Large scale flexible mesh 2D modelling of the Lower Namoi Valley

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Abstract: *With funding from the Australian and NSW Governments, the NSW Healthy Floodplains Project aims to reform water management in the northern basin of NSW. The NSW Government through the Healthy Floodplains project is developing floodplain management plans for floodplains in the NSW Border Rivers, Gwydir, Namoi, Macquarie and Barwon-Darling valleys. The project will be supported by applying various floodplain modelling techniques in areas of important floodplain conveyance.*

Floodplain conveyance modelling has to be sufficiently detailed and flexible to properly represent the hydraulics of watercourses and floodways, whilst still being able to capture the full extent of the entire floodplain. For example depth – velocity mapping from these models is being used to produce floodplain management zones to regulate future floodplain development.

A range of modelling approaches have been adopted for the floodplains of the Murray Darling Basin. This has included traditional 1D/2D linked fixed grid modelling, 1D/2D link flexible mesh modelling, and 2D flexible mesh modelling. The selection of models has depended on the existing models within the valleys, but also on the specific characteristics of each modelling case.

In the Lower Namoi a series of flexible mesh finite volume MIKE21FM models have been developed between Mollee Weir on the Namoi River and the Macquarie River junction on the Barwon – Darling. These are fully hydrodynamic 2D (channel and floodplain) models, running on GPU processors at higher order scheme precision. A 2D flexible mesh was selected for these models because of its ability to easily represent the complex geometry associated with the floodways. It allows smaller scale features to be represented at a finer resolution and the broader floodplain at a coarser resolution without resorting to model grid nesting. It also allows fully hydrodynamic higher order scheme simulations to be run on GPU processors.

Model performance under different computational settings is also reviewed. Comparison of MIKE21FM CPU and GPU based modelling indicates that there is negligible difference in results between the two computational processor options. Trials with the models indicate the fully hydrodynamic GPU run time was typically 5 – 10 times as fast as the CPU run time when run with a higher order scheme.

1 Introduction

1.1 Project background

The New South Wales government is currently implementing the joint Australian and NSW Governments funded Healthy Floodplains project in key regulated river valleys of the Murray Darling Basin. This project will see the development of floodplain management plans to regulate floodplain development for each valley under investigation.

In order to regulate floodplain development, it is essential to know how floodwaters move across the floodplain and how existing and future development will affect this. The NSW Office of Environment and Heritage (OEH) has undertaken a significant program developing detailed yet extensive models of key river valleys including the Gwydir, the Namoi, the Macquarie, the Barwon-Darling and the Border Rivers.

The models developed by OEH and its consultants will provide detailed hydraulic information about flood inundation patterns and velocities, and this will be used to determine management zones for regulating future floodplain development.

This paper describes issues considered in selecting model schematisation approaches, and outlines the development of one of the models, between Mollee Weir and Wee Waa on the Namoi River. Furthermore, simulation times under different processor and scheme order settings are compared.

1.2 Model schematisation approaches and implications

Developing large scale hydraulic models for the Lower Namoi and Barwon Darling region make this a challenging project. The hydraulic models need to be large enough to cover the entire floodplain system and at the same time they need to be sufficiently detailed to represent smaller features and flowpaths.

The floodplain area under investigation is highly developed, with a large number of constructed levee embankments used to protect farmland from small to medium sized floods. The NSW government controlled this development in the past, and worked to protect floodways between embanked areas to maintain unobstructed passage for floodwaters and avoid significant increases in flood risk elsewhere.

Computer advances have allowed sophisticated floodplain models to cover floodplains in greater spatial detail and to model more accurately the performance of critical floodways. The representation of floodway and river channel becomes an integral part of the modelling exercise and needs to be examined carefully. There are different approaches in setting up and representing these features and hence modelling outcomes can vary in their results.

Floodway representation

Floodway configurations are not always hydraulically optimal. For a variety of reasons they may include sharp bends, flow splits, contractions and expansions, and branches at acute angles (see examples in Figure 2 to Figure 4). With careful representation of the geometry, creative use of model parameters, and sufficient observed data to validate performance, such features can be represented in one-dimensional (1D) models. However, the correct schematisation of such features in a 1D model is complex, especially at higher flow rates where there may be transverse gradients in water level across the cross-section.

Two-dimensional (2D) modelling avoids much of the conceptualisation required to build an accurate 1D model in this situation. The hydraulics associated with the geometry is implicit in the spatial setup of the model, reducing the level of assumptions compared to that needed to set up a 1D model. Nonetheless, the application of traditional fixed grid 2D models still requires care. The grid size has to be small enough to actually model the hydraulic effects producing the hydraulic gradients through the floodway, particularly for flow splits, sharp bends and narrow channels running diagonal to the grid alignment. However if the grid is solely chosen to make sure the floodway is adequately modelled in the 2D grid, this will lead to a computationally slow model that produces unnecessarily detailed results for much of the floodplain.

Nested 2D modelling offers an alternative that embeds finer scale fixed grids within coarser scale grids. However there are limitations on nested models that make them unsuitable for many floodplain situations. Firstly, they require that the areas where finer scale hydraulic effects are important, or more detailed results are needed, are confined to one or a small number of well-defined areas. This is not the case for many of the floodplains in the Healthy Floodplains project. Secondly, for nested fixed grid finite difference models, the boundary interface between the nested and the background grid potentially introduces additional error. Blending the solution between the two grids requires interpolation between the solutions, and has to be properly formulated to avoid errors in mass and momentum conservation (Nash and Hartnett, 2010).

The Healthy Floodplains project has been investigating the use of flexible mesh finite volume based 2D models on some valleys. These overcome many of the limitations of other 2D models as they allow complex floodway geometries to be modelled with precision in 2D. They do not require the remainder of the floodplain be modelled at the same scale, they allow the computational mesh to be aligned and refined to suit the geometry of the problem, and they avoid the mass and momentum conservation issues associated with nested grid finite difference approaches.

