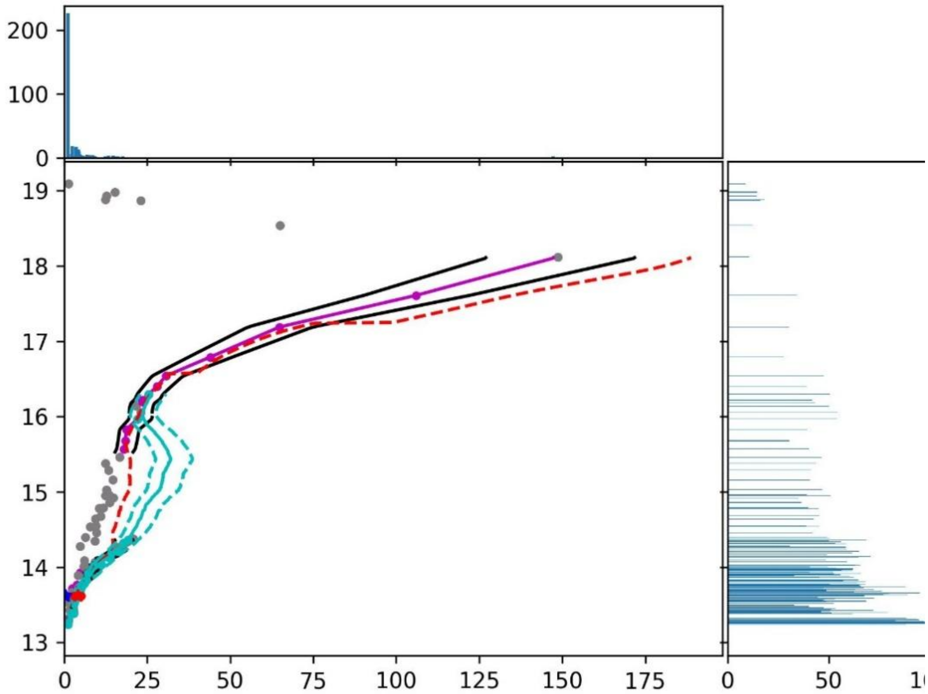

Figure 1: Adaptive Stage-Discharge Rating

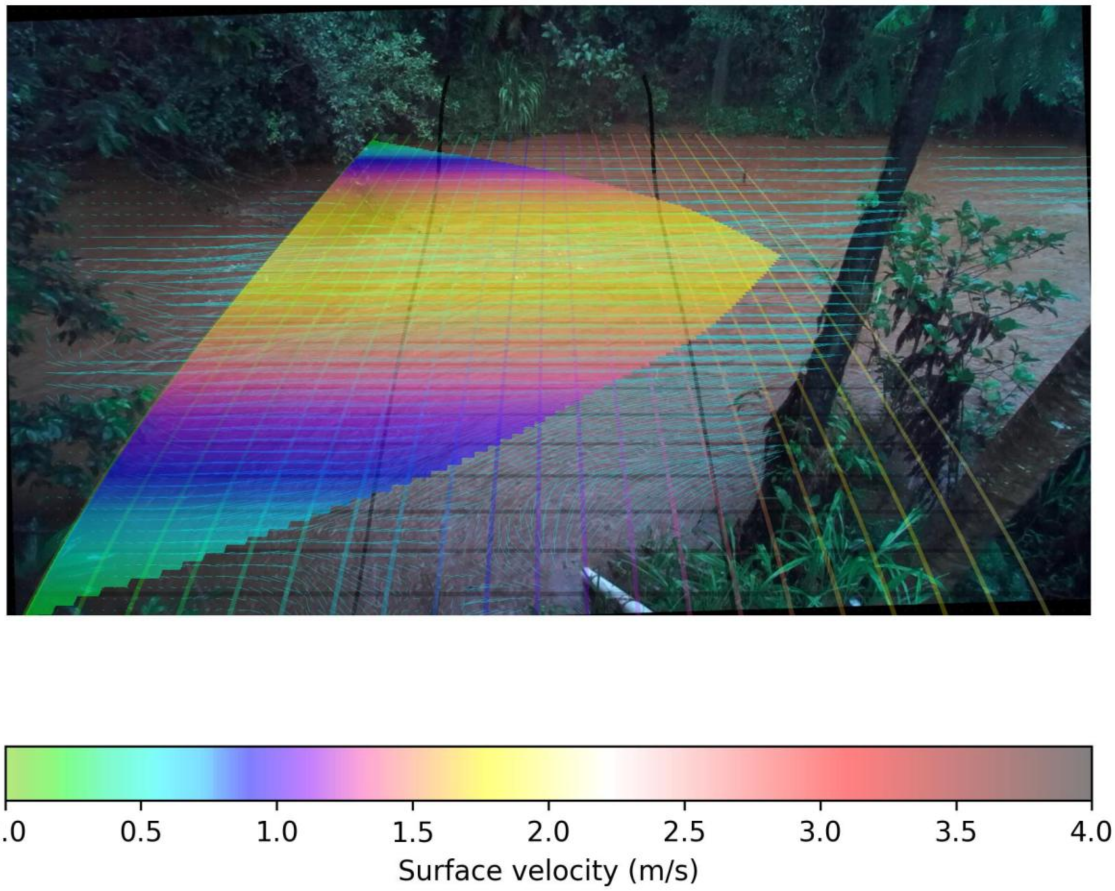

Figure 2: Surface Velocity Distribution

KEYNOTE SESSION

Operation of Discharge Measurement Station and Utilization of Hydrological Survey Data in Korea

Hwansuk Jin – Korea Institute of Hydrological Survey

Korean rivers are divided into four major basins, where rivers barrages are operated in the midstream areas to mitigate floods and droughts caused by climate change, secure stable water resources, and promote regional economic development. However, the operation of these barrages based on rainfall and water demand creates drainage effects, making it difficult to apply conventional stage-discharge rating curves. Additionally, tidal influences in coastal areas further complicate accurate discharge estimation. To address these challenges, Korea has implemented Discharge Measurement Station that utilize velocity sensors to obtain more reliable discharge data.

These discharge measurement station primarily consist of Horizontal Acoustic Doppler Current Profilers (H-ADCPs) and Microwave Surface Velocity Meters. As of March 2025, Korea

operates a total of 101 discharge measurement stations, distributed across major rivers: 30 in the Han River, 34 in the Nakdong River, 17 in the Geum River, and 20 in the Yeongsan River. Additionally, by the end of 2025, the system is planned to expand to 176 stations to enhance nationwide hydrological monitoring capabilities.
Data is collected at 10-minute intervals, measuring water level, velocity, signal strength, and water temperature. This information is transmitted in real-time to centralized servers and made publicly accessible via dedicated web platforms. To maintain data accuracy, 4 to 20 field discharge measurements are conducted annually, verifying and refining surface velocity-discharge relationships. Additionally, monthly monitoring is performed to detect any variations and ensure data reliability.
Collected data undergoes rigorous processing, including filtering and error correction, to maintain high-quality standards. Hydrological validation methods are applied to assess data consistency, and comparisons between upstream and downstream discharge relationships are used for verification. Discharge estimation relies on stage-discharge rating curves during standard periods, while surface velocity-discharge relationships are applied when affected by tidal or drainage influences.
The discharge data produced by these discharge measurement station play a crucial role in flood forecasting, water resource management, and environmental monitoring. These datasets are published annually in the Korea Hydrological Survey Yearbook and systematically managed through the Hydrological Data Information Management System (HDIMS), operated by the Korea Institute of Hydrological Survey (KIHS).
