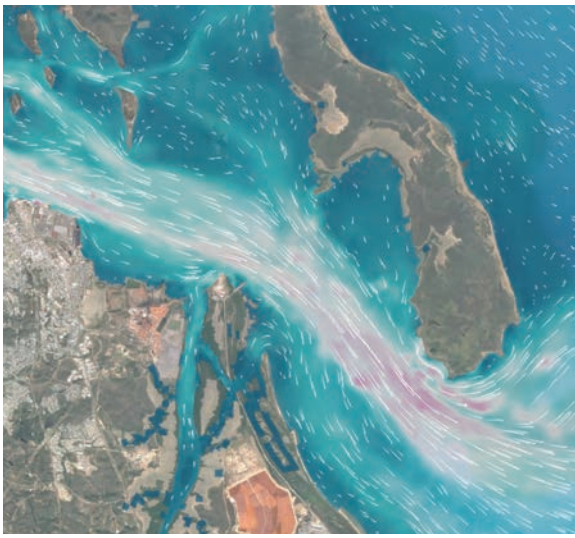
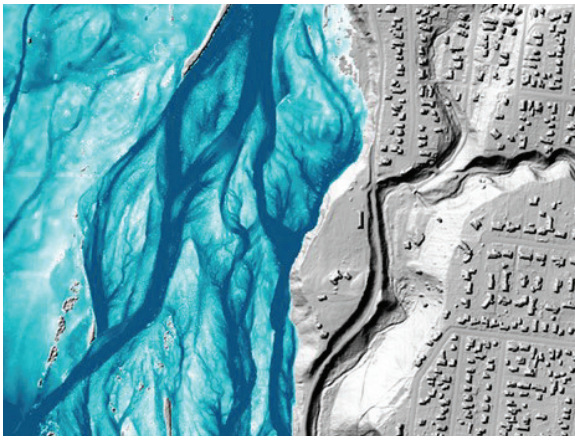
TUFLOW





Flood, Urban Stormwater & Coastal
Simulation Software

BMT

www.tuflow.com

Contents

TUFLOW Software Areas of Application

Catchments

Fast and accurate computing via GPU hardware for fine-scale distributed hydrologic applications and basin scale modelling.

Sophisticated options for landuse representation and a range of soil infiltration methods.

Urban drainage and stormwater

Superior 1D solver for simulating pipes, manholes, pits and lined channels. 1D links and operatable structures provide the solution for complex urban drainage, pipe networks and river systems.

Floodplains and rivers

TUFLOW's heritage, providing the benchmark modelling tool for floodplain management.

New alternatives and options with logic controls and advanced gate operations leading to flood warning and emergency response.

Flexible mesh and fast computing options.

Estuaries and river entrances

Where rivers and the sea meet; a complex interaction of tides, inflows and ocean currents combined with sediments and environmental issues.

Coastal and nearshore

Winds and waves, hurricanes, wave setup and current generation.

Longshore transport of sediments and morphological change.

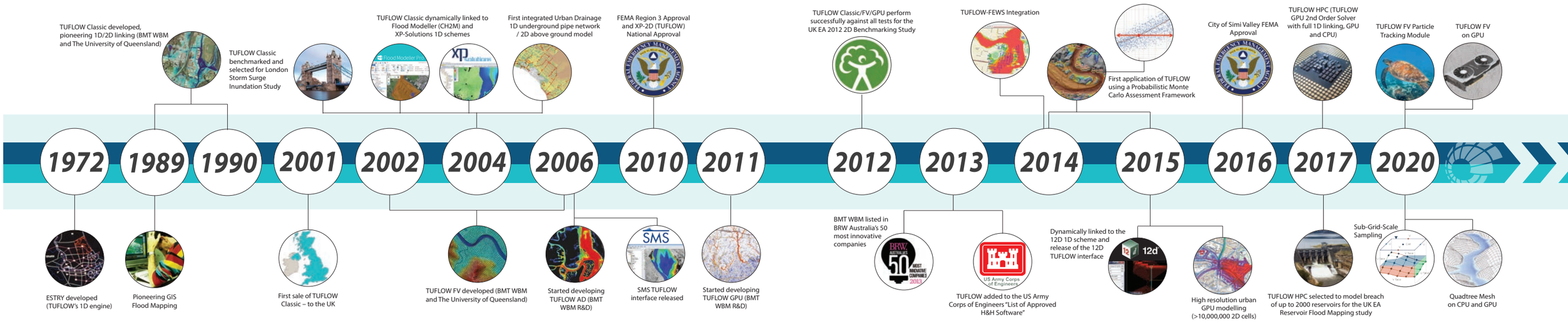
Tsunami propagation and inundation.

Offshore and metocean

Providing a link between oceanography and coastal engineering with high resolution nesting and advanced 3D boundary transfers.

Supporting the oil and gas industry; oil spill response and drill mud dispersion.

Our History



TUFLOW “Classic” and HPC

Fixed Grid Modelling

Floods, storms and coastal surges cause extensive damage, stress, loss of life-and-limb and disruption. To understand and manage these risks requires software that quickly and accurately models the inundation of rivers, urban areas and coastal floodplains.

TUFLOW is the most fully featured software for modelling:

- Flooding in major rivers
- Complex overland and piped urban flows
- Storm tide inundation of coastal plains
- Estuarine and coastal tidal hydraulics

Engines

Try TUFLOW for FREE

wiki.tuflow.com

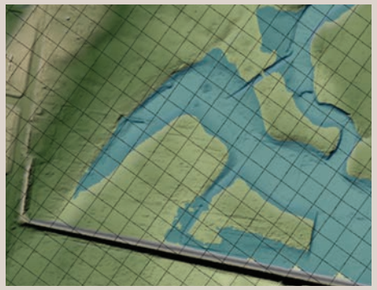
Ahead of the pack

TUFLOW is a versatile modelling platform that has been continuously enhanced, based on users’ needs, since the 1990s. Key features are:

