

This modelling feature leads with an article on a hydraulic forecasting system generated for flood emergency management of the rapidly growing Gold Coast area. Natural disaster mitigation is highlighted in an article about KBR's involvement in Vietnam. Behaviour simulation, asset management and mapping water losses is also covered.

Real time flood forecasting

As the City of Gold Coast continues to be confronted with population growth rates which are among the country's highest, a hydraulic flood forecasting system has been designed to enhance the accuracy and effectiveness of flood emergency management.

Much of the city's growth has historically been along the coastal zone and consolidation continues with canal and lakeside development within the Nerang and Coomera floodplains. However, this has resulted in thousands of residential and commercial properties being at potential risk from major flood events.

To help manage this risk, Gold Coast City Council (GCCC) recently commissioned a flood forecasting system called MIKE FloodWatch for the Nerang River catchment. The FloodWatch system is the first of its kind in Australia and can significantly improve the accuracy of flood forecasting which in turn, enhances

the ability of emergency managers to make sound decisions during a flood emergency. The system was designed and developed by DHI (Water, Environment, Health).

The system extends the current Bureau of Meteorology (BoM) regional flow forecasts into detailed water level and flood inundation maps through the use of real time and automatic hydraulic model simulations, developed by the Gold Coast City Council. The hydraulic model is based on the industry standard MIKE11 modelling software.

The hydraulic forecasting model has the ability to produce flood inundation and hazard (velocity x depth) mapping. It can also predict the influence of tidal ocean conditions (including storm surge) into the forecast, critical for areas on the coastal plain.

The unique capability of the system is the fully automated and self-correcting hydraulic model. During a flood emergency



Flood forecasting software MIKE floodwatch will receive live inputs from the Bureau of Meteorology and Gold Coast City Council water level measurements to produce forecast models in flood emergency situations.

there are many sources of information to consider and a large number of people must be consulted. In these periods there is much uncertainty which can place unnecessary pressure on flood emergency managers to quickly come up with responses.

The FloodWatch system will automatically produce forecasts throughout this period without the need for human intervention, providing accurate and vital information in a timely manner. The hydraulic model forecast system runs automatically every two hours producing forecasts over the city up to 72 hours in advance.

The innovative approach in the FloodWatch system is its ability to automatically make corrections to the model in real time so as to improve the forecast. The system will interrogate real time water level gauges throughout the floodplain during a forecast period. If differences in water levels occur between the hydraulic model and gauged levels, the model will automatically detect the error and produce a correction algorithm that can be used in the future. This is particularly important to ensure that the hydraulic model is in perfect agreement with the actual measurements at the time of forecast and also to maximise the accuracy of the forecast for all future times.

This kind of error correction is robust during large flood events when river rating curves can become unreliable in large

floodplains.

The system is accessible via the internet and can therefore be monitored from the home of emergency managers even before an emergency is declared. The system is hosted by a Tier 3+ rated data centre that offers the highest security and redundancy. The data centre is also located at a site remote from the Gold Coast City which helps to eliminate any potential for disruption to power and internet access that could happen locally during a flood event. The system is maintained remotely via SMS warning and experts from anywhere in the world can remotely access the system to troubleshoot and solve problems during routine maintenance periods.

Gold Coast City Council is currently undertaking feasibility study for the possible expansion of the system to cover all rivers and creeks within the council area. It will also look to extend the system down to individual stormwater drainage systems in areas where flooding is an issue as well as extend the system to cover flash flood forecasting which currently is not possible using standard forecast systems. Storm surge forecasting will also be further investigated. ●

This material was supplied by DHI. For more information contact Dr Graeme Cox by emailing gjc@dhigroup.com or Dr Hamid Mirfenderesk by emailing hmirfenderesk@goldcoast.qld.gov.au.

Strategic planning with behaviour simulations

As the prolonged drought forces governments and utilities nationally to ponder water infrastructure projects costing billions of dollars, an Australian company has applied the concept of the popular computer game, SimCity, to reduce the cost and risk of project modelling.

Intelligent Software Development (ISD) has drawn on experience from the defence industry to use Artificial Intelligence (AI) technologies to create realistic virtual models of cities for strategic planning and forecasting purposes.

