Version 4.5

JACOBS

Flood Modeller

floodmodeller.com

Flood Modeller Pro / Flood Modeller – What's new in v4.5

Flood Modeller v4.5 introduces a range of new functions (compared to v4.4.1) and addresses a number of issues identified in previous versions. This document contains the following sections:

1. **FLOOD MODELLER V4.5 – CHANGES AND ENHANCEMENTS**

1.1 Changes to Flood Modeller user interface in v4.5

The following enhancements were made to the Flood Modeller interface for v4.5:

(a) Flood Modeller user interface has now been compiled using only 64-bit components. The main advantage of this is it enables the interface to access more memory (the previous 32-bit interface was restricted to approximately 1GB, irrespective of available computer memory). Thus, it should now be possible to load larger GIS datasets into the map view. Note that load speeds will likely be unchanged, so loading larger datasets will take time.

(b) 2D model interface has been updated to be compatible with changes made to the 2D solver. Thus, you can select to automatically generate maximum flood extents as ASCII or GeoTIFF format grids during a simulation. The default setting is to always output maxima data as ASCII grids for each domain within your 2D model. This can be changed (on a domain by domain basis) on the Outputs sub-tab of the 2D model interface.

In addition, there are now two options for writing out check grids during a 2D simulation. These can still be written as ASCII raster grids (the default setting), but now can also be written to GeoTIFF format. This selection is also made on the Outputs sub-tab of the 2D simulation interface (on a domain by domain basis). Note that the default option does not write anything to the underlying 2D model XML file (also there is a third option which is to untick the check grid box and not write out this diagnostic information).

(c) New Project Catalogue Tool providing enhanced project management functionality to help organise modelling (Flood Modeller and/or TUFLOW) associated to a project. It incorporates standardised templates to guide the user to collect all required data associated to a project. The key benefits of the tool are:

- Automatically populates most simulation input and output data
- Easier to find stuff (i.e. inputs, run parameters, results)
- Easier to monitor modelling progress
- Easier to move files to a new location
- Easier to check that if all expected files are received

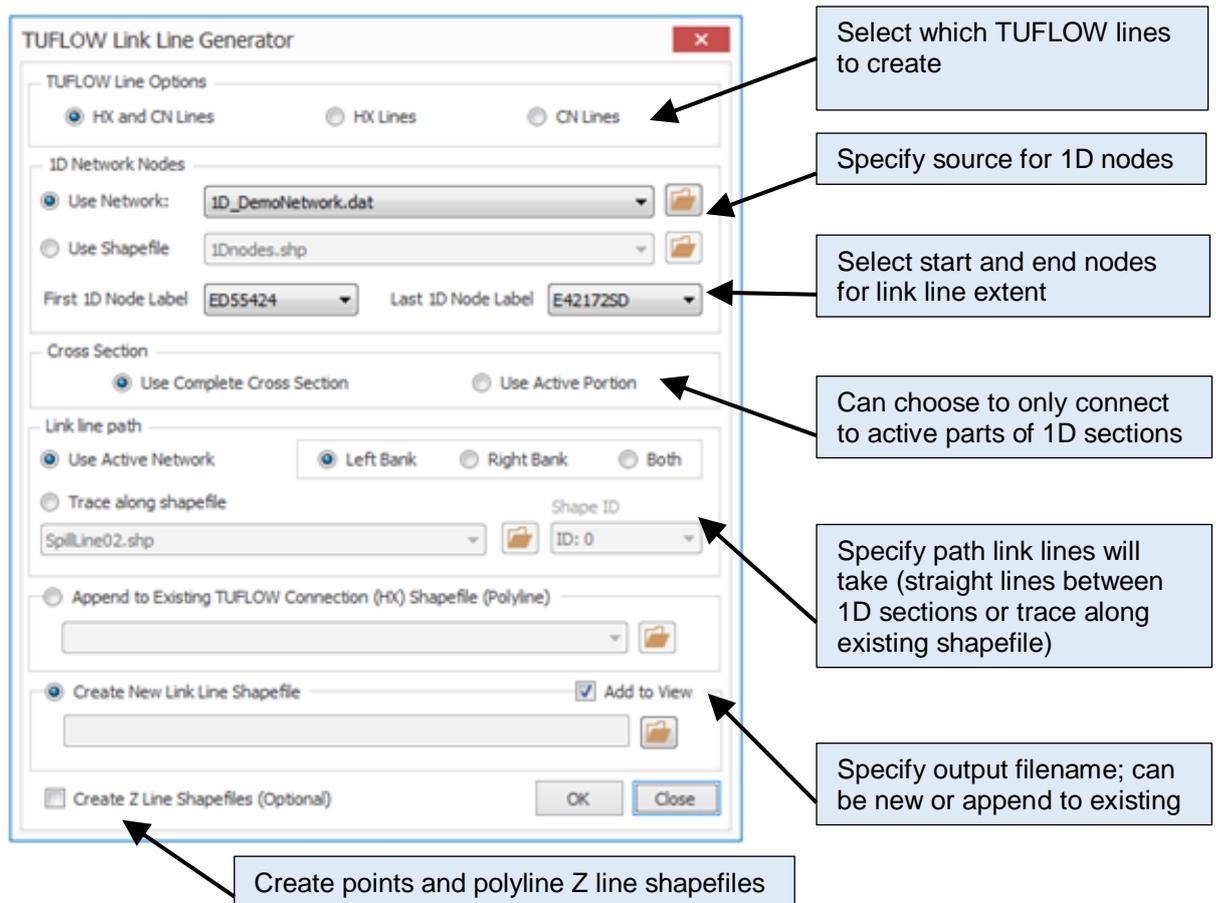The data collected and catalogued by the tool includes:

