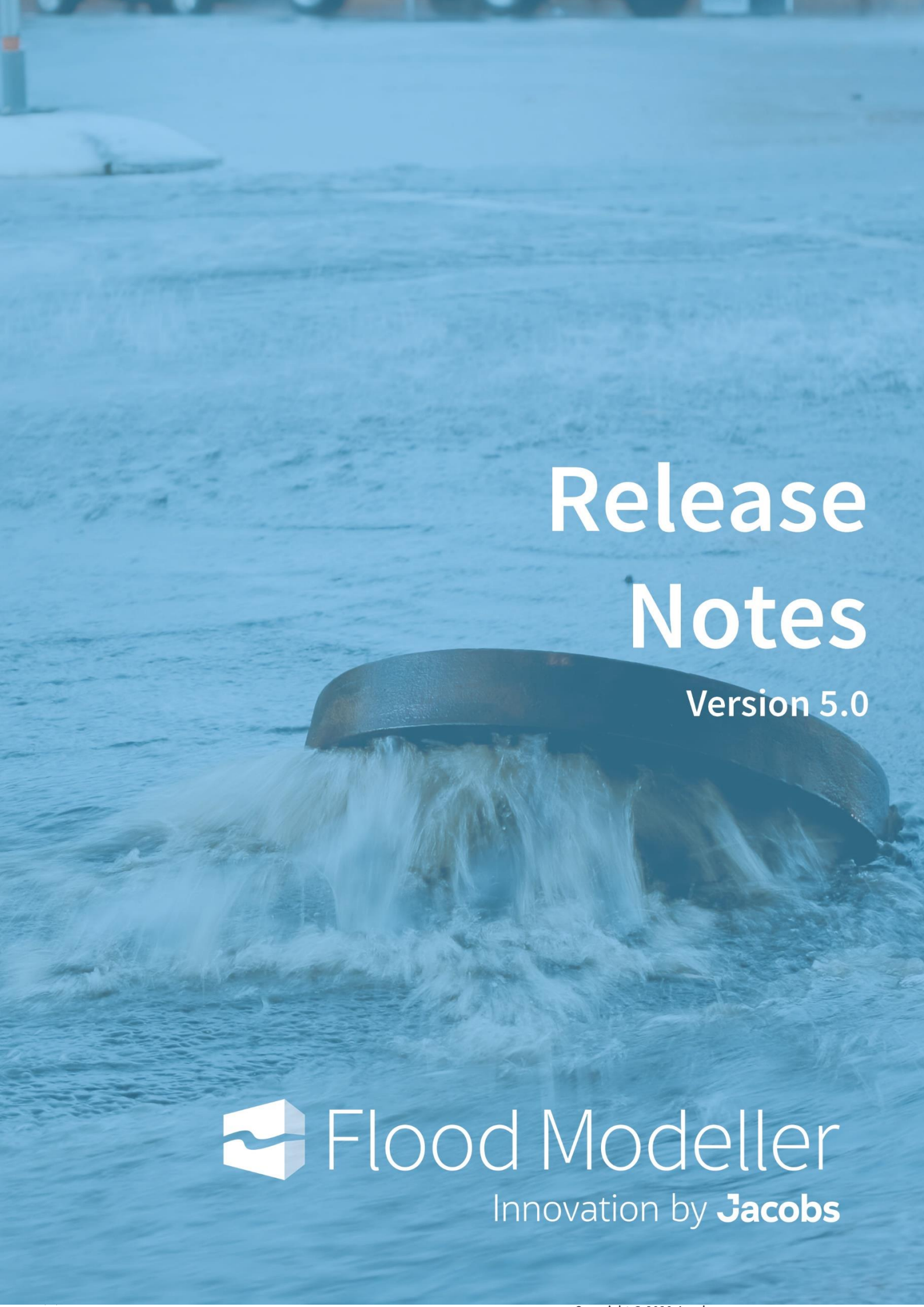


Release Notes

Version 5.0

Flood Modeller

Innovation by Jacobs

Flood Modeller Release notes

Flood Modeller v5.0 introduces a range of new functions (compared to v4.6) and addresses a number of issues identified in previous versions. This document contains the following sections:

1. Flood Modeller v5.0 – changes and enhancements

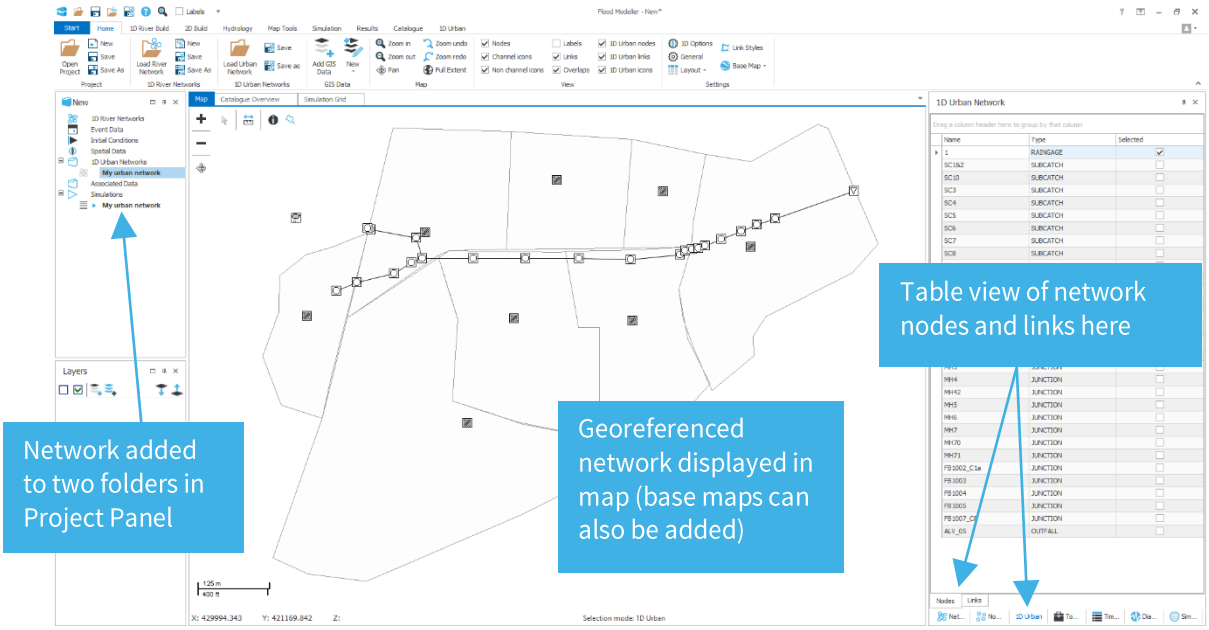
1.1 Changes to Flood Modeller user interface in v5.0