Table 1 Implications of different floodway geometry representations

Floodway representation	Ease of modelling local hydraulic effects	Mass and momentum conservation	Scalable to local features?	Able to be aligned to geometry?
1D	Difficult	Yes	No	Indirectly
2D fixed grid	Simple	Yes	No	No
2D nested grid	Simple	Depends on formulation	Yes, if limited	No
2D flexible mesh	Simple	Yes	Yes	Yes

River channel representation

Flood models are required to correctly reproduce the actual exchange of water between the channel and the floodplain. To be useful the model needed to reproduce the river-floodplain flow at the right water channel water levels, and at the right locations.

The Healthy Floodplains project is applying several approaches to river channel modelling. The approaches implemented on the various models include:

- 1D channel representation, linked to a 2D floodplain with user defined lateral links
- 2D channel representation, using an fine scale unstructured flexible mesh within the channel, evolving to a coarser unstructured mesh moving away from the channel
- 2D channel representation, using a more structured flexible mesh within the channel, evolving to a coarser unstructured mesh moving away from the channel

1D/2D modelling is currently used for most flood modelling. Well established modelling systems have been developed for developing cross-section based channel models and linking these to 2D finite difference and finite volume floodplain models. These typically use a weir formulation and allow the user to set thresholds along the banks. 1D models are typically calibrated to historical event observations and gauging station rating curves to ensure that they reproduce observed behaviour.

1D models cannot directly represent bends or the hydraulics associated with contractions and expansions. Consequently 1D calibration implicitly includes both channel friction losses and channel geometry losses. Cross-section parameters from the 1D cross-sections are then interpolated linearly between cross-sections. Overflows to or from the floodplain occur where this linear interpolation produces water levels that rise above or fall below the lateral link and the surrounding 2D terrain.

These effects in 1D/2D models mean that the model accuracy depends on how uniform the reach is between calibration points, and the density of cross-sections. Local changes in bed gradients, channel morphology and vegetation characteristics will mean the assumption of uniform characteristics between calibration points becomes less valid. If 1D/2D linkages are based on interpolated 1D levels this will reduce the validity of bank overflow modelling.

2D channel modelling is able to directly represent channel geometry and form, if a sufficiently accurate DEM is available. It also means the channel and floodplain exchange is not treated any differently from any other part of the model, and does not require assumptions about how flow exchange is controlled.

However representing channels using 2D grids in semi-implicit finite difference schemes can be problematic due to stability issues, often associated with model representation of wetting and drying, steep water surface gradients (and corresponding high velocities) and high Froude number flow conditions. While many of these issues are addressed in 2D finite difference schemes, the 2D explicit finite volume scheme tends to be more robust in these circumstances.

As the Healthy Floodplains project involves a wide range of modellers working on different valleys, it will produce a combination of 1D/2D finite difference, 1D/2D flexible mesh, 2D flexible mesh unstructured and structured channel model types.

Table 2   Advantages & disadvantages of different modelling methods

Method	Advantages	Disadvantages
1D/2D	- Fastest to run, if lateral links are stable	- Slow to build (cross-sections, lateral link definition) - Form and bend losses are parameterised in 1D hydraulic roughness - Bank overflow threshold modelling requires care - Unstable for abrupt changes in terrain
2D fixed grid (semi implicit finite difference) channel	- Fast to build if good channel DEM available - Direct bank overflow representation - Direct form and bend loss representation	- Grid not aligned to channel – poor conveyance modelling depending on channel width / grid size / alignment - Unstable for abrupt changes in terrain
2D unstructured mesh (explicit finite volume) channel	- Fast to build - Direct bank overflow representation - Direct form and bend loss representation - Very stable as able to handle discontinuities	- Slower to run than 1D/2D if channel representation is detailed and GPU not used
2D unstructured mesh with aligned channel mesh	- Fast to build - Direct bank overflow representation - Direct form and bend loss representation - Very stable as able to handle discontinuities - Fast to run if channel mesh defined well	- Slower to run than 1D/2D if channel representation is detailed and if GPU not used - Slow to build structured channel mesh

2 Model Application

2.1 Model software

MIKE FLOOD FM has been used for the Namoi and Barwon-Darling valleys in the Healthy Floodplains Project. MIKE FLOOD FM allows for dynamic linking of 1D and 2D domains. The 2D domain can be represented by either the widely used finite difference rectilinear grid (MIKE21 “classic”), or a finite volume based flexible mesh (MIKE21FM). For the Lower Namoi studies, all models were developed in MIKE21FM, whereas in the Barwon Darling a mixture of 1D and 2D MIKE21FM was used.

MIKE21FM is based on the numerical solution of the two-dimensional incompressible Reynolds averaged Navier-Stokes equations, assuming hydrostatic pressure. Primitive variable equations are discretised using an element-centred finite volume method. The spatial domain is discretised into non-overlapping elements, which can be either triangular or quadrilateral (MIKE by DHI, 2014).

The finite volume method sets up an Equivalent Riemann Problem (ERP) across each element interface, and solves it to determine the variable fluxes between elements. The technique used in MIKE21FM determines an exact solution to an approximate Riemann problem. The approach treats the problem as one-dimensional in the direction perpendicular to each element interface (Guinot, 2003).

MIKE21FM has two options for time integration accuracy, with these being a first order explicit Euler method (referred to as the lower temporal order scheme), and a second order Runge Kutta method (referred to as the higher temporal order scheme). There are also two options for spatial integration order, with the second order (higher order) accuracy being achieved through a variable gradient reconstruction technique prior to the ERP formulation (MIKE by DHI, 2014).

2.2 Extent of models

The Healthy Floodplains project is required to produce floodplain development zoning for the entire floodplain in each valleys. This limited the application of fixed grid finite difference approaches, as to cover such extensive areas in sufficient detail would have required a model domain too large for reasonable run times. Such a large model extent would have required extensive 1D modelling to cover smaller scale features such as floodways, as described above.

For the Lower Namoi floodplain flexible mesh modelling was applied. This allowed higher definition meshes to be applied over known flood runners and floodways, whilst much coarser meshes were applied to the broader floodplain where the terrain is more uniform requiring less detail.