- Data to be utilised as model inputs, e.g. DTM/DEM grids, topographic shapefiles, river surveys, gauge time series records, hydrological parameters
- Model files, e.g. Flood Modeller 1D networks (dat), events (ied) and simulations (ief) and/or TUFLOW control files (tcf), boundary files (tbc), geometry files (tgc), etc.
- Model results, both direct, i.e. raw outputs such as zzn/zzl or xmdf, and indirect, e.g. maximum flood extent outlines.
- Reports and other miscellaneous files associated to the project, e.g. calculation spreadsheets, email records, etc.
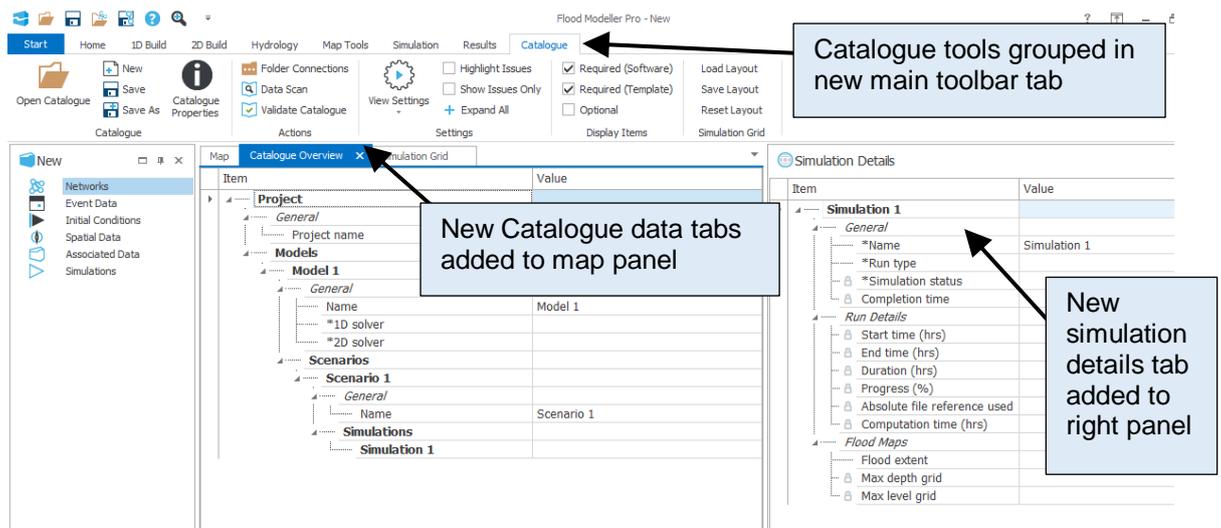
The Catalogue tab of the main toolbar includes tools to automatically scan your project to populate the metadata fields specified in the catalogue data template and then validate your project catalogue against the data requirements defined in the selected catalogue template.