The following enhancements were made to the Flood Modeller interface for v5.0:

(a) 1D urban (piped) networks can now be visualised in the Flood Modeller map view. Currently, your 1D urban network needs to be created outside of Flood Modeller. Future versions will enable you to build your urban models directly within Flood Modeller, without the need for SWMM. For now, we recommend that you download and install the EPA SWMM software.

It is possible to visualise both 1D urban and 1D river networks simultaneously. Therefore, it is now possible to view all components of an integrated model system (1D urban/1D river/2D) in one place.

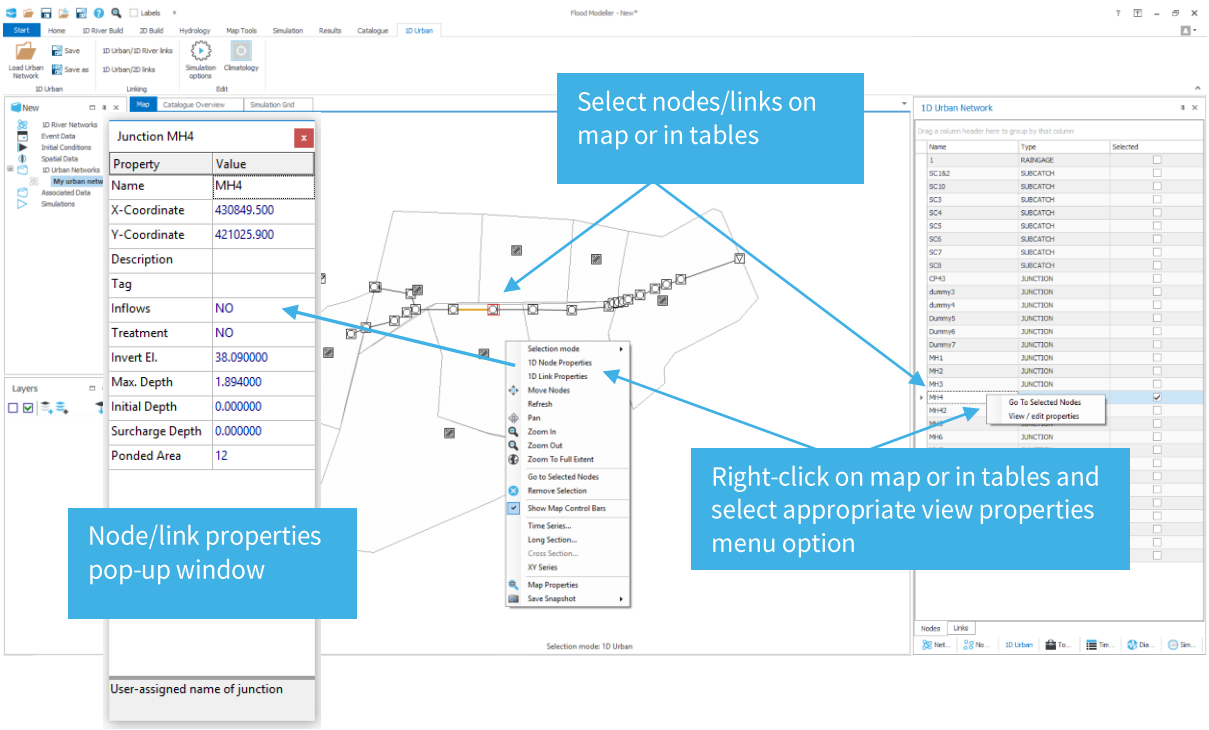
The displayed 1D urban network is also listed in a new dedicated tab of the right-hand panel. This shows all model nodes and links in separate tables which also display the component type.



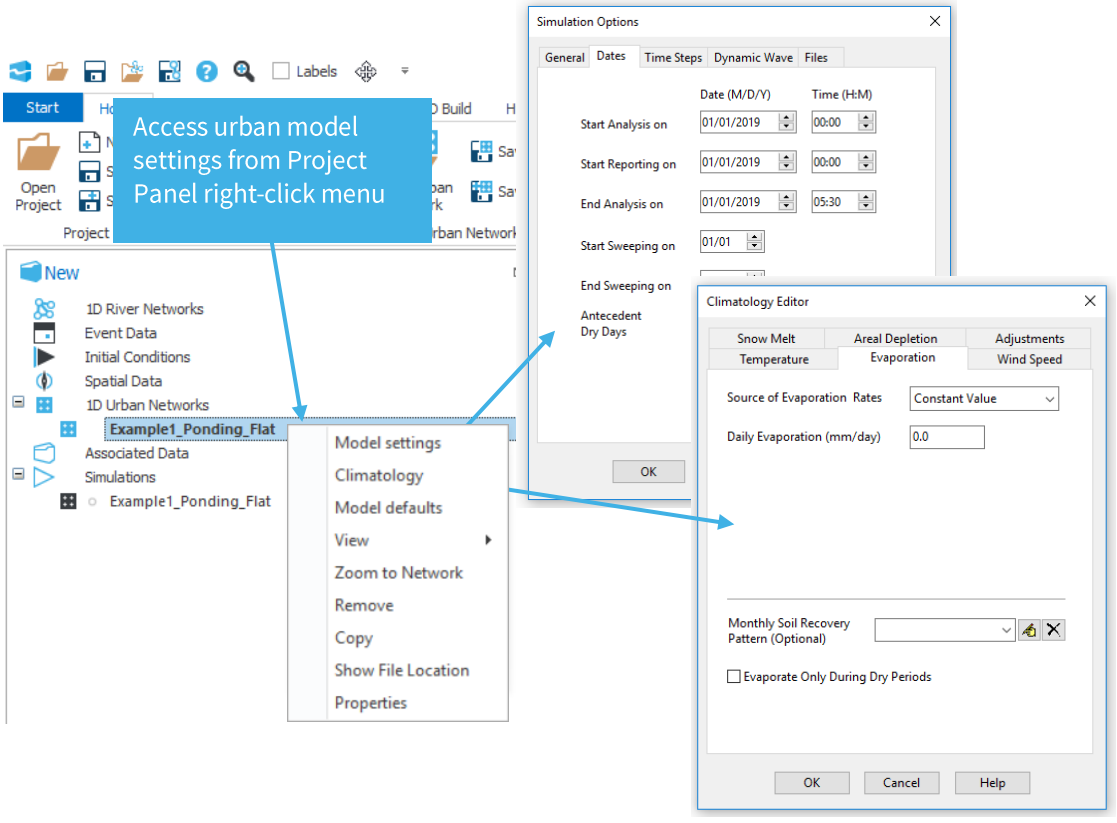
Loaded 1D urban models will also appear in the Project Panel in both a new 1D Urban Networks section and in the Simulations section (as the network file also contains simulation details).