The extent of the Lower Namoi models is shown in Figure 1. The models range in size from 68,000 to 350,000 hectares. The models developed or in development for the Healthy Floodplain project include the whole floodplain between Mollee Weir and Merah North (1; 68,000 ha), Merah North to Burren Junction (2; 237,000 ha)), Burren Junction to Goangra (3; 350,000 ha), and Goangra / Collarenebri to the Macquarie River Junction (4; 158,000 ha).

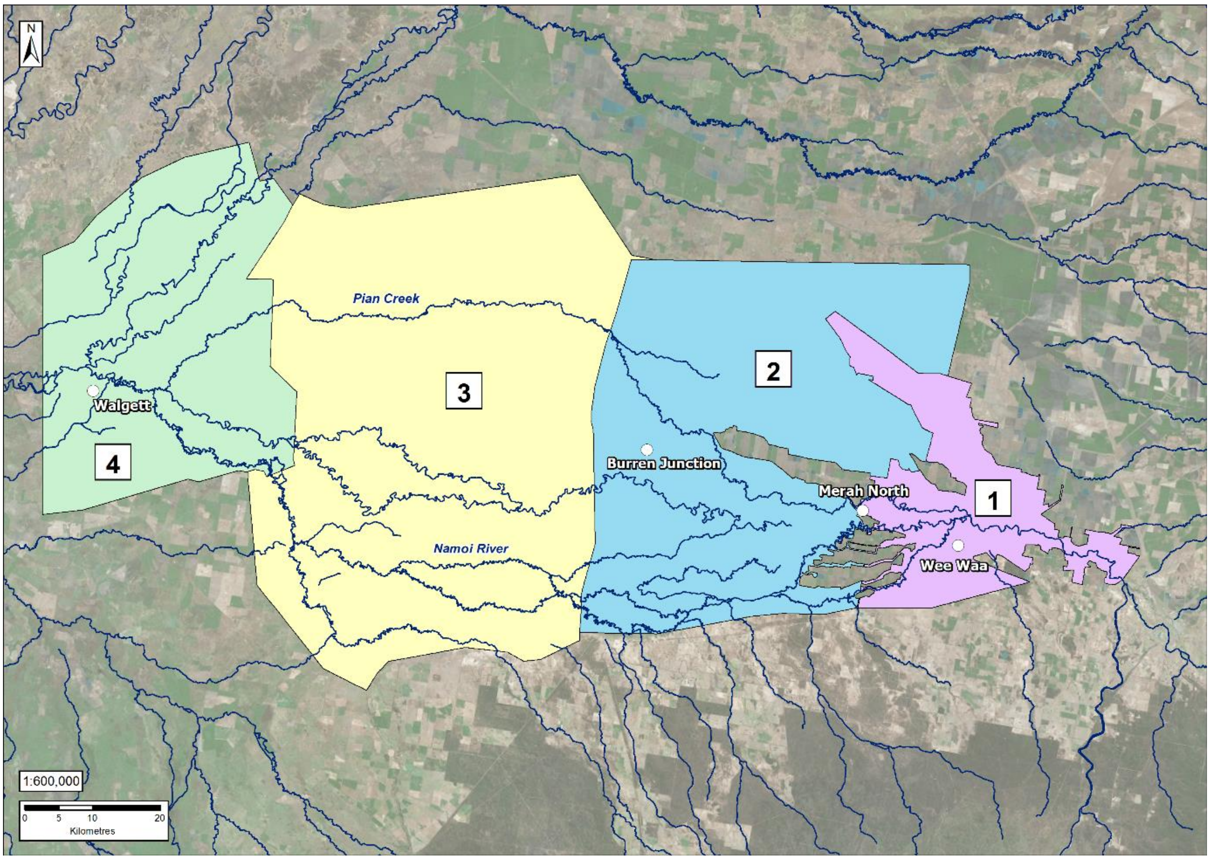


Figure 1 Extent of Lower Namoi/Barwon Darling models

2.3 Study focus: The Mollee Weir to Merah North model

The focus of this paper is the Mollee Weir to Merah North model, as shown as Model 1 in Figure 1. This model covers an area of intensive floodplain development, with a large number of constructed embankments protecting cropped farmland from small to medium floods, as well as a levee protecting the town of Wee Waa (Falkenmire et. al., 2006). The floodplain is largely undivided at the upstream end of the model at Mollee Weir, however it divides into numerous floodways at the downstream end of the model. In large floods some of these floodways carry flows of the same magnitude as those in the main river channel corridor. Floodplain development restricts the immediate floodplain around Wee Waa, and water is redistributed across larger formed floodways to the north and south.

Near Wee Waa the river turns to the southwest, and the reducing channel slope means floods naturally overtop the banks and spill to the west and northwest through the Gunidgera and Pian creek systems. These systems have extensive floodplains independent of the Namoi River, and there has also been extensive development within these floodplains. Flood flows are directed into about a dozen different defined floodways between the Namoi River and Gunidgera Creek, and between Pian Creek and the Gwydir Valley to the north.

The development in the Namoi floodplain has required prioritisation of remaining flood conveyance pathways in order to maintain a distribution of flows between the Namoi River, Gunidgera Creek and Pian Creek systems that minimises economic and social impacts and supports regional environmental values.

The model developed for this project extends three separate existing models. These include the Namoi River MIKE11 model, a TUFLOW 1D/2D finite difference model of Wee Waa and the surrounding floodplain, and an RMA2 model of the Nowley floodplain and floodways to the north of the river.

2.4 Topographical data

The model is chiefly based on LiDAR data. This had already been captured for some areas for specific past studies, in particular around Wee Waa. Much of the remainder of the floodplain to be included in the model was surveyed under the NSW Land and Property Information (LPI) program to extend LiDAR coverage to all major river valleys in New South Wales. There were some remaining gaps in the topographic dataset required to form a complete DEM. LPI provided photogrammetry based ADS40 data to cover these areas. This data was compared against LiDAR datasets in overlapping areas to ensure consistency and check the accuracy of the photogrammetry. Some cross-section data was available for the main Namoi River channel from previous studies, and this was used to supplement the LiDAR, particularly around the Gunidgera Weir Pool.