- Choice of 2nd order ADI (Classic) or 2nd order FV (HPC) 2D solvers
- Layered data approach - no data duplication
- Layers independent of 2D cell size, grid extent and orientation
- Modify data easily for “what-if” scenarios
- Powerful topography manipulation tools
- Hydraulic structures in 1D and 2D
- Supercritical, weir and subcritical flow switching in 1D and 2D
- The best 1D/2D linking available
- Boundaries and 1D/2D links at any orientation and location
- Nested 2D cell sizes using the multiple 2D domains in both TUFLOW Classic and TUFLOW HPC with Quadtree
- Easy and efficient management of events and scenarios
- Speed and reliability for real-world modelling
- Extensive range of outputs
- Advanced flood risk management analyses
- Extensive QA and healthy model checks
- Comprehensively detailed manual
- Seamless integration with GIS platforms and third party graphical user interfaces
- Customisable hazards – create your own USER_DEFINED.dll
- TUFLOW Tutorial/Demo models
- Active on-line TUFLOW Forum and Wiki
- Advection-Dispersion Modelling
- Sub-grid scale topography sampling functionality
- Advanced sub-grid turbulence models

Background

TUFLOW originated from a joint R&D project between WBM Pty Ltd and The University of Queensland in 1989/90 to develop a 2D modelling system with dynamic links to a 1D system, and has since gone from strength to strength as an industry leader.

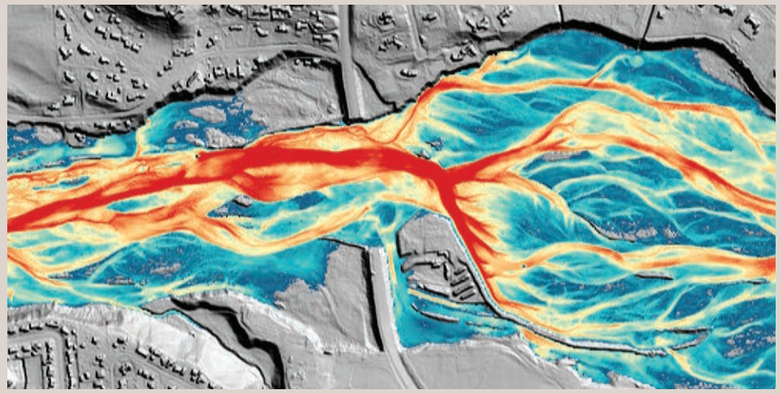


Fixed grid mesh

Workflow Efficiency

The simple logical scripts, GIS data layering, powerful topographic modification functions and clever event and scenario management, make TUFLOW the modeller’s model. For those who wish to model quickly and efficiently, TUFLOW is the preferred option.

TUFLOW’s workflow efficiency and superior accuracy are the primary reasons TUFLOW has become the dominant 1D/2D flood modelling software in Australia and the UK, and is seeing a significant uptake in the USA and elsewhere. TUFLOW makes modelling easy, flexible, customisable and extremely efficient for detailed flood assessments and modelling numerous what-if scenarios.



Solution Schemes

TUFLOW’s Classic 2D solution is the leading alternating direction implicit (ADI) scheme on the market, while the new 2nd order TVD finite volume (FV) 2D solver (HPC) is taking the industry by storm. The 1D scheme is a very stable and accurate second-order, Runge-Kutta solution.

The 2D schemes automatically handle upstream controlled flow regimes (supercritical flow down steep slopes and weir flow over levees), bridge decks, box culverts, excellent wetting and drying and other features. HPC’s adaptive timestep FV approach makes it virtually 100% stable.

TUFLOW HPC also allows features sub-grid sampling which represents the underlying sub-grid topography within the grid cell geometry. This allows larger grid sizes whilst maintaining accurate representation of the topography allowing quicker simulations.

The 1D solution includes detailed representation of rivers, floodplains, extensive pipe network systems, pits and manholes, and a range of structure types, and highly flexible structure operational controls. Energy loss coefficients at manholes and culvert transitions are reevaluated every timestep.

TUFLOW 1D/2D Dynamic Linking

TUFLOW’s 1D/2D dynamic linking is the best in the industry.

- 1D/2D links can be at any orientation to the 2D grid, start completely dry, and wet and dry during the simulation.
- Operate as simple source/sink links (eg. connections to pipe network pits) through to momentum preservation links across major waterways, large 1D structures and along river banks.
- 1D/2D links do not force a reduction of the 2D timestep
- Apply the full 2D solution for momentum preservation
- Switch automatically to the weir equation when upstream controlled (eg. free flow over a levee)
- Do not need to be reworked if the 2D cell size or grid orientation changes.
- 1D-2D Links can handle spatially distributed 2D grid sizes.

Engines

Estry

TUFLOW's 1D Engine

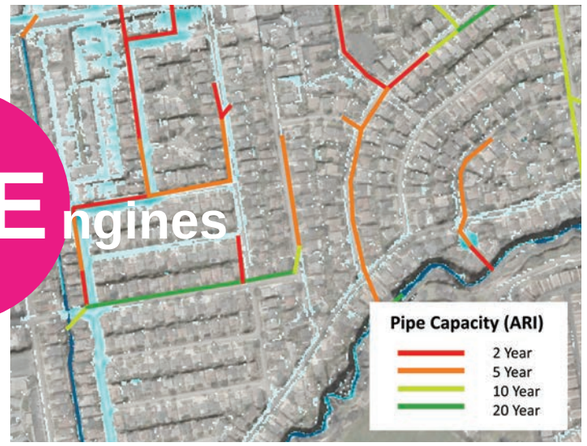
ESTRY is the primary 1D engine used by TUFLOW. It has been developed over a period of 50 years, has continued ongoing development. It is in its own right a powerful 1D network dynamic flow software. It is suitable for modelling of open channel fluvial and catchment flooding, real time control structures or urban underground pipe networks. ESTRY is dynamically linked with all TUFLOW fixed grid 2D solvers.