Future advancements in discharge measurement aim to integrate Machine Learning (ML) and Artificial Intelligence (AI) techniques to further improve accuracy and applicability. In this workshop, we introduce Korea's discharge measurement system and share insights into its technical and operational aspects. Through this, Korea aims to strengthen international cooperation in water resource management, establish a global network, and lay the foundation for mutual collaboration in the field of hydrology.

Non-Contact Radar: Surface Radars as powerful measurement systems in mobile and stationary solutions

Michael Sommer – Sommer

Surface radars have been on the market for over 15 years, gaining recognition with each new installation worldwide. These versatile instruments can be utilized in a variety of applications and for numerous purposes.

In this talk, we will explore different applications of surface radars, ranging from mobile to semi-stationary to fully stationary setups, and from handheld to cable-operated or tripod-operated systems. We will discuss the scenarios where surface radars are most effective, as well as situations where their use may not be ideal. Additionally, we will delve into the mechanics of how these instruments work.

Non-Contact Radar: Radar and AI

Michael Sommer – Sommer

Surface velocity methods, despite their varied approaches, all aim to measure the surface velocity of rivers and streams. A common factor influencing these measurements is wind. Wind can create ripples on the water's surface that either oppose the natural flow of the river or add to its velocity, complicating accurate measurement.

In this talk, we will explore an innovative Artificial Intelligence (AI) approach designed to mitigate the impact of wind on radar measurements. By employing a neural network, the algorithm can continuously evolve, learning more about the specific characteristics of the measurement site over time. This adaptive learning process enhances the accuracy and reliability of surface velocity measurements, making it a valuable tool for both researchers and practitioners in the field.

We will delve into the mechanics of how this AI-driven method works, examining its potential to transform surface velocity measurement by reducing wind interference. This approach not only improves measurement precision but also broadens the applicability of surface velocity methods in various environmental conditions. Join us as we uncover the benefits and intricacies of integrating AI into surface velocity measurement techniques, paving the way for more accurate and dependable data collection in hydrological studies.