2.5 Mesh development

The Mollee Weir to Merah North model is a fully 2D flexible mesh finite volume model, covering an area of 68,000 ha, and a length of Namoi River channel of approximately 70 km. The mesh was developed as follows:

- The Namoi River and Gunidgera Creek channels were developed as a structured mesh using quadrilateral elements, with the longer (longitudinal) side being aligned to the direction of flow and shorter transverse direction perpendicular to flow (Figure 2);
- Defined floodways were modelled as a mixture of quadrilateral elements and triangular elements, as was required to provide sufficient definition for each floodway geometry (Figure 3);
- The immediate river corridor and important natural flood runners were modelled using a fine scale triangular mesh (Figure 4); and
- The broader floodplain was modelled using a coarser triangular mesh.

While the above principles were applied for each area, the mesh transitions smoothly from one type of area to another. For example, triangular meshes do not abruptly change from fine resolution to coarse resolution within the floodplain, but progressively increase in area between features.

Representing the channel with quadrilateral elements had advantages and disadvantages. This approach greatly reduces the number of channel elements compared to a triangular mesh. It also proved to be more stable under rapidly changing flow conditions in early versions of the model, especially for abrupt channel and bed transitions. However developing a well-spaced quadrilateral mesh that aligns well with flow direction, and which merges well with surrounding triangular elements is time consuming, and requires careful thought and review to make the most of the approach. This is especially true for a strongly meandering channel.