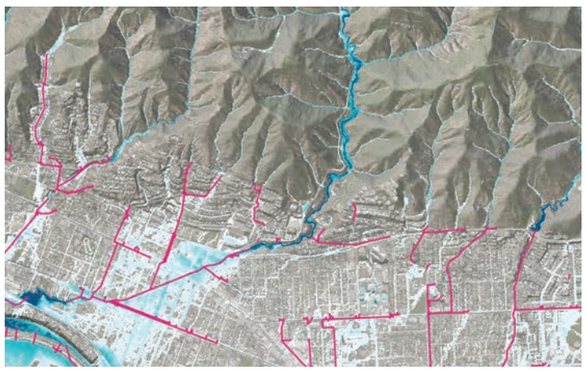
Features

- Open channel network and catchment storage areas
- Culvert equations for circular, rectangular (box) and irregular shaped culverts
- Bridges
- Weirs, spillways, radial and sluice gates
- Real time controls, including gates and pumps
- Pipe networks, including pit and manhole inlets
- Advanced dynamic treatment of pipe network energy losses

History

- Development started in 1972
- Linked to TUFLOW Classic (2D) in 1989
- Linked to TUFLOW HPC (including the GPU Module) in 2017





Solution Schemes

- Open channel flow are calculated using the full one-dimensional (1D) free-surface St Venant flow equations.
- Culvert equations are built directly into TUFLOW. Twelve different flow regimes have been coded into the software. The regime for every structure is checked for every timestep of the simulation.
- Bridge flow dynamics, adjustment of bridge form loss values accounting for the transition from upstream controlled flow to/from downstream controlled flow is automatically accounted for by ESTRY.
- Losses within an underground pipe network at pipe junctions account for change in pipe geometry, angle, elevation and flow expansion/contraction at manholes. They are calculated and adjusted based on the hydraulic conditions at every pipe junction for every timestep of the simulation.
- Nine weir types have been coded into ESTRY. Manual coefficient specification is also an option. ESTRY automatically tests for flow submergence every timestep and adjusts the hydraulic calculations accordingly.

Fixed Grid Modules

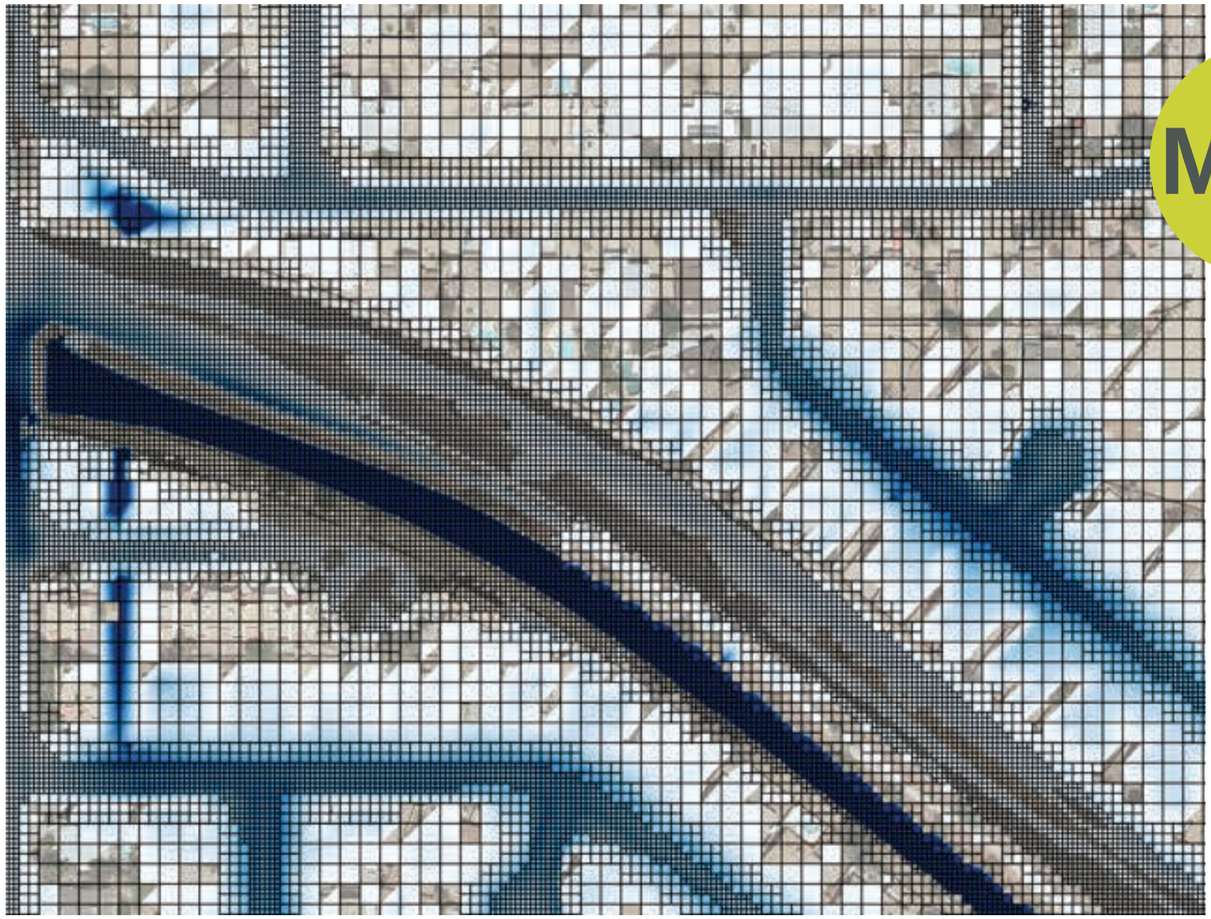
TUFLOW Classic and HPC fixed grid modules have been designed to increase simulation efficiency and speed

Multiple 2D Domain Module/TUFLOW Quadtree

TUFLOW's multiple 2D domain (M2D) module is available using TUFLOW Classic and now TUFLOW HPC (known as TUFLOW Quadtree). The module provides the capability to nest areas of finer mesh resolution within a coarser resolution. This feature allows users to obtain high resolution accuracy in key areas of interest without excessively increasing the overall cell count and simulation run time for a model, as would be the case for a single domain model at a high resolution.