Multiple 1D urban networks can be loaded into the same Flood Modeller project. In this case, the network set as “Active” will be displayed in the map and right panel (and will be shown in bold in the Project Panel).

(b) Editing of 1D urban node and link properties can be performed in the Flood Modeller user interface (for the active network). If you need to create new 1D urban nodes this currently needs to be done outside of Flood Modeller.



(c) Configure and run 1D urban simulations from within the Flood Modeller user interface. Whole model settings can be reviewed and adjusted. These are accessed from the menu displayed when right-clicking on an active 1D urban network in the Project Panel.



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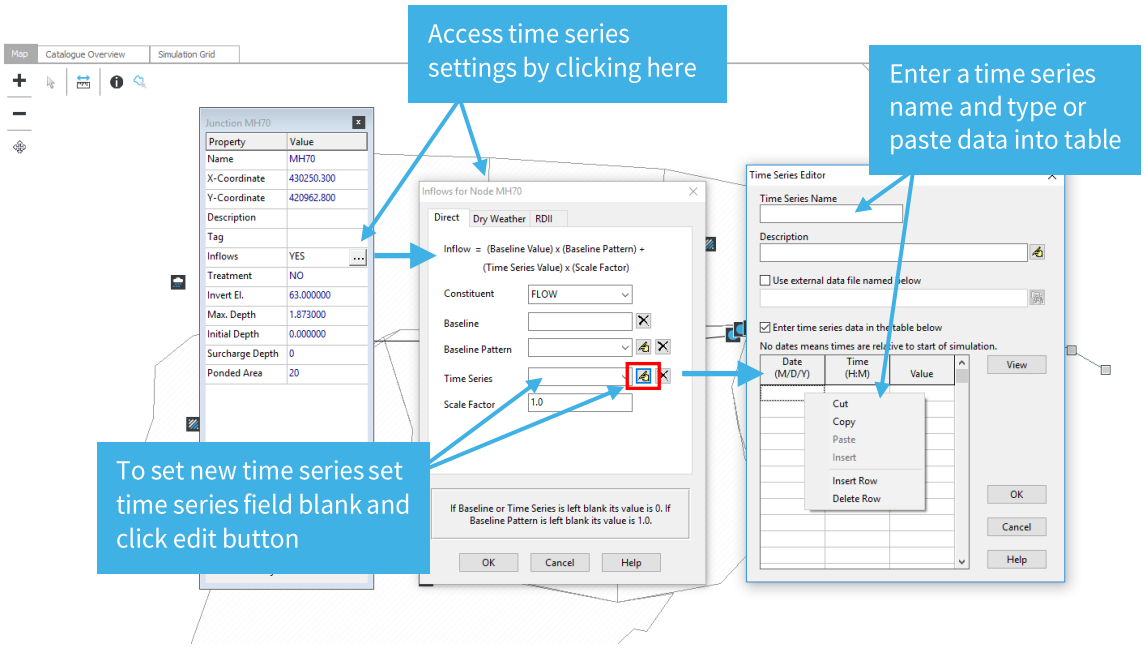
The active 1D urban network in the Flood Modeller interface is also added to the list of simulations in the Project Panel.

Functionality is now provided to enable standalone 1D urban models to be run without needing to install 3rd party software.

(d) Define new input time-series for 1D urban simulations. Selected urban node types can be assigned time series data, e.g. different rainfall profiles for rain gage nodes or inflow time series for junctions (i.e. manholes). The node property windows enable existing time series to be reviewed and edited. They also allow new time series datasets to be specified. These can be typed into the time series tables (as shown below) or a complete series can be defined elsewhere, e.g. in MS Excel, and then copied and pasted into the urban time series table.



(e) Plotting of time series, XY scatter and long section results from 1D urban simulations has been added to the Flood Modeller interface.

Plotting tools can access results for 1D urban models that have been run in isolation or in an integrated model.

The Time series plotting tool for 1D urban allows linking flow data to the 2D domain to be added to a chart (these data are output in csv format from linked 2D simulations).

The Long section tool includes functionality to animate results within the long section.