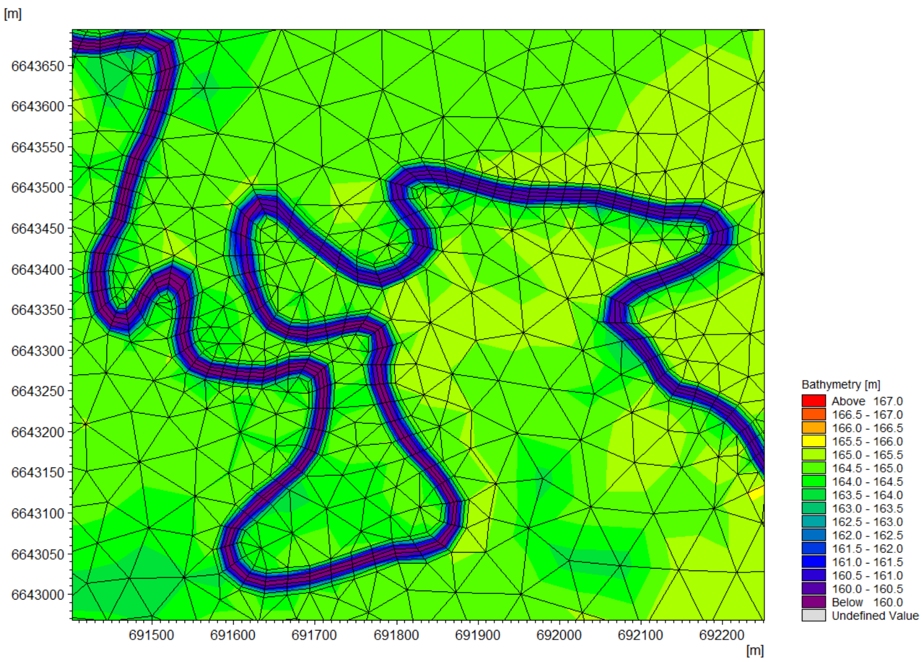


Figure 2 Quadrilateral element mesh along Namoi River

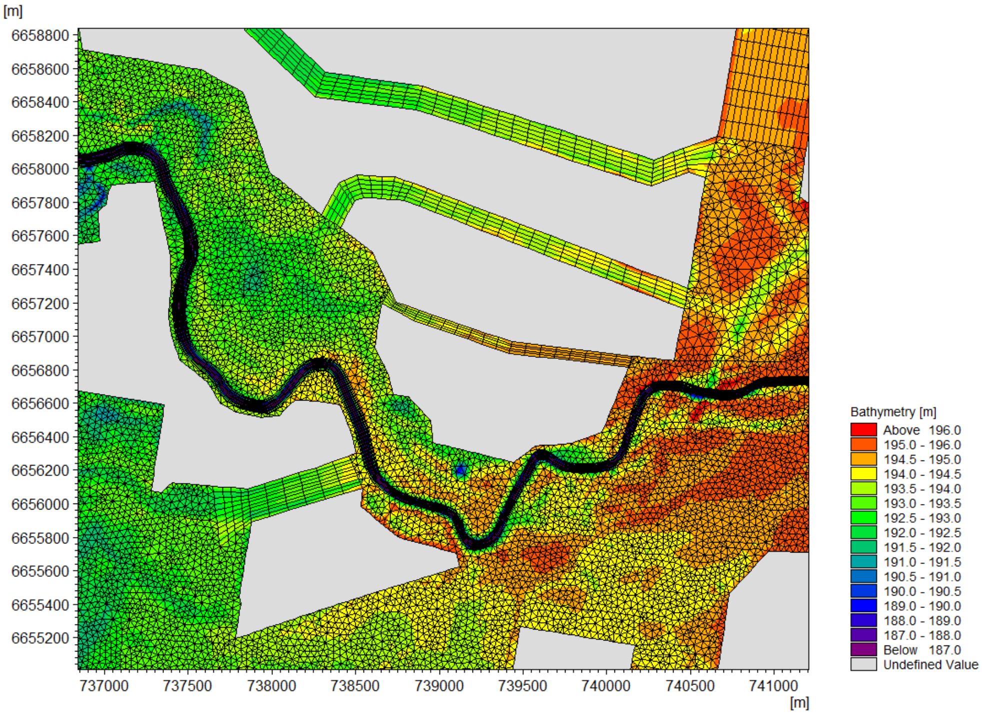


Figure 3 Quadrilateral and triangular element mesh on floodways

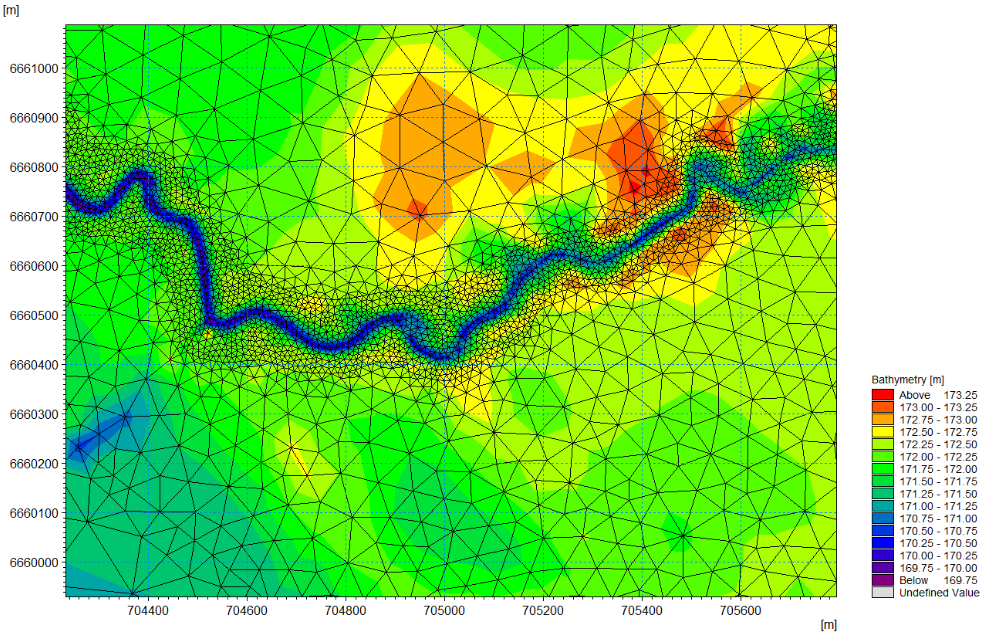


Figure 4 Fine scale triangular element mesh along river corridor

2.6 Boundary conditions

The nature of the Mollee Weir to Merah North floodplain implies the model has one inflow boundary and multiple downstream boundaries.

The inflow boundary is the total discharge downstream of Mollee Weir, where a gauging station with a long record and stable and extended rating curve is available. This is applied as a discharge boundary in MIKE21FM (strong boundary condition type). This boundary applies the total discharge across the nominated boundary extent, with the volume assigned according to the relative conveyance of different parts of the mesh. This ensures it assigns flows first to the channel and then progressively to the floodplain.

Treatment of the downstream boundaries depended on the particular nature of each outlet location. For relatively well-defined flow paths such as the Namoi River channel, Gunidgera Creek and smaller and well confined floodways, stage-discharge boundaries calculated from the topography were applied. For broader floodways with less well-defined flowpaths, stage-discharge boundaries were not sufficiently accurate. In these cases the model mesh was extended away from the area of interest (i.e. further downstream), and an artificial steep slope in the mesh bathymetry was used to avoid water accumulating against the boundary and affecting results inside the area of interest. Fixed water level boundaries were set at the downstream end of these artificial model extensions.

3 Model Results

3.1 Depth-velocity product mapping

The developed floodplain models will be used to produce depth-velocity product (DV) mapping reflecting the relative conveyance of parts of the floodplain. A mock-up DV map is shown below in Figure 5. This information will inform the development of floodplain management plans, which aim to protect floodplain conveyance in existing and future developed areas.

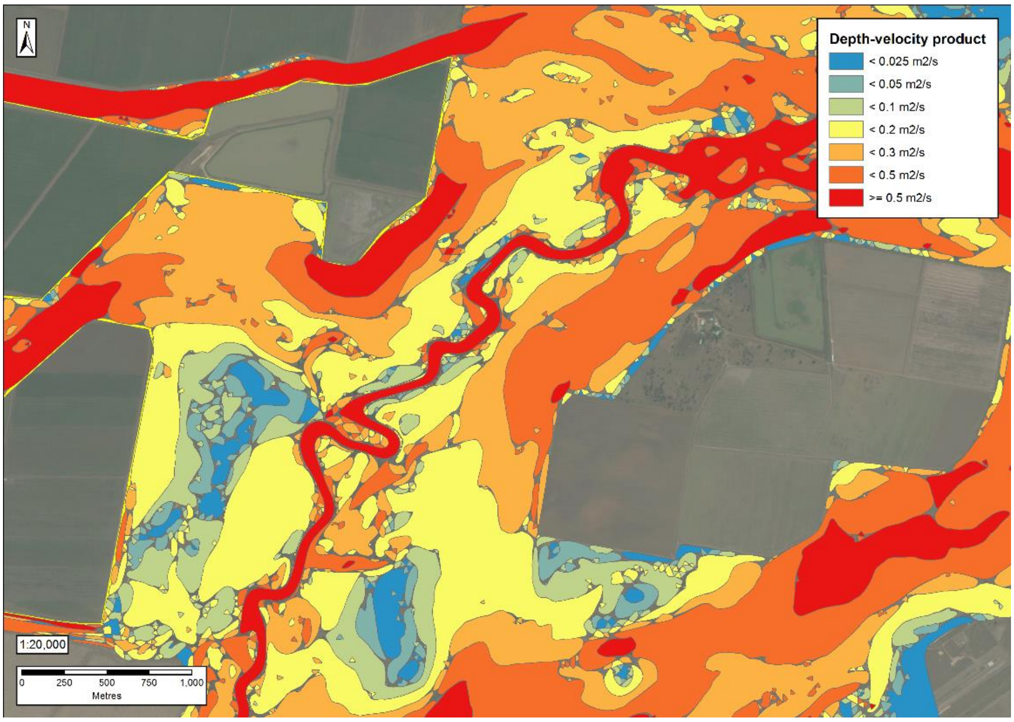
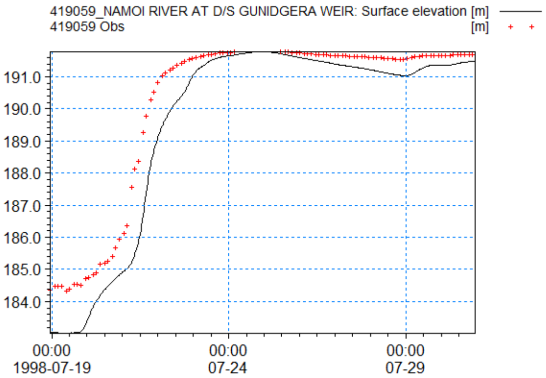


Figure 5 Example of depth-velocity product map (mock-up)

3.2 Model calibration and validation

Large floods have occurred in recent times in the Namoi Valley in 1971, 1984, 1998 and 2012. The 1971 is the largest of these events, and some coarse aerial photography and limited streamflow gauging station records exist. For the 1998 flood a large amount of detailed aerial photography was taken during the event, and there are good gauging station records, and some spot level records around Wee Waa. The model calibration focussed on the 1998 event, although the flood extents were compared against the 1971 event where possible.