Key Features

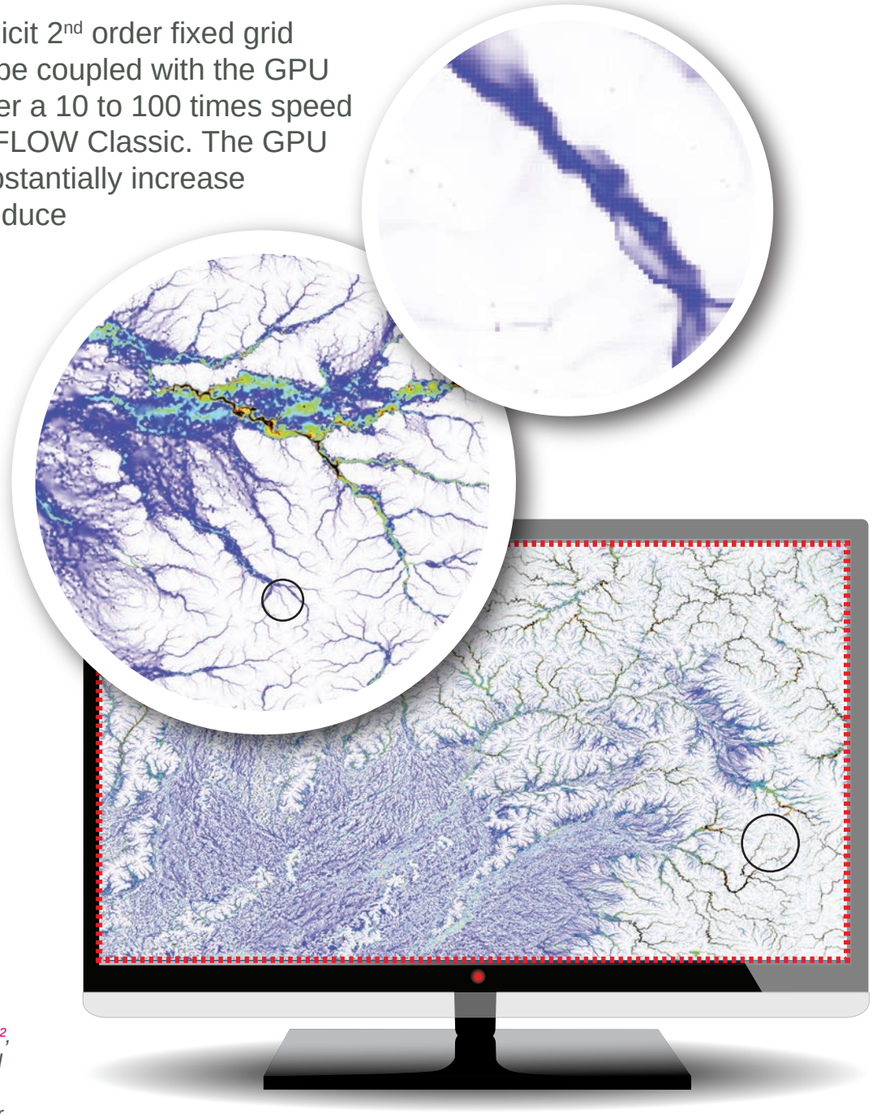
- Full flexibility regarding the nesting extent.
- Multiple layers of nested grids.
- No limitation on the number of domains.
- Compatible with the GPU module.

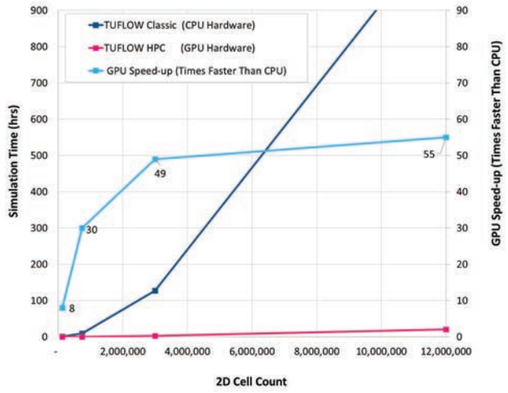


Fixed Grid Modules

GPU Acceleration

The HPC parallelised explicit 2nd order fixed grid hydrodynamic solver can be coupled with the GPU Hardware Module to deliver a 10 to 100 times speed increase compared to TUFLOW Classic. The GPU Hardware Module can substantially increase simulation turnover and reduce project delivery times.



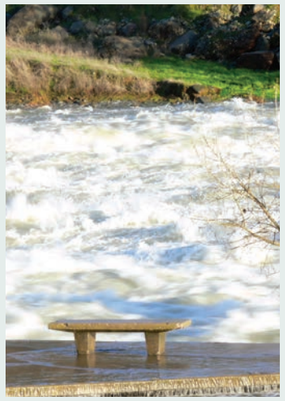


Catchment scale modelling

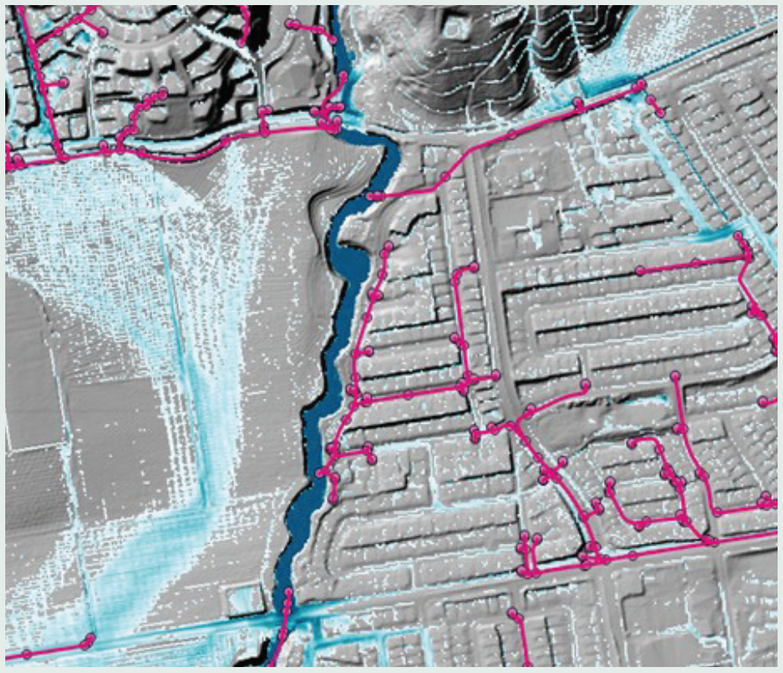
Direct rainfall over the Condamine-Balonne catchment and surrounds, an area of over 400,000 km², was modelled on a 30 m resolution grid using TUFLOW HPC. A total of 486 million elements over a rectangular area of 810 km x 540 km.