Panel Session, Facilitated by Joe Gendall – Watercare

From Waders to Widgets: Tradition, Technology, and the Future of Hydrology

After a successful panel discussion at last year's Tech Workshop in Queenstown, I thought it was pertinent to follow up with another discussion this year. Hydrology in New Zealand is entering a transformative period, where traditional approaches meet rapidly evolving technologies and methodologies. This panel discussion will bring together experienced, and emerging, practitioners, to explore how our relationship with water and our professional practice has transformed over time.

The discussion will examine several transitions: the shift from traditional field methods to automated, digital and AI-integrated approaches; the evolution from siloed thinking to collaborative approaches; and the changing skill requirements for water professionals. By learning from past practices and embracing new innovations, we can better equip the next generation of hydrologists to tackle future challenges.

Panel Members:

Tane McFaddon – Waikato Regional Council
Mic Clayton – Cooma, Australia
Evan Baddock – NIWA
Wendy Purdon – Greater Wellington Regional Council

Validating High Flow Rating Curves: A Comparative Approach Using Slope Area, STIV, and Radar Gun Gaugings

Pete Mason and Reuben Stuart – West Coast Regional Council

Despite our anticipation and hope for the ultimate flood, no significant high flows have occurred on the Orikaka River since last year's workshop to extend our flow rating curve. However, the Labour Weekend Floods of 2024 provided a unique opportunity to capture high-stage gaugings on the Buller and Inangahua Rivers using two distinct methods: Slope Area Gaugings and the STIV method via drone technology.

This study focuses on comparing surface velocities measured by drone with mean velocities derived from Slope Area calculations to validate both approaches and improve confidence in extending Flow Rating Curves. Additionally, a new slope area reach has been established at Blacks Point on the Inangahua River, incorporating a bridge for Radar Gun Gaugings. This setup enables direct comparison of Slope Area, STIV, and Radar Gun measurements under the same conditions.

By integrating traditional expertise with emerging technology, we push the boundaries of hydrological measurement. Join us as "Old Dog" Pete Mason and "New Tricks" Reuban Stuart go head-to-head in this methodological showdown—where the best technique takes the win.

New HFWQ sensor selection guidance – optical nitrate, optical DO, temperature and EC

Lucy McKergow[1], Jade Arnold[2], Alex Vincent[1], Neale Hudson[1]
[1] NIWA Hamilton
[2] NIWA Christchurch

Obtaining information about water quality dynamics over short time scales (such as diel cycles, or during a storm or rain event lasting a few days) using conventional discrete samples or field measurements may be costly and logistically challenging to undertake frequently. Fortunately, high frequency water quality (HFWQ) monitoring using in-situ field sensors to continuously measure variables of interest (e.g., nitrate, dissolved oxygen) can provide detailed insights into water quality dynamics. However, selecting the "best" sensor for a project can be challenging.

Regional council and NIWA staff are working together on an Envirolink Tool project (2023-2025) to develop guidance on sensor selection for optical nitrate, optical DO, temperature, conductivity, turbidity and algal fluorescence. Regional council staff and researchers from several CRIs and universities shared a large amount of knowledge and expertise via online surveys and workshops held between October 2023 and October 2024. The guidance will help regional council staff shorten the learning curve for new users, support them to select an appropriate sensor, and enable them to fast-track collection of high-quality data.

In this presentation we will provide an overview of the first group of guidance chapters. Each standalone chapter describes the sensors' basic operating principles, identifies key sensor features, compares sensors, and summarises key sensor selection questions. Sensor comparison tables summarise basic information on the sensors commonly used and user knowledge on sensor hardware, software and support. Case studies outline a range of side-by-side sensor comparisons and technical challenges experienced users have overcome.

New and experienced sensor users will be invited to participate in the review process occurring in April.

Kiri Mason – Greater Wellington Regional Council

Reflecting on our first 365 days in field hydrology – growth through collaboration.

Madison Ganicz-White and Campbell McCusker – Auckland Council

Entering into the field of hydrology brings various challenges, learning curves and opportunities for growth. This presentation will highlight our key experiences during our first year and share examples of how collaboration/teamwork can be used by early-career hydrologists to drive their development and passion for field hydrology.

The trials and tribulations of Horseshoe Lagoon

Julie Grant and David Ashby-Coventry – Environment Canterbury

Horseshoe Lagoon has the only known population of giant kōkopu (*Galaxias argenteus*) in Canterbury. The lagoon is at risk from climate change, infilling from beach berm, increased salinity and declining water quality. As part of a joint project, we were involved in obtaining data about the environment the giant kōkopu reside in. This includes discrete and continuous monitoring, fish and macroinvertebrate surveys, and eDNA sampling. Our presentation will summarise our findings to date, share environmental and instrumental challenges we faced along the way, and considers future management options for both the lagoon and the giant kōkopu.