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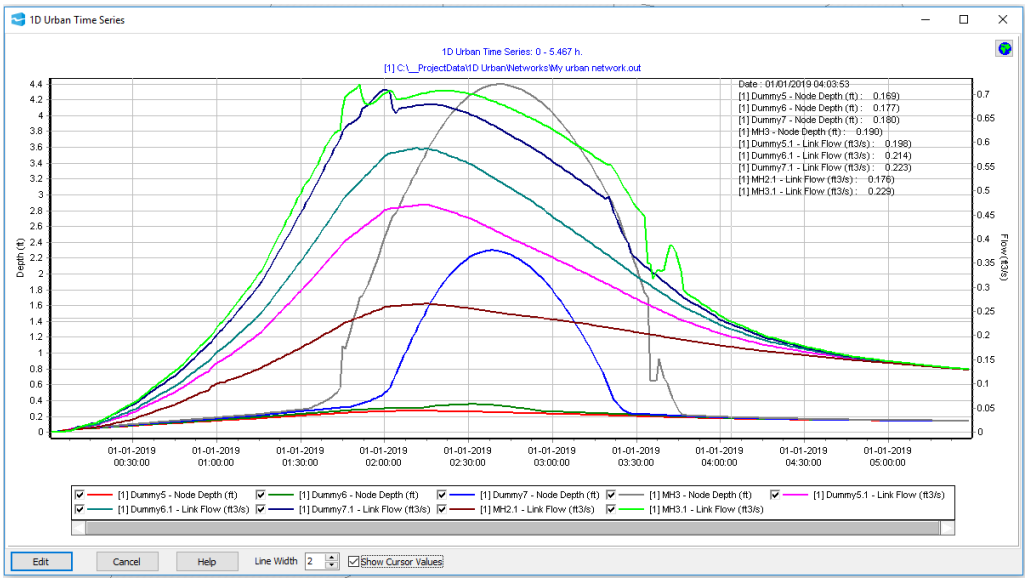
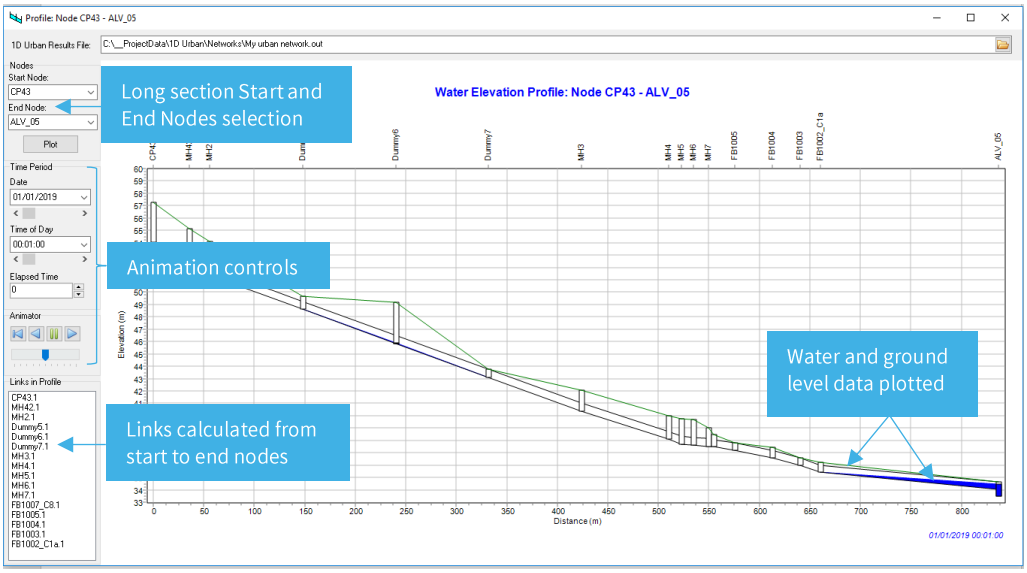
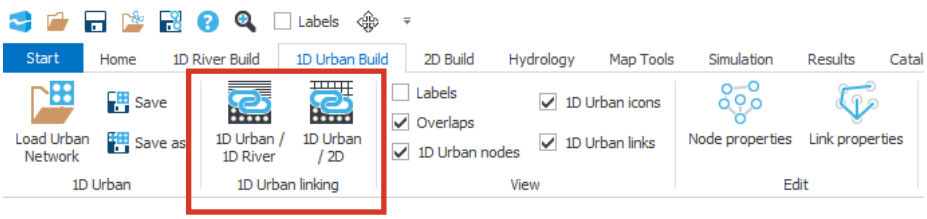




Urban data plots created in Flood Modeller can be exported as images for use in reports or the underlying data can be exported for use in Excel (or similar). Editing tools are also included to enable customisation of charts.

(f) New linking tools have been added to enable linking of 1D urban models to Flood Modeller 1D river and 2D models. This enables the creation of fully integrated surface/sub-surface model systems that utilise all Flood Modeller model components (1D urban/1D river/2D) dynamically linked.

New 1D Urban linking tools accessed from new tab in main Toolbar:



The 1D Urban/1D River links that you define are stored in a comma separated text file with extension ".isl".

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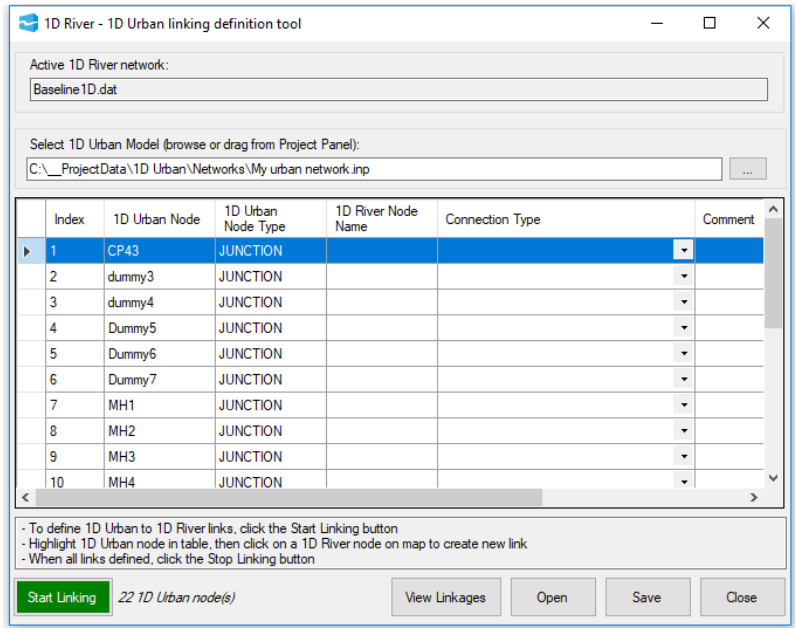
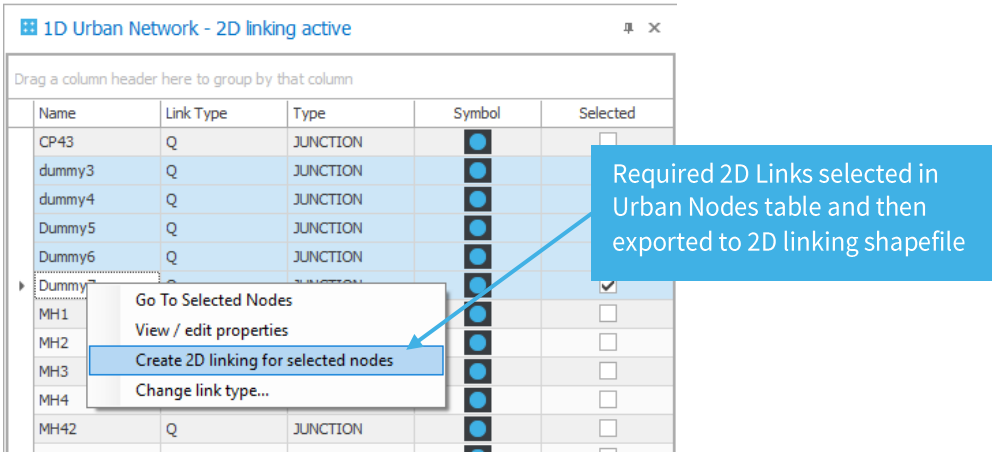
The 1D Urban / 1D River linking tool enables 1D river to 1D urban node cross references to be defined by clicking on 1D river nodes on the map view:



1D urban / 2D links are defined by shapefile elements located at relevant 1D urban node locations on the 2D domain. These elements can be polygons, polylines or points that will then each interact with either single or multiple underlying 2D domain grid cells. The 2D linking tool creates these elements automatically after the user selects the relevant 1D urban nodes in the Urban Nodes table. The selected 1D urban / 2D links can be exported to a new shapefile or appended to an existing linking element shapefile.



(g) Flood Modeller has been enhanced to enable selected structures (1D structures) to be embedded within a 2D domain.

Previously, embedding a 1D structure within a 2D domain could only be done using a linked 1D river network. As such, their operation was always more restricted (e.g. embedded culverts had to remain wet to maintain model stability).

In v5.0, embedded structures are defined as independent model components, with locations represented by polyline shapefiles and structure properties stored in an associated text file ("structure" file, with extension ".str").

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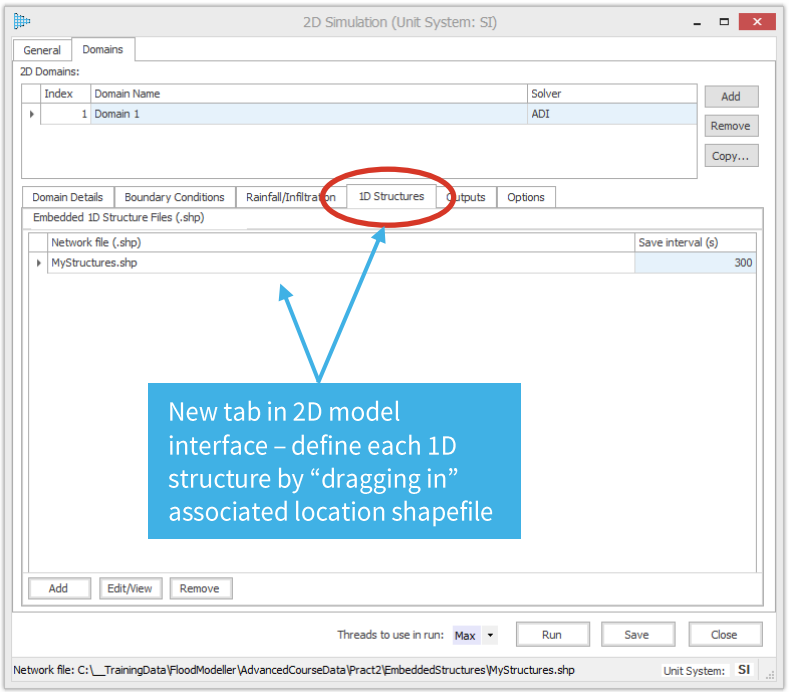
Available structures that can be embedded in a 2D model are:

- Culvert – incorporates any existing 1D conduit shape, coupled with entry and exit losses and optional bend
- Weir – can be any existing weir type
- Orifice

Structures within a 2D model are defined with much the same properties as within a 1D river network, but with the advantage that they are not restricted to always remain wet. Thus, they provide a more stable option for representing structures within the 2D domain, e.g. bridge arches, embankment culverts, etc.