The inflow to the model was based on the Namoi at downstream of Mollee Wee discharge (gauging station 419039). For the 1998 event downstream water level recorder gauging station sites are located on the Namoi River and the Gunidgera Creek. Results from the calibration against these gauging stations are shown in Figure 6. The model shows very good agreement with the main river gauging stations within the model extent for which data was available, downstream of Gunidgera Weir and at Glencoe. This was achieved with minimal calibration adjustment of channel and floodplain roughness parameters.



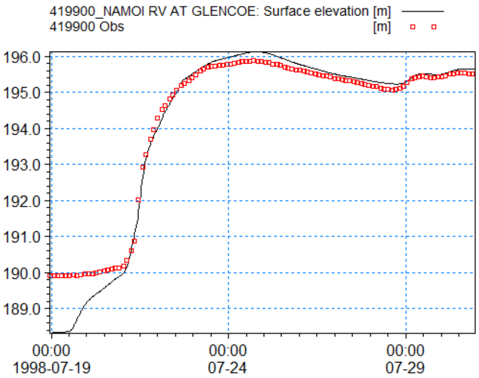


Figure 6 Spot level comparison at selected gauging stations around Wee Waa for the 1998 calibration event

Flow distributions for larger floodways were available for the 1971 event, and this was previously used to validate the RMA2 Merah North model (Parsons Brinckerhoff, 2010). Peak flows between the two models generally agree to within 20%.

An example of the depth outputs from the 1971 event model are shown in Figure 7. The depth is overlain on the finite volume mesh used in the model. It shows how the mesh has been developed to represent the floodways, protected farmland areas and broader floodplain. The mesh consists of triangular and quadrilateral elements of various sizes depending on the level of resolution required. Fine quadrilateral elements aligned to the dominant flow direction have been used for the defined floodways. Fine triangular elements have been used for confined areas of floodplain that exchange flows with floodways. Coarser triangular elements have been used for more open floodplain where less detail is required.

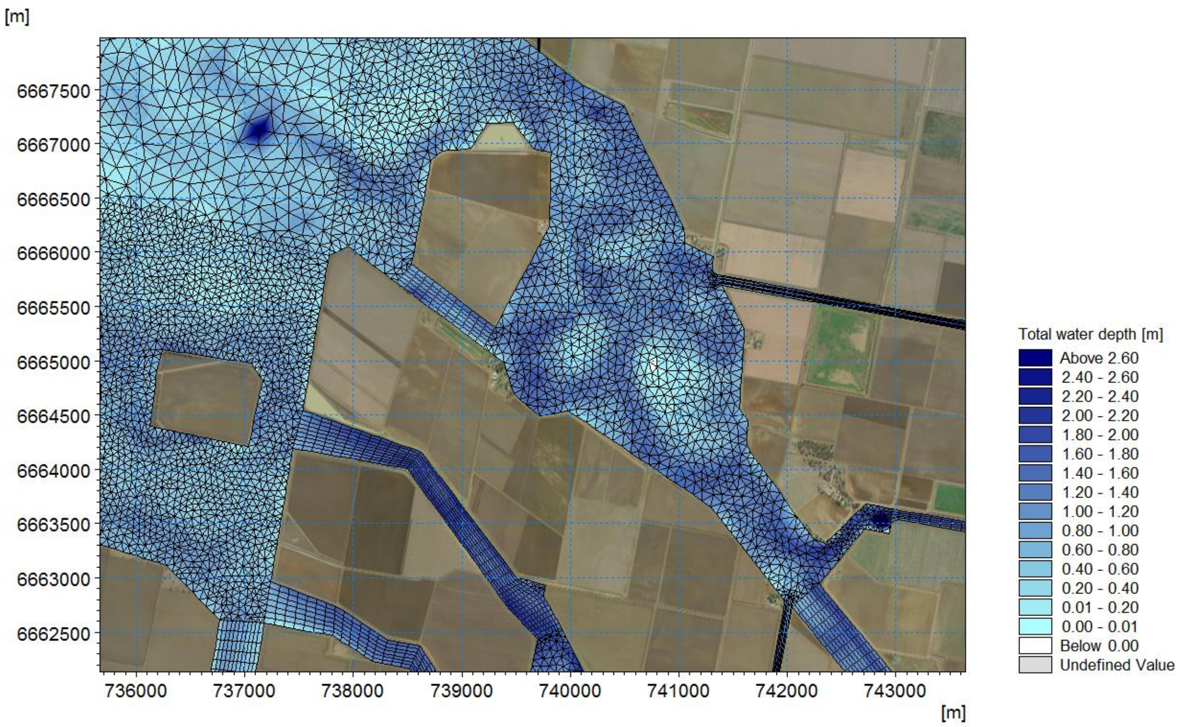


Figure 7 Depth near peak of 1971 event with finite volume mesh overlain

Figure 8 shows velocity vectors near the peak of the 1971 event for same area as Figure 7. The figure show the strong interaction between the floodplain topography and the geometry of the floodways. The topography in the middle of the figure affects the distribution of flow upstream of the protected area in upper middle of the figure. This in turn alters the distribution of flow around the southern and northern side of the protected area.