No matter what the scale of the modelling, from flume scale to catchment scale, TUFLOW HPC GPU module can lead to significant reductions in run times whilst also providing unrivalled accuracy. Now in 2020, the GPU module can be used with TUFLOW Quadtree for the most efficient fixed grid modelling available in the market. Simulations can be run up to 400 times quicker providing results faster.

> Supercomputer performance on a desktop



100% stability make TUFLOW HPC the optimum tool for reservoir dam breach assessments



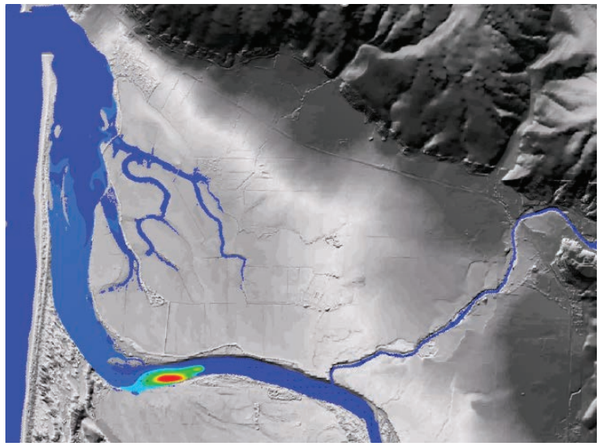
TUFLOW HPC Integrated 1D/2D Urban Drainage modelling

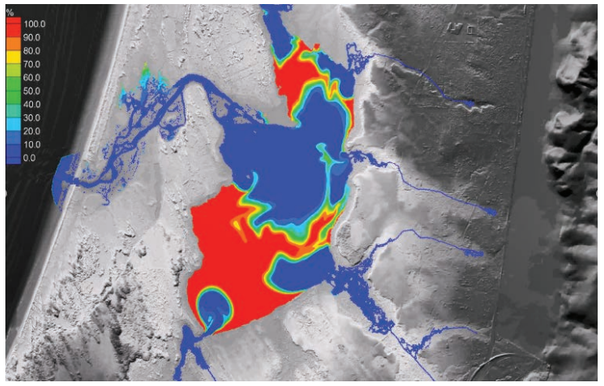
- All the power and flexibility of TUFLOW's superior GIS functionality, scripting and scenario/event management is at your fingertips when using HPC's GPU Module.
- The explicit finite volume 2nd order space, 4th order time solution is 100% stable.
- Solves the full 2D free-surface equations including inertia and sub-grid turbulence (eddy viscosity) – a superior solution at all levels compared with other GPU accelerated solvers.
- Succesfully benchmarked and a top performer of the UK EA 2D Benchmarking.
- Full 1D/2D dynamic linking functionality.
- High resolution integrated 1D pipe / 2D overland urban drainage modelling now a reality.
- Soil infiltration using IL/CL, Green-Ampt and Horton methods.
- Multiple water level boundaries, rainfall distributions and catchment inflows.
- Vary Manning's 'n' with depth.
- The GPU Module requires CUDA enabled NVidia cards.
- Simulations can be split across multiple GPU cards to allow larger models to be simulated and quicker simulation times.
- Spatially variable mesh cell size with TUFLOW Quadtree.
- Sub-grid sampling
- Advection-Dispersion Modelling

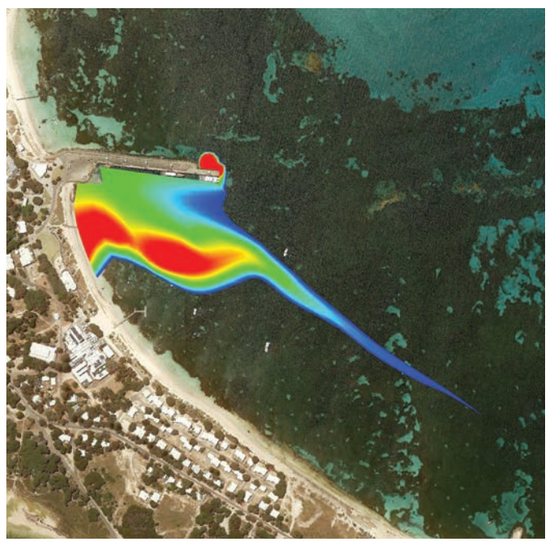
Modules

Advection Dispersion

- TUFLOW AD (Advection Dispersion) is a module for simulating depth-averaged constituents fate and transport.
- TUFLOW AD takes depth and velocity fields computed by TUFLOW Classic and, new in 2020, TUFLOW HPC and uses this information, together with initial states and boundary conditions, to simulate the advection and dispersion of constituents.
- TUFLOW AD is specifically oriented towards such analyses in systems including coastal waters, estuaries, rivers, floodplains and urban areas.
- With the addition of the TUFLOW AD module to TUFLOW HPC, GPU card technology can be used to significantly reduce simulation times for advection-dispersion modelling to provide timely outputs.







Harbour Contaminant Plume

Features

- Up to 20 constituents, either dissolved or particulate, can be simulated.
- Determinants can be applied to a variety of boundary conditions.
- Atmospheric Exchange.
- Advection-Dispersion runs can now be simulated with GPU card technology for faster outputs.
- Constituent decay processes.
- Settling processes.