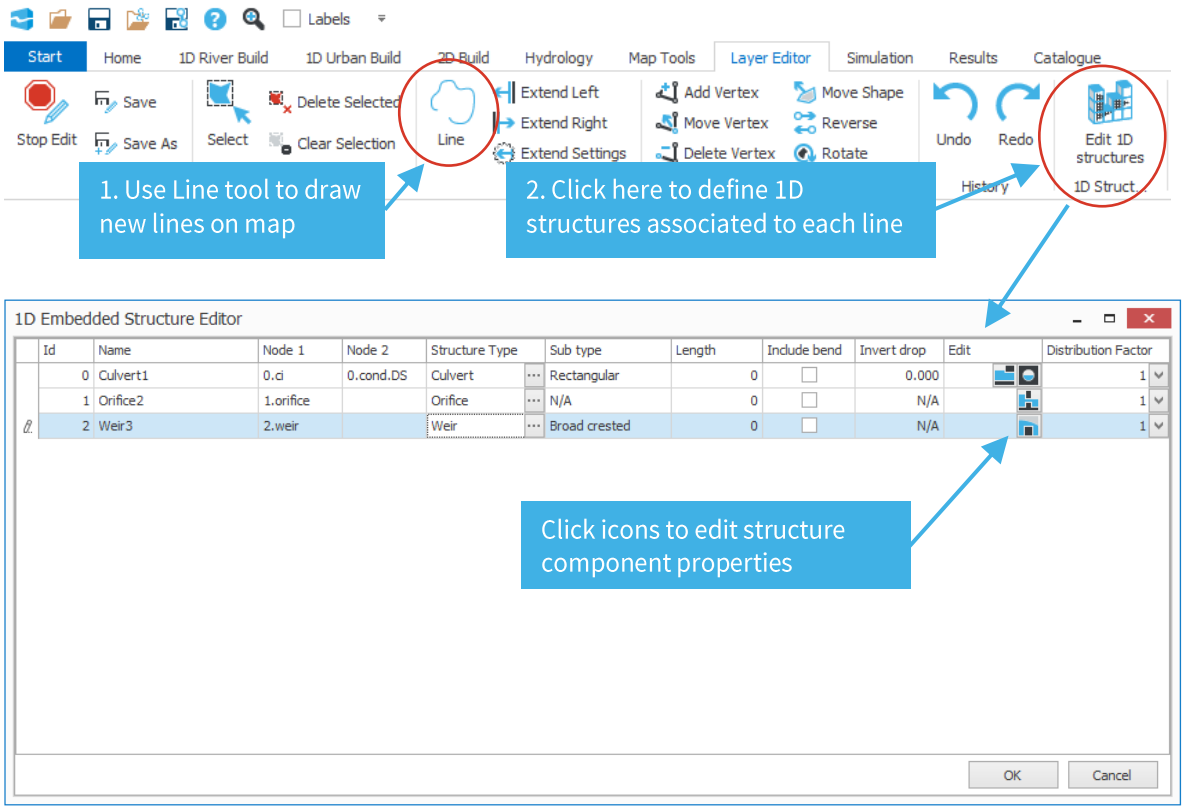
Each domain of a 2D model can incorporate multiple embedded 1D structures. These are defined on a per domain basis, in a new tab added to the 2D model interface.

The interface also enables output variables and save intervals to be defined independently for each embedded structure.

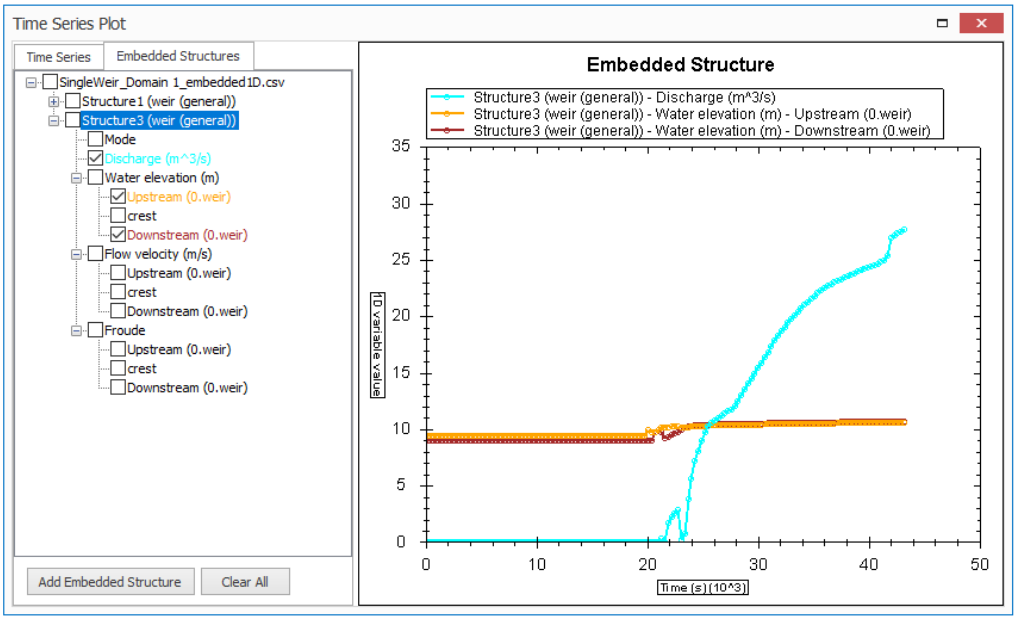


(h) A new 2D Build tool has been added to enable the quick and easy definition of embedded 1D structures.

New shapefile polylines are drawn as normal using the provided shapefile editor tools. These represent the structure locations within the 2D domain and also define the 2D grid cells that will interact with the start and end of the structure. The embedded structures tool in the Layer Editor then associates user defined 1D structures to each line and writes the data for these to an associated 1D structures file (".str" file). The structure dimensions can be specified either by user entered parameters or by utilising the length and line direction represented by the shapefile polyline.



(i) 2D results time series plotting tool enhanced to add plotting of 1D embedded structures results. These data are written to a csv text file. Multiple output files (e.g. from different simulations) can be loaded into the tool and results plotted on the same chart.



(j) Improved handling of large 2D results sets – The map view is now up to ten times faster at loading big 2D results datasets into the map view and moving between timesteps once these data are loaded.

