An Innovative, Cloud-Based, Operational Flood Water Control Room for Melbourne Water

B Jackson[1 *], P Rasmussen[2]

[1]*Water Technology, 15 Business Park Drive, Notting Hill, Victoria.*

[2] *Melbourne Water, Gate 12 Worsley Rd, Bangholme 3175, Victoria.*

**Corresponding author email: brian.jackson@watertech.com.au*

Highlights

- Improved information sharing for diverse decision-making needs with HydroNET.
- Improved forecasted and observed rainfall and alerting with rain gauge adjusted radar data.
- Water level monitoring of over 200 gauges.

Introduction

Melbourne Water (MW) have extensive monitoring equipment and data management systems to assist them to play a leading role in supporting partners to prepare for, respond to, and recover from potential flooding events and other urban drainage related management responsibilities across the region. However, many significant rainfall events still miss the rain gauges, leading to gaps in the understanding of the intensity, duration, timing and locality of events. MW thus wanted to trial the use of rain gauge adjusted radar rainfall data and short-term high-resolution rainfall forecasts to assist with informed decisions and actions based on the events.

MW also sought to evolve their technology around operational information creation and sharing for effective and coordinated decision making needs across the drainage operations, flood warning, flood mitigation and flood modelling domains, all without disrupting the existing systems and processes and keeping costs down.

After an evaluation process of various products on the market, the HydroNET Water Control Room (WCR) was chosen for trial implementation over an initial evaluation period of 1 year. HydroNET is a well-established, web-based decision support platform that provides users with smart tools overlying existing data sources and systems, allowing them to easily access and use their connected data to generate personalised dashboards, forecasts, alerts, notifications and reports on-the-fly without burdening the data source and system administrators.

Methodology

The implementation of the HydroNET WCR and radar rainfall data was conducted using an Agile approach over four phases. The project commenced with an initial functional design phase to formulate the various HydroNET dashboards required. Secure, real-time connections to the required disparate hydrological and meteorological databases where then configured in a second phase.

Data Connections

The HN WCR was initially connected to the MW Flood Information Decision Support System (FIDSS) providing MW users access to MW's rain gauge, river level gauge, tidal gauge, water quality gauge and drainage basin gauge network data. The Bureau of Meteorology (BoM) weather data FTP connection was also configured to provide BoM weather data, including their new Rainfields 3 high resolution, bias adjusted radar rainfall data and radar based high resolution, short term rainfall forecasts up to two hours ahead (known colloquially as NowCast). HydroNET also set up a further process to adjust the BoM radar rainfall data against the MW rain gauges to provide MW with a radar rainfall product with improved calibration against rain gauges.

In the 3rd phase, the HydroNET WCR tools were made available as an added value service to translate the archived and operational weather and water data into valuable tools, applications, personalised dashboards and reports. These were then used to set up initial benchmarking dashboards in support of an extensive Site Acceptance Testing (SAT) process that followed over a period of 12 weeks. This was guided by a SAT document and included an extensive issue identification and resolution logging process.

Once the SAT and benchmarking was approved, the final 4th phase - currently in progress - commenced. This is an initial 1-year trial subscription to the HydroNET software as a service (SaaS) system with included helpdesk, support and maintenance. The system will continue to be tested and improved during this trial. All four phases and the associated data connections and HydroNET tools are summarised in figure 1 below.

Figure 1. Trial HydroNET phased implementation process.

Digital Delta Approach

The HydroNET WCR methodology is known as the Digital Delta approach, where all services are delivered directly from the disparate data centres, over the internet, removing the need to duplicate data and circumventing any versioning issues while ensuring that the user is seeing the latest master data available. A further benefit is provided by the HydroNET WCR architecture, which uses a HydroNET server hosted in the cloud to do the intensive data processing required to support the various tools, and the HydroNET Portal to provide the individual users with the tools they need to visualise the information in the customised way they require.

Results and discussion

Example Dashboards showcasing the combination of MW Rain Gauges with Radar data and Nowcasts

MW now have numerous dashboards that can be configured in various ways by any staff member themselves without the need to request database administrators or programmers to do it for them. Two examples are shown in figure 2 and figure 3 over the page.