Figure 7 and Figure 8 demonstrate some of the key benefits of the finite volume flexible mesh approach for this project. Aligning the mesh to the geometry of floodways avoids the drawbacks of 1D network representation, with which it would be difficult to model the flow distribution show in Figure 8 correctly. Furthermore, using a 2D finite difference grid representation in this case would have required either coupled 1D branches of these floodways, or using a small 2D grid spacing for the entire model to adequately represent the narrow floodway flood conveyance.

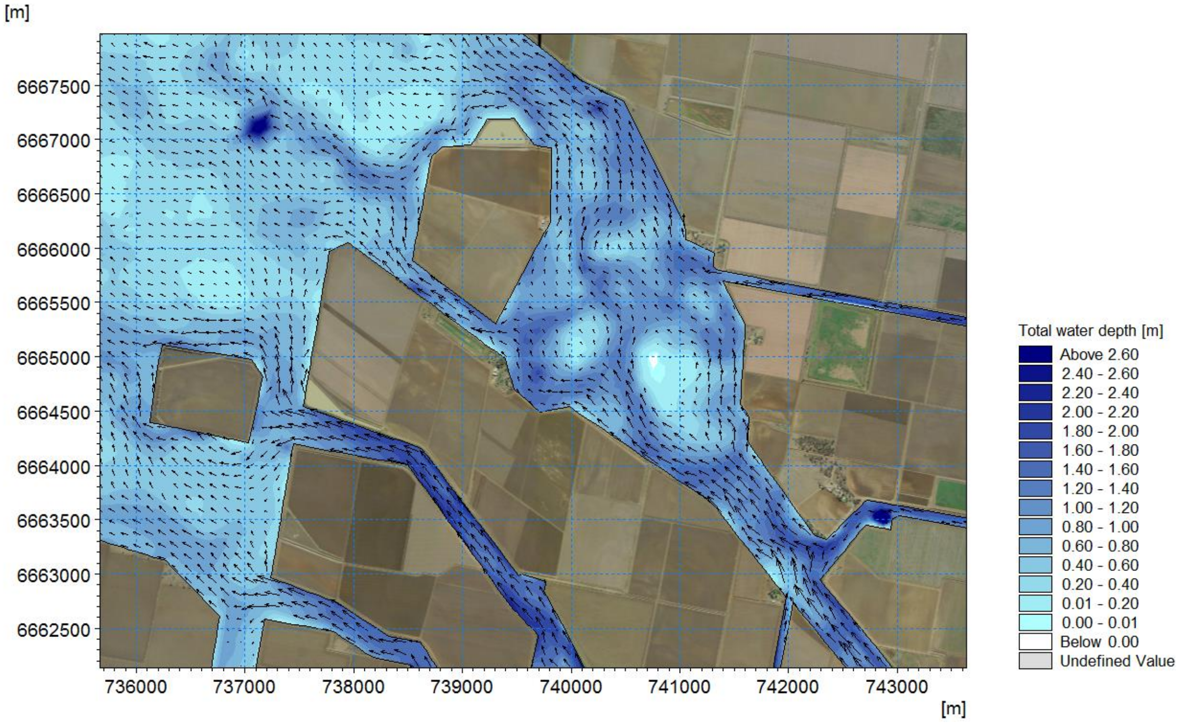


Figure 8 Depth near peak of 1971 event with velocity vectors overlain

3.3 Simulation times, scheme order and computational processor selection

MIKE21FM can be configured in a number of ways depending on the scheme precision required and the hardware available. This affects the simulation time and accuracy of the results required.

- Computational Processing Unit (CPU) and Graphical Processing Unit (GPU) computations: MIKE21FM uses exactly the same fully hydrodynamic numerical scheme and interface for CPU and GPU simulations. Fully hydrodynamic GPU simulations with one GPU processor typically take 10%-20% of CPU simulation time for inland flooding applications.
- Spatial and temporal precision: In MIKE21FM the computational scheme can be run using higher or lower order scheme options for both time and spatial dimensions. Running a model at lower order for both takes 25%-50% of the time required for fully higher order simulations.

Trial simulations evaluating the effect of these scheme precision and hardware options were carried out. Results for CPU and GPU runs were compared for the large 2D flexible mesh model of the Namoi Floodplain between Merah North and Burren Junction. Differences in the results between the two hardware options were less than 1mm throughout the model domain (i.e. negligible).

The scheme order selected affects the accuracy of the solution and the simulation time. Trials were carried out with the Mollee Weir to Merah North model over the rising limb and peak of the large February 1971 flood event. CPU based simulations were carried out using a typical i7 four core PC with 8GB memory, and a high specification Xenon 32 core run machine with 64GB memory. These CPU-based simulations were compared to

GPU simulations on a run machine using a NVIDIA GeForce GTX TITAN GPU card. This card was designed for computer gaming applications, and was typically sold for around $1200 AUD. GPU simulations were also carried out with lower and higher order numerical scheme settings to investigate the effect on model results and simulation time. Simulation times using different processors are compared in In order to compare the relative accuracy of the higher and lower order schemes, discharges at two locations at the downstream end of the model were compared. Results for the higher order and lower order are shown in Figure 9 for the main Namoi river channel, and in Figure 10 for the Merah North floodplain. The figures show similar hydrographs with the higher order discharge being slightly larger than the lower order discharge for the river channel, and smaller for the northern floodplain. The calculation order has not affected the overall mass balance, however it has slightly altered the distribution of flow between the river and floodplain. The lower order spatial results are the same irrespective of the temporal scheme order, indicating the difference is due to the spatial scheme order.

Table 3.

In order to compare the relative accuracy of the higher and lower order schemes, discharges at two locations at the downstream end of the model were compared. Results for the higher order and lower order are shown in Figure 9 for the main Namoi river channel, and in Figure 10 for the Merah North floodplain. The figures show similar hydrographs with the higher order discharge being slightly larger than the lower order discharge for the river channel, and smaller for the northern floodplain. The calculation order has not affected the overall mass balance, however it has slightly altered the distribution of flow between the river and floodplain. The lower order spatial results are the same irrespective of the temporal scheme order, indicating the difference is due to the spatial scheme order.