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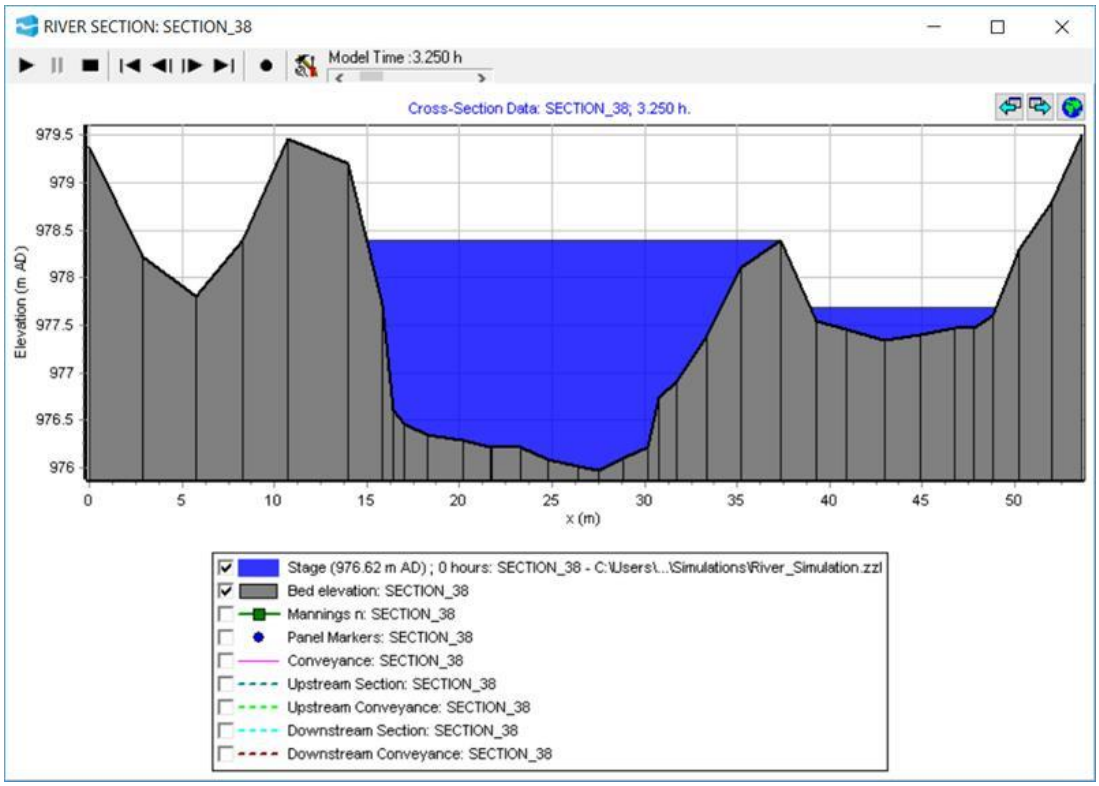
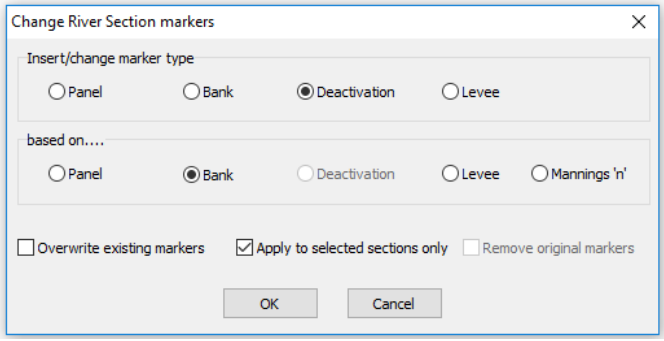
(k) Levee type structures can now be included in 1D river cross sections. When present the 1D solver will calculate different water levels across a single 1D section; for left bank, right bank and main channel (see user guide for the technical explanation of the method). This enables 1D river sections to more accurately represent extended sections which can contain lower lying areas disconnected from the main channel. With levee markers in place these disconnected areas will only become wet after water levels exceed the river bank heights, instead of a single 1D water level being calculated and applied across the entire section.

New levee markers, specified in the Special Markers column of a river cross section, define the extent of the main channel and left and right banks.

(l) 1D river cross section plotting tool has been enhanced to display separate left, right and main channel water levels for cross sections containing levees. All three water level datasets can also be animated in cross section charts.



(m) Change river section marker tool (in Toolbox) has been enhanced to allow a wider range of automated marker changes. This will enable deactivation or levee markers to be added at panel marker (or bank marker) locations for multiple river sections in a single operation. Also allows quick setting of levee markers, e.g. based on existing bank markers.



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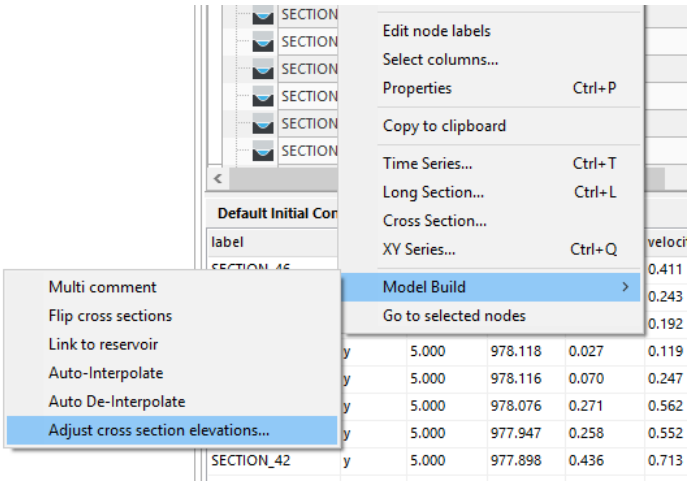
(n) When editing existing 1D culvert inlets you can now access the culvert wizard tool to define different inlet parameters (based on the UK CIRIA culvert design and operation guide). This is accessed via a new button added to the culvert inlet node properties window. Previously the culvert wizard was only accessible when defining a new culvert inlet node (and the option to use the culvert wizard was ticked in the 1D River options window – which is the default setting).

(o) When sending simulations to the Flood Cloud service the user is now able to select the solver version they wish to utilise for a batch of model simulations.

(p) Simulations that use the new 1D urban solver can now also be sent to the Flood Cloud service for processing.

(q) When sending simulations that require the TUFLOW engine to the Flood Cloud service the user is now able to select TUFLOW HPC with GPU.

(r) Enhanced global edit tool for modifying all cross-section bed elevations (for a user selected group of river cross sections). This tool is located in the right-click menu of the 1D river network table (right-hand panel):



1.2 Enhancements to the 1D and 2D calculation engines implemented in v5.0

The following sections detail changes and enhancements made to Flood Modeller 1D river and 2D solvers.

All solvers in the v5.0 release have been compiled using the latest Intel Fortran and C++ compilers. In previous versions of Flood Modeller, the solvers were compiled with earlier versions of these compilers. It is possible that the upgrade of the compilers may lead to slightly different results compared to simulations run using earlier versions of the software (using the same settings). This will usually equate to differences measured in fractions of a mm, however in some cases (where a model is particularly sensitive to small changes) bigger differences may be seen.

1.2.1 1D River Solver enhancements

(a) The 1D solver dynamic links to 1D urban nodes has been enhanced to make the connection more stable and accurate.