Note: This initial version of the Catalogue Tool is considered a beta version. All included functions are fully working, but they are a subset of the planned functionality for the final version of the tool. It is envisaged that different users will want different things from the Catalogue Tool. We therefore thought it beneficial to release this initial beta version and then gauge reaction and feedback from you. This can then help guide the development of the final version to best meet the needs of our users.

(d) New type of bridge unit can now be selected from the interface toolbar to be incorporated into 1D networks. The new bridge unit aims to improve the calculation capabilities of the software concerning the flow through bridges where the dominant cause of losses is the friction from piers. It utilises the empirical equation derived by Yarnell (1934). The addition of this unit provides a new option for modelling a bridge, in particular where low flow is more frequent.

(e) A new asymmetric culvert unit has been added to the 1D suite of unit types. The property window for the asymmetric culvert enables entry of an irregular channel shape. It also provides a choice of roughness coefficient; Mannings or Colebrook-White.

(f) The link line generator tool has been enhanced to provide multiple options for creating link lines (defining links in a 1D-2D linked model). In v4.5 the user can now:

- Use the active network or a point shapefile to define the start and end points of link lines and the 1D node references

- Link location can now be defined by joining end points of 1D cross sections (these can be end of full sections or end of active portions only). Alternatively, tool can trace link lines along a specified polyline shapefile or polygon (active area) shapefile (previously only tracing along a polygon was possible).

- Link line elevations can be taken from an underlying DEM (ASCII raster grid) or from the section end point elevations of the active 1D network.

(g) A new TUFLOW Link tool has been added to the 2D build tab of the main Toolbar. This provides similar functionality to the 1D-2D link line tool, creating new polyline shapefiles containing TUFLOW HX and CN lines (used for the dynamic linking of TUFLOW 2D models (Classic or HPC) and Flood Modeller 1D networks). This tool provides a more automated alternative to manually drawing TUFLOW HX and CN lines using the shapefile editor (with the option of utilising snapping to existing features).
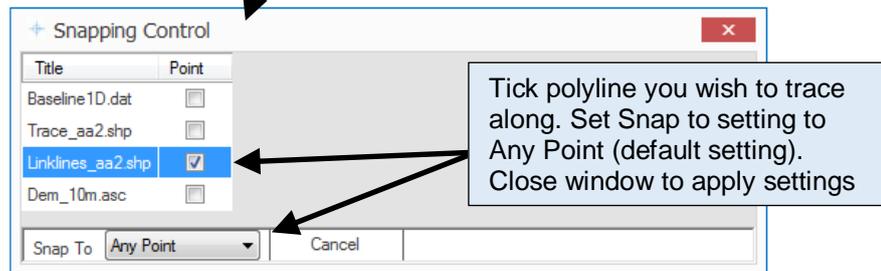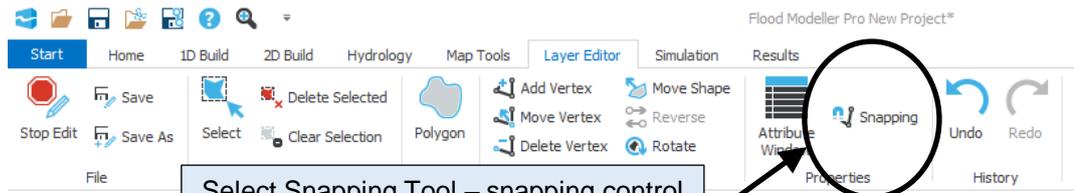
TUFLOW Link Line Generator

Select which TUFLOW lines to create

Specify source for 1D nodes

Select start and end nodes for link line extent

Can choose to only connect to active parts of 1D sections

Specify path link lines will take (straight lines between 1D sections or trace along existing shapefile)

Specify output filename; can be new or append to existing

Create points and polyline Z line shapefiles

(h)   2D active area draw tool has new option to trace along a specified polyline shapefile (to form part of the overall active area).