Table 3 Comparison of simulation time under different processor and scheme order settings for Mollee Weir to Merah North model

Processor	Time order	Spatial order	Simulation time (days)	Percentage of CPU (4 core) time
CPU 4 core 8GB RAM	High	High	18.3	100%
CPU 32 core 64GB RAM	High	High	4.1	22%
GPU (Single processor)	High	High	1.9	10%
GPU (Single processor)	High	Low	1.4	7%
GPU (Single processor)	Low	Low	1.1	6%

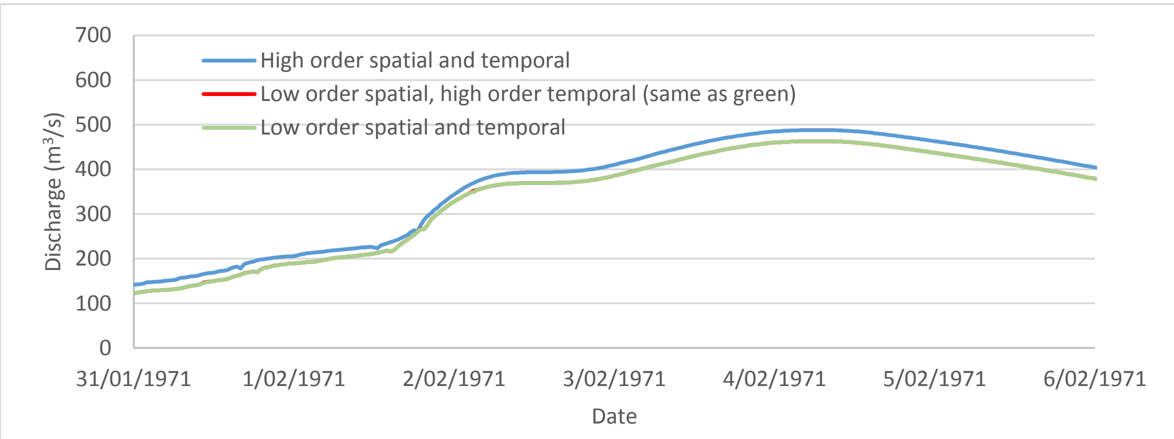


Figure 9 Simulated discharge for higher and lower order runs for the Namoi River channel at the downstream end of the Wee Waa to Merah North model

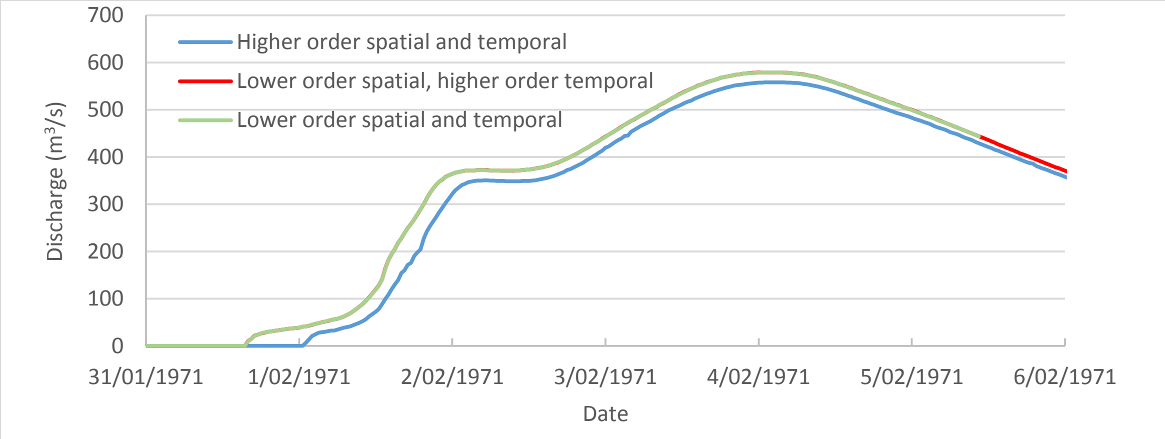


Figure 10 Simulated discharge for higher and lower order runs for the Merah North floodplain at the downstream end of the Wee Waa to Merah North model

4 Conclusions

The NSW Healthy Floodplains project aims to manage development of the state's rural floodplains in major valleys in the Murray Darling Basin by developing floodplain management plans supported by computer-based floodplain management models.

In order to produce the flood mapping necessary to support the process, river conveyance and floodplain models have to be sufficiently detailed and flexible to properly capture the hydraulics of watercourses and floodways, whilst still being able to capture the full extent of the entire floodplain. These models will also form a basis for more consistent and extensive modelling of all rural floodplain development in the future.

Traditional approaches using 1D models and 2D fixed grid models were considered. In some cases 1D models have been used in the Healthy Floodplains project to represent the main river channels. However 1D branches were not widely used for floodplain runners or floodways, due to their inability to easily capture the geometry and hydraulic processes associated with these features. Similarly, 2D fixed grid models were used in some instances where the same grid spacing could be applied satisfactorily. Nested grid fixed grid models were also considered however discounted due to their tendency to produce mass and momentum conservation errors across nested grid boundaries.

A series of flexible mesh models have been developed between Mollee Weir on the Namoi River and the Macquarie River junction on the Barwon – Darling River. These are fully hydrodynamic 2D (channel and floodplain) models, running on GPU processors using the higher order scheme. Floodplain Depth-Velocity mapping from these models are currently being prepared to categorise the floodplain for future development management.

Comparisons of model performance under different computational settings highlight the effect these have on simulation times. The Healthy Floodplain mapping project utilises a MIKE21FM fully hydrodynamic model running a higher order numerical scheme on a GPU. Comparison of MIKE21FM CPU and GPU based modelling indicates there is negligible difference in results between the two computational processor options. GPU run time for a higher order simulation was approximately 10% of the CPU run time for a standard workstation. Trials with lower order scheme indicate lower order runs would be approximately 50% of the time for higher order runs. In the Mollee Weir to Merah North model trialled here the accuracy of the results was largely unchanged when a lower order scheme was used.

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