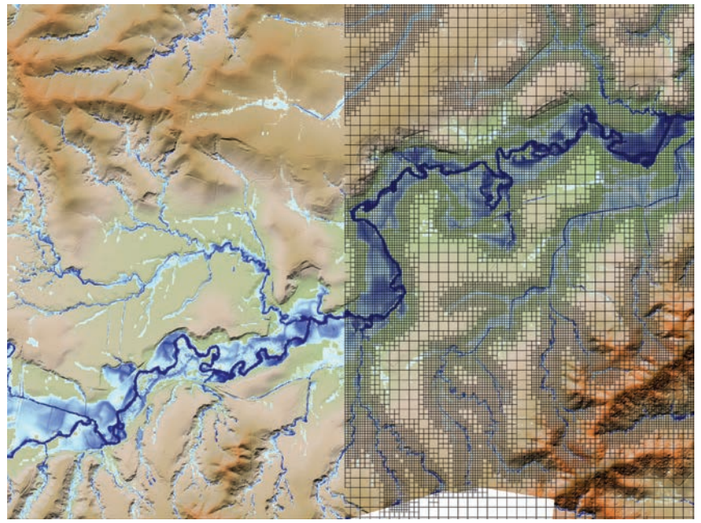
Applications

- Trace constituents within the hydrodynamic field.
- Urban washoff assessments.
- Attribute flood sources.
- Residence/Flushing time in lakes, estuaries and rivers.

New TUFLOW Functionality for 2020

TUFLOW Quadtree

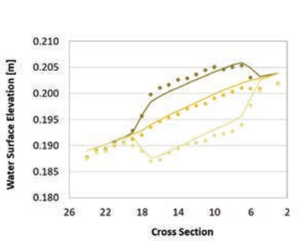
The TUFLOW Quadtree module provides the capability to nest areas of finer mesh resolution within a coarser resolution. This feature allows users to obtain high resolution accuracy in key areas of interest without excessively increasing the overall cell count and simulation run time for a model, as would be the case for a single domain model at a higher resolution.

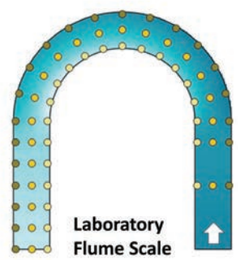


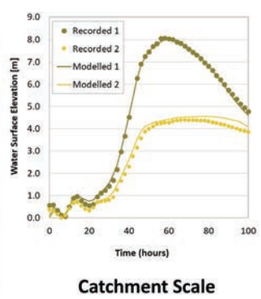
- Rapid development of Quadtree nesting levels using GIS layers
- Up to 9 nesting levels
- Full 2D solution across nesting levels
- Unlimited number of nesting polygons
- Full support for 1D-2D Linkages.
- GPU compatible

Sub-Grid Sampling

TUFLOW HPC now allows utilisation of the rich topographic information available from LIDAR and other Digital Terrain Model sources regardless of the mesh resolution. With use of Sub-Grid Sampling all the topographic variation within the terrain can be represented for more accurate modelling. The powerful sub-grid sampling functionality means it's now possible to model at any mesh orientation and mesh size as well as improving the representation of the wet-dry boundary. Results are comparable to flexible mesh results with the computational efficiency provided by a fixed grid.







Catchment Scale

TUFLOW FV

Flexible Mesh Modelling

TUFLOW FV is a 1D/2D/3D flexible mesh finite volume numerical model that simulates hydrodynamic, sediment transport and water quality processes in oceans, coastal waters, estuaries, lakes and rivers. TUFLOW FV's unparalleled speed, flexibility, robustness, stability, and wide-ranging functionality make it a powerful hydrodynamic computational engine. It can be executed on either CPUs, as is the case in traditional numerical models, or on Graphical Processing Units (GPUs), which offer orders of magnitude increases in simulation speed.

Engines

TUFLOW FV Solution Scheme

The finite volume numerical scheme solves the conservative integral form of the non-linear shallow water equations (NLSWE). The equations can be solved in 1D, 2D (vertically depth-averaged) and 3D. The flexible mesh allows representation of complex geometries whilst maintaining computational efficiency.

Engines

Key TUFLOW FV Scheme Features

- Explicit Finite Volume solver that intrinsically handles shocks
- Subcritical, supercritical and transitional flows
- Locally (and globally) conservative to numerical precision
- Robust wetting/drying
- Parallelised explicit scheme (varying Courant dependent timestep)
- 2D and 3D scheme with 1st and 2nd order solutions

Speed

TUFLOW FV code is optimised for use on Nvidia GPU hardware and multi-core CPU machines. GPU run times can be up to 40 times quicker than CPU runs. The TUFLOW FV engine is available as Linux and Windows builds.

Features

Flexible controls / interfacing

TUFLOW FV allows integration with common GIS formats to allow rapid development of model geometry and control files. This provides flexibility and efficiency in controlling model configuration, boundary condition specification and output requirements.

Open boundaries

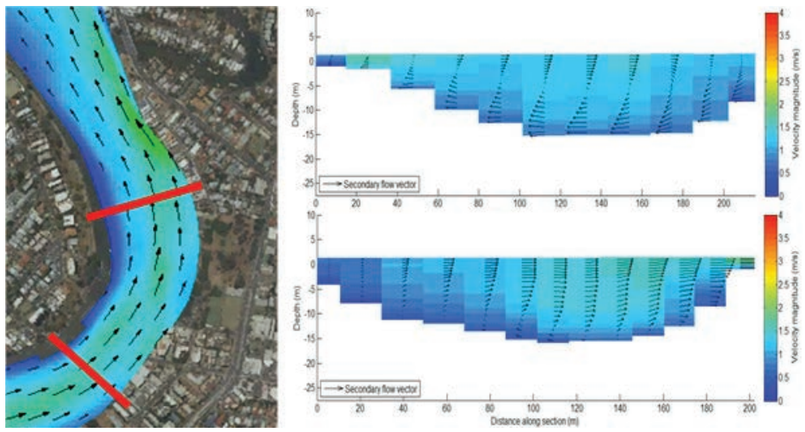
- Fully open (non-reflective)
- Specified water level
- Specified discharge
- 3D linkages to ocean circulation models