If you have a (high) bank line or 1D-2D link lines already defined, then you can quickly trace your active area along these lines in a single operation (rather than separate clicks snapping to one point at a time) to extend your area over every point along the line. The tracing procedure is as follows:

- Ensure the polyline shapefile you wish to trace along is loaded in your map view and then start drawing a new active area.

- In the Layer Editor tab of the main Toolbar, select the snapping control. In the pop-up window that is then displayed, select to snap to the polyline shapefile you will be tracing along – tick the box next to the appropriate file and select to snap to any point on the line (the default option).

It is recommended that when tracing you should only have snapping defined for the polyline selected to trace along and no additional files.

Select Snapping Tool – snapping control pop-up window is then displayed

Tick polyline you wish to trace along. Set Snap to setting to Any Point (default setting). Close window to apply settings

- Close the pop-up window to apply the snapping setting.

- Click on the Draw Polygon button in the Layer Editor to start drawing a new active area. Move the mouse cursor (which should change to a pen icon) close to the point where you wish to start tracing on your polyline. The snapped point should be shown with a dotted line rectangle surrounding it. Click the left mouse button to start drawing from this point.

- With the Shift key depressed, move the cursor to where you want to trace to on the polyline. When the correct point is displayed with the "snapped to" rectangle around it click the left mouse button (with Shift key still depressed). Active area points should be added at all points along the traced polyline (between your specified start and end points).

- To add further, non-traced points to your active area continue to left-click on the map, but without depressing the Shift key.

- Double-click to stop adding points and to close the active area polygon.

(i) Charting of 1D model results has been enhanced to allow easy selection of multiple results for the same plot. When initialising a plot you can now select multiple 1D units either on the map or in the network table. Then, when you access the plotting function (as normal), the revised plot tool window will list your selected units together with a full list of units in your 1D network enabling you to add or remove further units from your selection for plotting.


Units selected for plotting

Controls for moving units in/out of selection list
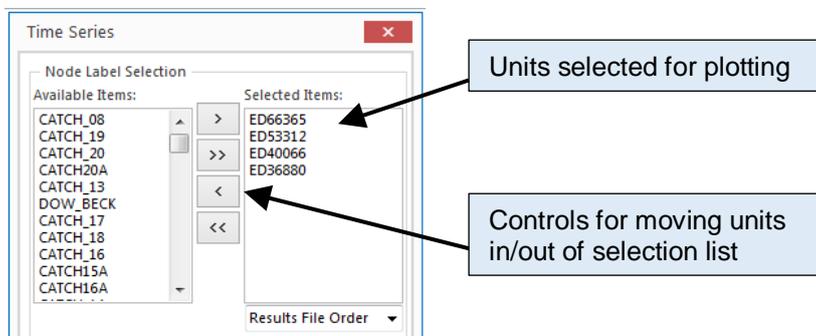
Once the parameter and timing are selected clicking the plot button will generate a chart showing data from all selected units together:
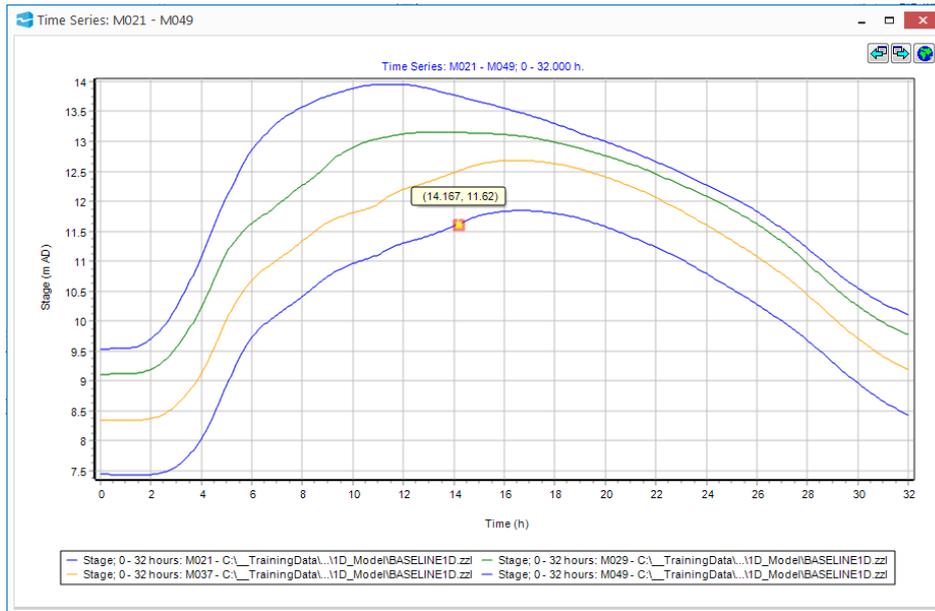
(j)   The Damage Calculator tool is enhanced to include options to calculate additional damages beyond the direct property damage due to flood levels.