(b) The 1D river cross section units can now include markers to identify levee structures. These inform the solver to calculate separate water levels for low lying areas detached from the main channel, beyond the left and right banks. Normal handling of these by the 1D solver would calculate a constant level across the entire cross section, whereas in reality the left and right extremities of the section would only get wet once the banks of the main channel had been overtopped (or breached). With levee markers added, the solver will not calculate a water level in the areas beyond the main channel banks until water has exceeded the banks. This is achieved by deriving a water level vs. cross sectional area relationship for each river section until the floodplain water level equalises the main channel water level (see user guide for the full technical explanation of the method). Note that flows through the section are only calculated as an overall total (and not separate values for main channel and left and right banks).

(c) TUFLOW linking has been enhanced to now allow models defined using double precision setting for the 1D river network and single precision for the TUFLOW HPC component.

1.2.2 2D Solver enhancements

(a) The 2D solver dynamic links to 1D urban nodes has been enhanced to make the connection more stable and accurate.

(b) The 2D solver now produces an additional diagnostic file to log interactions with any 1D linked components (i.e. 1D river models, 1D urban models and 1D embedded structures). The file records flows passing between these components. The file is written to a comma separated text format.

(c) The 2D solver (ADI and TVD only) now enables models to include one or multiple embedded 1D structures. Compatible structure types are culverts (utilising any current conduit shape linked with entry and exit losses and optional bends), weirs (any current weir shape) and orifices. Flows through the 1D structures are calculated within the 2D solver, i.e. not by linking to the 1D river solver (although the same 1D hydraulic principles are adopted – as detailed in the revised user guidance). The advantages of this are that structures can run dry and 2D domains can contain multiple structures in isolation from any dynamically linked 1D river network.

(d) 2D FAST solver enhanced to work with files specified using relative paths (previously only option was full paths).

(e) A new option for specifying spatially varying ground roughness has been added to the 2D solvers (and 2D model interface). The look-up file that cross-references land use types (defined in a Mastermap shapefile), with Mannings roughness values, can now be specified in a comma separated text format (".csv" file). This is in addition to the existing fixed format text file (".fric" file) option, which is retained.

(f) 2D solver model initialisation now reads "Z data" from polygonZ / polylineZ / pointZ as elevation adjustments if these data types are listed as 2D topographic features. This means that any elevation data defined in the attributes tables for these file types will now be ignored.

1.3 Bug fixes included in v5.0

This section details the key bug fixes implemented for v5.0. These relate both to the user interfaces and solvers within the software:

(a) Issues with the operation of WMS layers have been addressed which should allow new or existing WMS layers to be added to the Flood Modeller map view.

(b) Bug fixed whereby linked TUFLOW HPC/Quadtree models would cause errors in outputting temporal WLL output.

(c) Plotting of results from 1D water quality simulations can now be plotted in the enhanced time series plotting tool.

(d) The enhanced plotting tools (added in v4.6) have been further developed to re-enable the move next / move previous functionality (buttons in upper right of chart window). Also, some additional bug fixes have been applied to ensure parameters are plotted on the correct y-axis and parameter labels include the correct units.

(e) Some of the interface browse buttons have been enhanced to “start” in a more intuitive folder to make browsing more efficient for users.

(f) The XML (model) validation function in the 2D model interface has been enhanced to include checks for whether the specified 1D urban linked model exists. Other new checks have been added to ensure all specified input and output filenames and folders are valid.

(g) The cancelling of a 1D / TUFLOW linked simulation from within the user interface has been made far more reliable in terms of producing results data up to the point of cancellation. It should always work now, i.e. write all results already generated prior to the abort. Previously it would only work some of the time (or the user could run the simulation with the native TUFLOW progress window visible to achieve success).

(h) 1D solver issue fixed to prevent unsteady models crashing when Direct Method Transcritical Solver (DMTS) option is ticked on (user reported error). In theory, the DMTS should have no effect. Investigations showed that the DMTS option removes the "simplified method", whether in Direct Method or not. This therefore retains the convective acceleration term in the momentum equation and can make models crash at high Froude numbers. Fix was to remove simplified method when DMTS is ticked (for Direct Method only). Tests verified this resolved the issue.

(i) The 2D model interface has been enhanced to prevent specified time entries from being truncated to 2 dps. Thus, preventing incorrectly rounded values from being written to the 2D model XML file.

(j) Fixed a user reported issue with 1D river solver; if the "Use defaults from v4.4" setting is selected and the "output georeferenced diagnostics" option is switched on (which it is by default), then the solver attempts to write the latter file before it has been "officially" opened. Thus, it defaults to writing to a file named fort.101 (unit no=101). This poses problems if trying to run two or more such simultaneous simulations from the same folder, e.g. batch running, as they both try to write the same file. This causes fatal errors (attempting to write to a read only file) for the second one. In v5.0, the correct diagnostics are now written out if this combination of settings are selected.

(k) Fixed issue in long section plots (of 1D river data) that causes an invalid data warning to wrongly appear if node selection encompasses any “Comment” entries in the network.

(l) Interface now prompts to save the active 1D river network as a new file (i.e. Save As function) if network is set as read only. Previously a catastrophic error was triggered, and user changes would be lost.

(m) Fixed issue: Setting a 1D River ief file active could add a second instance of the associated 1D River network to the Project Panel if it was already present in the project (so it appears twice in the list of networks). Interface now recognises if network is already loaded to prevent it loading a second time.

(n) Improved performance of the “fill in missing eastings and northings” georeferencing tool so that it ignores “0, 0” coordinate entries when calculating a direction for a cross section from the available data.

(o) Fixed issues with the “Optimise for large datasets” function provided when loading 2dm/dat format 2D model results. Previously this would not work when loading the 2dm file instead of the sup file.

(p) Over 50 other bug fixes and enhancements aimed at delivering workflow efficiencies, including the ability to include zzx (supplementary data) in time series charts

2. Third-Party Software

Flood Modeller utilises various third-party software within the solvers and user interfaces. For full details of these and their individual terms of use please see our website; www.floodmodeller.com.

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