Other example boundary conditions

- Global cell inflows and outflows (e.g. rainfall, evaporation)
- Cell inflows/outflows (e.g. pollutant source/sinks)
- Wind and wave stresses, atmospheric pressure
- Holland parametric cyclone wind and pressure model

Structures

- Weirs, culverts
- Adjustable beds, levee failure, etc
- hQh matrix specification at selected cells
- Logical controls
- Auto weir function



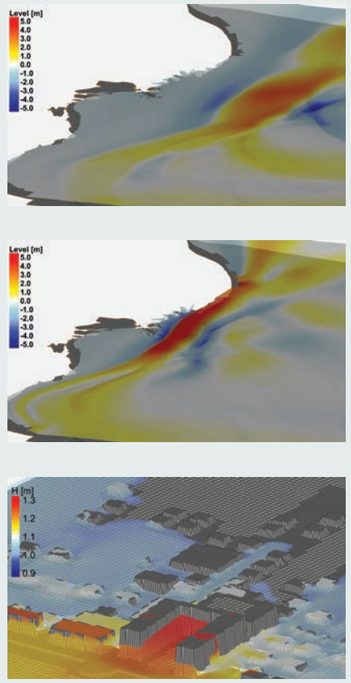
Modelling 3D flow fields in a flood model

TUFLOW FV can be run in 2D and also has a range of 3D layering methods to capture complex 3D flow patterns during periods of flood. This feature has been successfully applied to the design of riverbank infrastructure.

Complex problems require clever solutions

From the oceanic to local scale. A nested modelling approach to establish design parameters for infrastructure.

- 3D currents, temperature, salinity, mean sea level anomolies and vortex shedding input boundaries from global circulation and forecast models.
- Hurricane activity, generating high currents on local and regional scales.
- Rapidly shallowing bathymetry, with tidal and wind driven currents becoming influential close to the coastline.
- Flexible, scriptable and GIS compatible outputs directly available for impact mapping, dashboards, operational warning systems and forecasts.



Tsunami

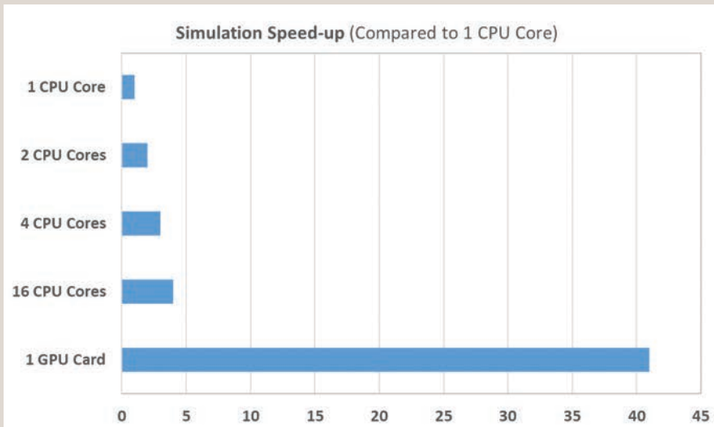
Understanding the risk of tsunami hazards is critical to the development of coastal environments. We are now better placed than ever to use computational hydraulics to simulate and map tsunami hazards. To do so requires robust and accurate hydraulic calculations.

To accurately capture steep wave gradients associated with tsunamis, the higher order spatial solution scheme for TUFLOW FV was applied to simulate the Tsunamic generated by the Great East Japan earthquake in 2011.

A flexible mesh is well suited to the representation of complex coastline geometries whilst maintaining simulation efficiency in areas in the deeper ocean.

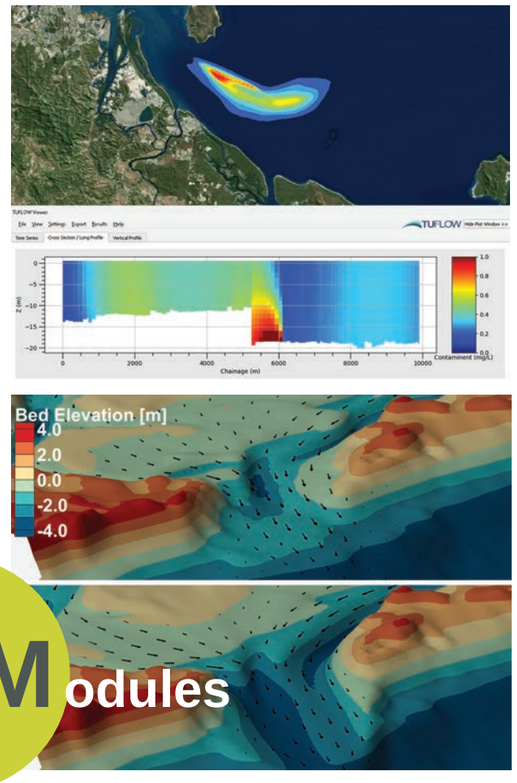
TUFLOW FV GPU Module

Since 2020, TUFLOW FV is now capable of utilising NVidia Graphical Processor Unit (GPU) technology to simulate 2D/3D hydrodynamics, sediment transport and particle tracking at speeds that are orders of magnitude greater than previously achievable.



Flexible Mesh Modules

TUFLOW FV's modules provide expanded functionality and capability, and allow users to investigate a wide-range of issues related to water and its environments.



Sediment Transport and Morphology

TUFLOW FV's Sediment Transport (ST) has cohesive and non-cohesive sediment transport capabilities, which provides a high level of control over the sediment characteristics. Sediment transport predictions can also be set to feed back to the hydrodynamic engine via morphological update routines. Sediment calculations can be decoupled from hydrodynamic calculations for further efficiencies.

Undertake TUFLOW FV simulations on NVidia GPU card technology provides significant improvements to run times. This is particularly useful when completing long term morphological change assessments in a timely manner.