- Vehicle damages
- Indirect damages to non-residential properties
- Emergency response and recovery costs
- Evacuation and relocation costs for residential properties

Each of these four additional damages are calculated as separate damage figures against each (applicable) property and as an overall total for each dataset analysed, e.g. total vehicle damage for 100yr return period 2050 epoch event. If multiple input datasets are specified, then the additional damage totals will also have AAD and PVD values calculated. These data will also be included in the summary spreadsheet that can be exported from Damage Calculator (using the "View Summaries" button).

The Settings tab provides the options to affect each of the additional damage calculations:
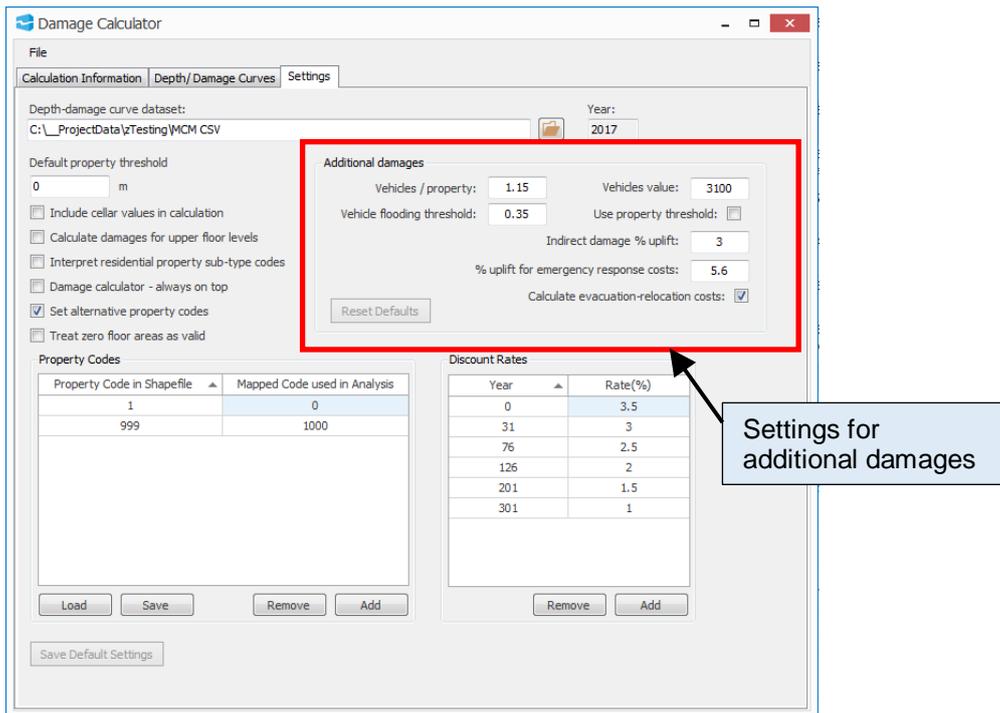
(k) 1D node selection now includes an option to select multiple nodes by "drawing" an irregular polygon around all required nodes. Activate polygon selection by clicking the icon in the upper left corner of the map:
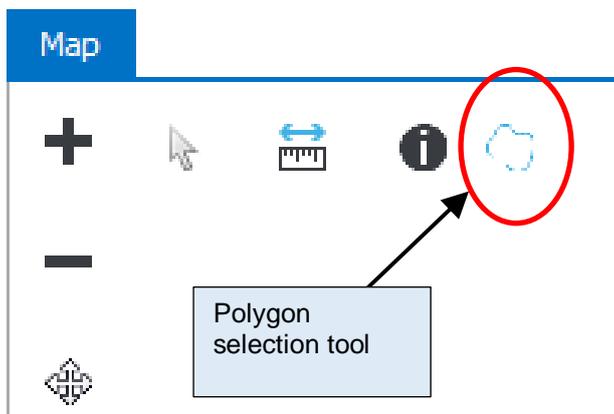
Left click on the map to start drawing your selection polygon. Each subsequent click will add extra points. The polygon will be displayed as a semi-transparent, yellow shape. To end drawing click with the Ctrl key depressed. The nodes within the polygon will be highlighted and the selection mode will be returned to the default mode (i.e. rectangle selection).
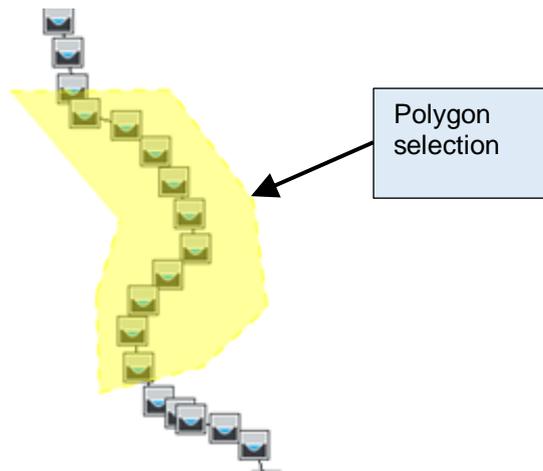
(l) Enhanced auto-georeferencing when loading 1D networks without an associated gxy file. Flood Modeller will now try to position all 1D units by applying the following conditions:

- River sections with non-zero coordinates will be located in their correct position on the map

- Non-georeferenced units between these river sections will be located on the map between the river section locations. If there are multiple units between river sections, then these will be distributed linearly in the space between the river sections.

- Any units that can't be positioned using the above conditions will be located adjacent to the main network and distributed linearly within the zoom extent of the georeferenced part of the network. Previously the current map zoom extent was used to encompass these non-georeferenced units (relying on the user to set this extent prior to loading the network).

Note: It is still possible for some units in some networks to be omitted from the above tests and these units will still revert to a 0,0 coordinate location. Occurrences of this type should now be rare though.

(m) The model packaging functionality in Flood Cloud has been enhanced to enable a wider range of model configurations to be run in the cloud. This is in terms of model file locations and file types (and mainly applies to TUFLOW models).

(n) Flood Cloud test mode no longer requires a local Flood Modeller Pro licence (or TUFLOW licence – implemented in v4.4). Note that test mode is only available in the Flood Cloud standalone interface (this is packaged with Flood Modeller but is different from the Flood Cloud interface accessed from the Flood Modeller Simulations tab).

Bug fixes to Flood Modeller main interface:

Some bugs identified since the release of v4.4.1 have been addressed in v4.5. The most significant fixes are listed as follows:

- 1D-2D link line generator tool was starting/ending links at position (on specified active area outline) closest to 1D cross section centre point instead of end point. In some cases this could lead to link lines starting/ending at location offset from where 1D cross section "touches" 2D active area (thus requiring additional manual editing of polylines).

1.2   Enhancements to the 1D and 2D calculation engines implemented in v4.5

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

1.2.1   1D Solver enhancements

(a) Links with TUFLOW HPC have been extended to enable inclusion of ESTRY components in the linked 1D to TUFLOW HPC model.