As with SimCity, Intelligent Software's AI approach can model elements of a city, such as households and their demographic characteristics. This city simulation can then be used to assist with strategic planning and demand forecasting by running "what-if" scenarios and analysing the impact that proposed strategic decisions, infrastructure and policy will have on the population's behaviour, including demand, spending and consumption.

Intelligent Software director Dr Don Perugini said AI technology reduced the cost and risk of planning for major projects and decisions. "This SimCity approach has the benefit of crystallising vast quantities of consumer behaviour data into a model that is readily understood and interpreted," he said.

Already, Intelligent Software's application, SimuAI Water, has been applied to the water industry to assist with price policy planning. In collaboration with the University of Adelaide, SimuAI Water was used to analyse urban water trading. The simulation modelled individual households and their economic behaviour for purchasing, consuming and trading water.

The application provided insight into the behaviours of individual households, by identifying unexpected and potentially costly outcomes that were not previously considered. It enabled fairer trading approaches to be devised that provide incentives

for households to save water.

Currently, SimuAI Water is being used to analyse various pricing policies for the entire city of Adelaide. More than 580,000 households containing in excess of 400 demographic types have been modelled.

Also, in collaboration with SA Water, SimuAI Water is being used to analyse water rebate policies. The simulation models household spending behaviour on water-related retail items, such as washing machines, over many years.

The software can analyse the impact that rebates have on household spending behaviour, and differences in water consumption, in order to determine the most effective rebate policies.

Perugini pioneered applying advanced software technology from Australia's defence industry, where it has been applied to logistics and emergency response planning, to the water industry.

The technology comprises individual software programs that mimic elements of a physical or social system. The software also models the higher-level and intangible factors required for strategic planning and forecasting, including economic, political, environmental, human and social elements.

Intelligent Software simulation architecture models complex distributed systems that are too difficult for mathematical models or traditional approaches.

Perugini said Intelligent Software's simulation technology had uses beyond the water sector. "Using our AI innovation, this technology has applications that range from utilities, retail, finance, real-estate, transport and emergency services to infrastructure and policy planning at every level of government," he said.

For more information contact Dr Don Perugini on (08) 8343 8455, or visit www.intelligentsoftware.com.au. ●

Modelling the world of water

MIKE by DHI



MIKE by DHI delivers superior modelling technology for the entire water cycle and provides outstanding value based on forty years of experience and know-how.

Investing in MIKE software as your modelling technology is an investment in your development as a professional and it is a gateway to the largest and most knowledgeable community of water modellers in the world.

Superior tools built on sound science

For more than twenty years DHI has made the results of our science available to water professionals around the globe as software products.

The MIKE product family covers a wider range of water modelling needs than any similar family. You can always find the tool to solve your problem - and this tool will work conveniently together with all other MIKE Software tools.

You also know that your investment in software and in your professional development is protected by DHI's unwavering commitment to quality and continued innovation.

More than just software

Excellent tools turn the hardest job into a joy! However, even the best tools may reach their limit, and that is precisely when you find out what you have paid for!

With MIKE Software you have not just purchased a tool - you have stepped into a unique technical support system with local support in more parts of the world than any similar product family.

If you have never experienced really committed technical support before, please ask our users if it makes a difference!

MIKE 21
Coastal and inland waters in 2D

MIKE 3
Coastal and inland waters in 3D

MIKE FLOOD
Inundation and mapping

MIKE SHE
Integrated hydrology

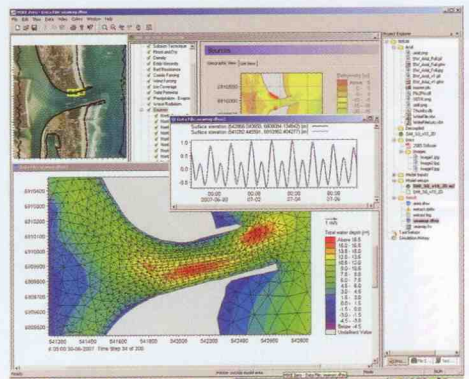
LITPACK
Sediment transport and littoral processes

MIKE URBAN
Collection systems

FEFLOW
Groundwater systems

MIKE URBAN
Water distribution

MIKE 11
Rivers, channels and reservoirs



DHI is a global organisation dedicated to the development and practical application of knowledge and technology related to water, environment and health. Our leading MIKE by DHI products are used by professionals worldwide and