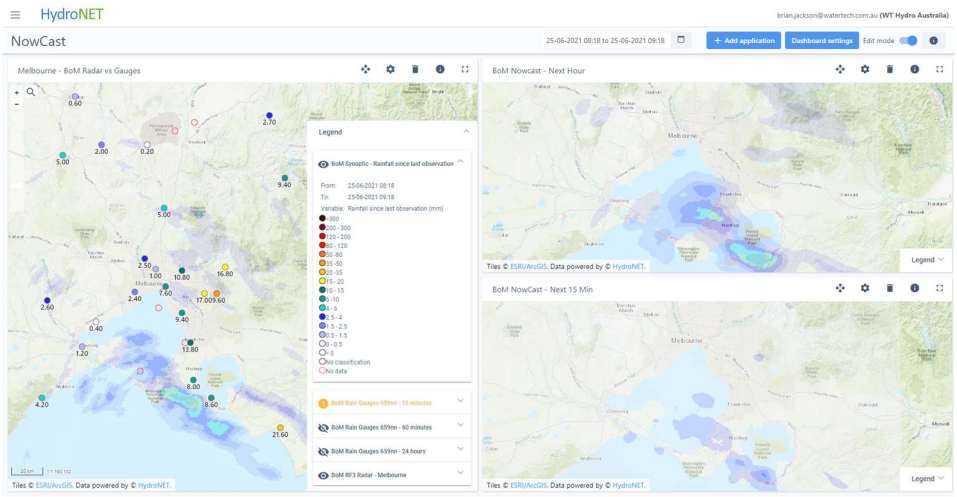

Figure 2. Rain Gauge and Radar rainfall data visualised in HydroNET. The last hour of observed rainfall is shown in the left map and the radar-based forecast for the next 15 minute and 1-hour durations are shown on the right (any intervals can be configured).

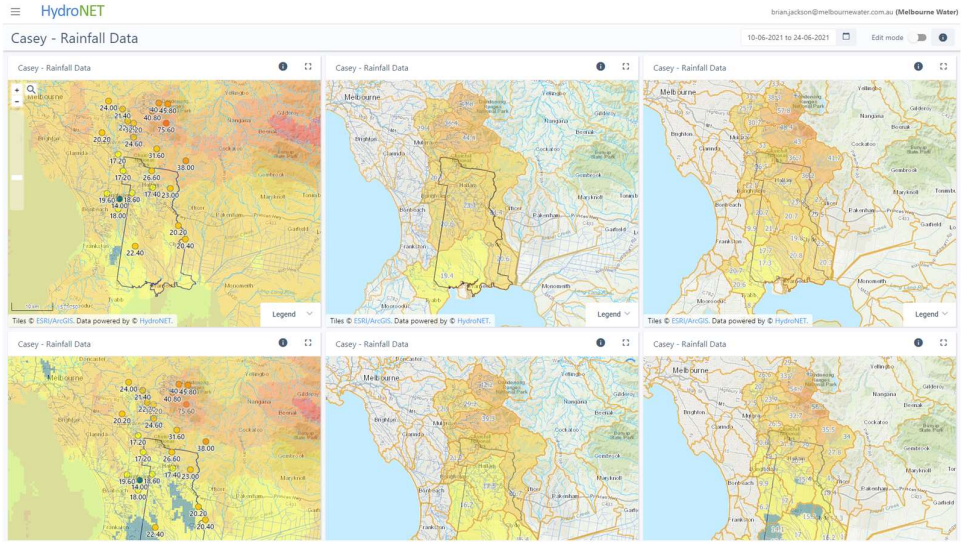

Figure 3. HydroNET dashboard showing the gridded radar rainfall data (1st column) and the catchment aggregated rainfall calculated on-the-fly (next columns). The 1st row shows the BoM data and the 2nd row shows the HydroNET gauged adjusted data.

Conclusions and future work

HydroNET now provides MW with simple, robust tools for accessing and sharing the live information required for various differing needs before, during and after events, based on the same underlying data. This greatly improves joint decision making. The observed and forecast radar rainfall data also provides improved understanding of the intensity, duration, timing and locality of events when compared to rain gauges alone, as has been found by several other studies (Daly, 2016; Sun, 2000). The automated catchment aggregation further improves the understanding of catchment flooding.

Further work in progress includes:

- Connections to more cloud data sources for Urban Drainage Visualisation (urban drainage monitoring) needs, including the MW Hydstra database.
- Implementation of an alerting trial to provide flood alerts to Emergency Management Victoria.
- Dashboards for several Metro Councils to improve MW's data sharing responsibilities.

References

Daly, A. Radar Rainfall Calibration of Flood Models – the future of Catchment Hydrology? Paper presented at the Stormwater Queensland Conference, 2016.

Sun, X., Mein, R.G., Keenan, T.D. and Elliott, J.F., 2000. Flood estimation using radar and rain gauge data. Journal of Hydrology, 239(1), pp.4-18.