(b) New type of bridge unit added to the 1D solver. The new bridge unit aims to improve the calculation capabilities of the software concerning the flow through bridges where the dominant cause of losses is the friction from piers. It utilises the empirical equation derived by Yarnell (1934). The addition of this unit provides a new option for modelling a bridge, in particular where low flow is more frequent.

(c) New asymmetric culvert unit added which enables the definition of an irregular channel shape. It also offers a choice of roughness coefficient, i.e. Colebrook-White or Mannings.

(d) New "test Run" mode implemented/finalised - no licence check; no results output; limited simulation duration

(e) Dlls are now loaded using the dll's own folder as top of the search path hierarchy for further dependent dlls – improves the ability to load TUFLOW dlls for linked simulations

(f) Added extra cumulative volume (to 2D) per node output to zzx for "2D Flow" [TUFLOW] option

(g) New default minitr = 3 (and consequently avitr=3.5)

(h) Linking to TUFLOW HPC - **new timestep synchronisation option (default=ON)** so that the timesteps of TUFLOW HPC and Flood Modeller 1D always coincide *exactly* when they exchange variables.

(i) Ability to rewind to previous version's defaults implemented (see above options)

(j) If a non-existent Results folder is specified, this is automatically created (one level down only)

(k) Ability to write a temporary (short, fine temporal resolution) "rolling" zzn file to aid debugging close (in time) to problem area.

(l) Improved error /warning messages on:
   a. Licence, etc. failures
   b. Failure to load/find TUFLOW dll
   c. two rules simultaneously applying (better identification of rule numbers)
   d. Allocation errors, e.g. "Too much memory requested"

(m) Null stage values (e.g. returned from dry 2D areas) are not subject to (alpha-)relaxation; this prevents occasional spurious non-convergence warnings

1.2.2   2D (HD) Solver enhancements:

(a) 2D solver can now write out the calculated maximum extent (i.e. 9999 timestep) in an ASCII grid format. User can set whether to write these data out using the 2D model interface (although the default setting is to write this grid).

(b) 2D solver enhanced to allow simulations to start without the user needing to specify a 1D-2D mass balance diagnostic filename. Previously this would cause the solver to crash unnecessarily.

(c) NetCDF and XMDF results file output formats now fully supported

(d) Check files may now be output in GeoTiff format (improved option for rotated grids - no holes shown)

(e) New functions in SWMM link to be able to extract flooded and ponded flow from a SWMM node (via a Q-link)

(f) Stability of Q-link return flow improved

(g) Improved synchronisation of SWMM-Flood Modeller 2D time steps/simulation times

(h) Improved mass balance calculation on H-link lines; H-link cells accounted for separately

(i)   Improved diagnostics (messages & quantity added to MB file) if trying to extract more flux than it can from a Q-link

(j)   Superfluous/irrelevant warning about SWMM being in US units removed

(k)   FAST module – shapelib.dll file updated to use more recent (non-obsolescent) Microsoft VC++ redistributable (dependencies)

Removal of extraneous/excessive "this is the first and last [negative depths] warning" messages

Bug fixes to Flood Modeller solvers:

Some bugs identified since the release of v4.4.1 have been addressed in v4.5. The most significant fixes are listed as follows:

1D Solver:

(a)   Errors in automatic top slot for curved-topped conduits (Circular, Full Arch, Sprung Arch) fixed.

(b)   The Direct Method now exhibits consistent behaviour when failing due to inappropriate initial conditions in the model file (.dat) and network connectivity.

(c)   Direct Method failure for a QH Control with downstream water level below crest level fixed.

(d)   Error if number of snapshots exceeded maximum (10) now fails gracefully with appropriate warning.

(e)   minimum p1 (and p2) for sharp-crested weir (SCWEIR) raised to 0.1m (with warning), in line with recommendations; was previously calculating unrealistically high ce coefficient values at previous minimum of 0.01m

(f)   Maximum number of boundaries in a model increased from 300 to 1000 - was causing "illegal storage" errors with models with > 300 boundaries,

2D Solver:

(a)   Failure caused by very long combined polyline-point file names now fixed