Friday 28th March

Water quality and quantity measurements in the field. Frequently asked questions

Dirk van Walt – Van Walt Ltd

What happens when pressure sensors drift and can they be calibrated? How does a dissolved oxygen sensor correct for atmospheric pressure? How often should sensors be calibrated? How can I tell a healthy sensor from a bad one? Sound familiar? I would think it does as these are topics I cover annually at HydSOC and on a daily basis at work. But they stay relevant and as monitoring teams expand and employ new crew members. So lets dive back in and talk about some of these frequently asked questions.

Wai-Spy – Something old, something new, something borrowed, something blue.

Alex Vincent 1, Lucy McKergow 1, David Wood 2, Valerio Montemezzani 1, Gareth van Assema 1, James Sukias 1, Rebecca Stott 3, George Payne 3, Rob Davies-Colley 3, Niketi Toataua1, Derek Roberts 4, Anton Major 4

1 NIWA, Hamilton
2 NIWA, Christchurch
3 WaterHealth Consulting, Hamilton, formerly NIWA, Hamilton
4 Mangatoatoa Paa, Tokanui, Waikato

Wai-Spy is an MBIE Smart Idea Fund supported project that runs from 2022 to 2025. The goal of the project is to help inform people about the potential health risk of contact recreation in waterways. We are developing a new cost-effective, real-time warning system to provide now-casts of visual clarity and microbial quality (Escherichia coli) in freshwater environments. The ‘smart idea’ in WaiSpy is to use a simple camera system, constructed from consumer components, as in-situ radiometers. This presentation will focus on the technical aspects of Wai-Spy, including the camera, high frequency water quality (HFWQ) sensing and real-time

communication of health and safety risk to people engaged in contact recreation in freshwaters.
The Wai-Spy camera capture images of river water, which are then analysed to estimate remote sensed reflectance (Rrs). The camera adopts the approach used by the HydroColor App and takes images of the “blue” sky, water and a reference grey card. Recreational safety and health risks can then be estimated in near real-time by building site specific relationships between camera Rrs and visual clarity or microbial quality.
To test the camera system’s performance Wai-Spy uses HFWQ sensors. A sensor package has been deployed on the Puuniu River at Mangatoatoa Paa alongside a camera system. The sensor package includes a VWMS ColiMinder for microbial quality, a Sea-Bird beam transmissometer for water clarity, a Sea-Bird NTURT for low range turbidity, and a multiparameter YSI EXO sonde. The sensors are telemetered in real-time to support operations and data sharing with partners. The HFWQ data is verified using grab samples, field measurements with reference sensors, and sensor validation measurements (e.g., air & blocked path measurements for the C-star). The project data is combined with discharge and stage measurements “borrowed” from WRC’s site downstream. Findings of the side-by-side turbidity sensor comparison will be included in turbidity sensor selection chapter of the HFWQ Monitoring Guidance Envirolink Tool.
In partnership with Mangatoatoa Paa, we are working out how to communicate risk to swimmers. Real-time data sharing is a key part of WaiSpy and is done with dashboards in Aquarius WebPortal. A simple dashboard summarises the latest sample data and key field measurements for health risk and swimmer comfort. A more detailed dashboard includes time series plots of all the data. Information from the dashboard is shared by our partners on social media so that swimmers at the Paa have the most up-to-date information before they chose to swim.

Are we getting better?

Phil Downes – Environment Canterbury

Phil Downes quite a few years experience (30+++) and wearing my NEMS hat I’ve reflected on the quality of data overtime.
This presentation will summarize the history of sensors over time and the impact they have had on the quality of data.
Outline some observations and conclusions from the results of the data.
Some good moments of reflection for everyone.

Marlborough District Council Flood Network Risk and Resilience Review 2024

Emma Chibnall – Marlborough District Council

Not all monitoring sites operated by Marlborough District Council were installed with the purpose of flood warning. Sites have historically been installed to monitor long term trends, environmental impacts from low flows, compliance or water quality. Due to the limitations of the installed sensors or the location of sensors, sites may not be installed to a standard that can withstand the largest flood flows or be able to collect accurate or timely data that is crucial for flood warning and decision making.

Additionally, the systems supporting the physical network, including telemetry, servers, websites and quality data, all require reviews to ensure they are operational, resourced, backed up and can withstand the rigours of serious weather event.

Marlborough District Council has initiated many network and system reviews, through both internal and external experts.

The purpose of this review was to classify **what is a flood site**, **determine the resilience of the sites**, **systems and process**, **determine the quality of the data, highlight the risks and make recommendations**.

Greater Wellington's Flood Network Performance Standards

Georgia Spankie – Greater Wellington Regional Council