Example applications

- Sediment plumes from dredging
- River, estuarine and coastal morphology
- Scouring and bank stability

Example features

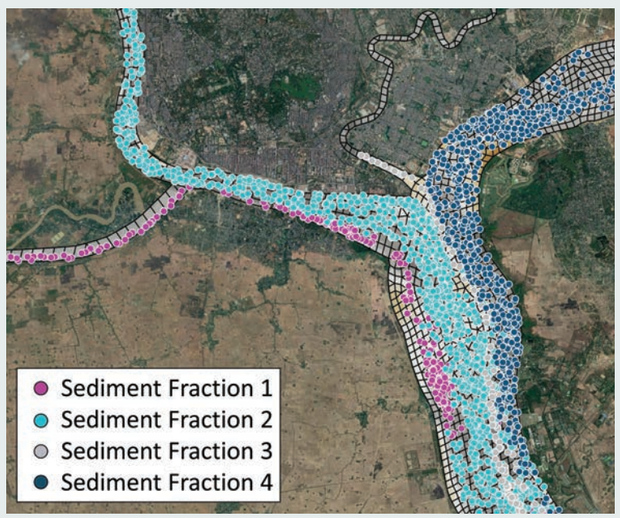
- Multiple bedload and suspended load sediment transport models.
- 2D and 3D Sediment Transport driven by currents and/or wave processes.
- Cohesive and non-cohesive Sediments.
- Erosion, deposition and dispersion.
- Bed-armouring, flocculation and hindered settling.
- Unlimited number of sediment fractions.

Particle Tracking

TUFLOW FV's particle tracking module allows the 2D/3D modelling of discrete Lagrangian particles as they are transported by either hydrodynamics, waves or wind. Simulated particles have properties related to settling, buoyancy, decay, sedimentation and resuspension. More complex particles can also have motility characteristics to allow free movement outside of hydrodynamic, wave or wind drivers.

Applications

- Animal migration
- Larvae transport
- Search and rescue
- Pest species transport
- Ballast water fate



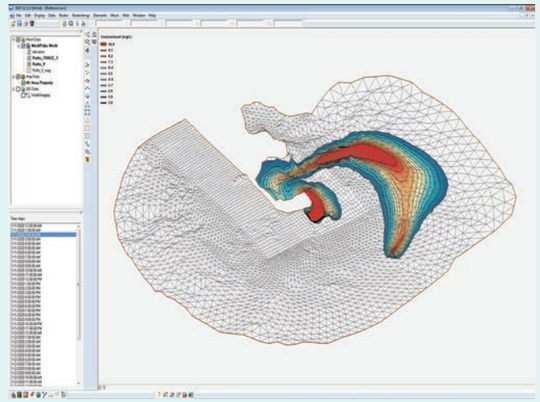
Advection Dispersion and Water Quality

Advection Dispersion and Heat Balance

The Advection-Dispersion (AD) module provides capability to simulate constituent fate and transport in receiving waters. It also underpins the simulation of sediment, salt and heat. It is applicable to, for example, simulation of mixing in all waterways, pollutant plume fate and transport assessment and flushing studies.

The AD scheme can be coupled to TUFLOW FV's heat module to support simulation of atmospheric heating and cooling, with associated water density modulation.

The AD scheme also simulates the conservative transport of sediment and water quality constituents. These modules, in turn, execute the corresponding non-conservative simulations.

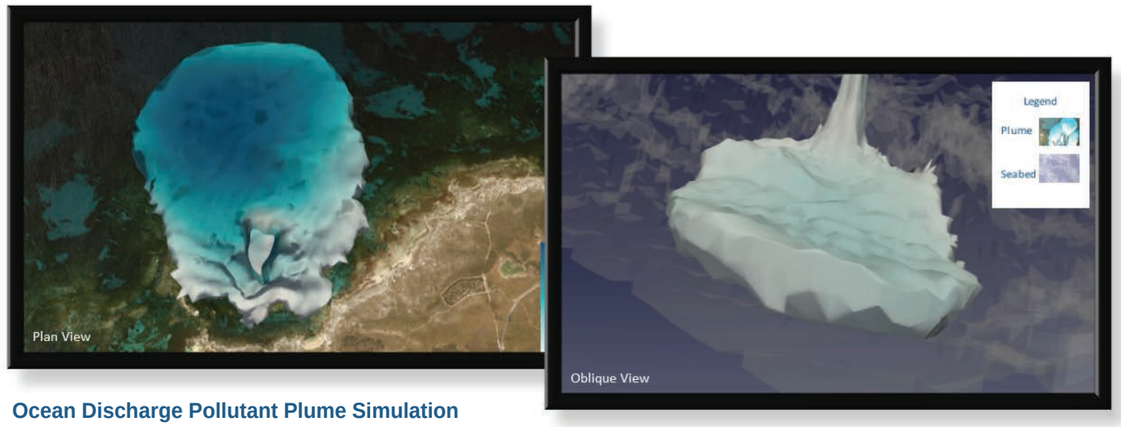


Water Quality

TUFLOW FV water quality supports the simulation of aquatic biogeochemical and ecological processes. The water quality model is based on science from the University of Western Australia and provides a library of tools to customisably simulate key environmental water quality and aquatic ecosystem dynamics. These range from simple oxygen dynamics to advanced biogeochemical processes.

The water quality functionality includes processes relating to dissolved oxygen, inorganic nutrients, organic matter, phytoplankton, zooplankton and pathogens and geochemistry.

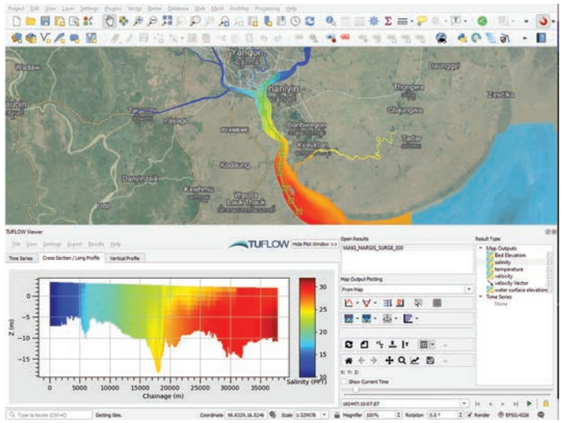
Since 2011, the module has been applied to a wide range of receiving waters including ponds, lakes, constructed wetlands, rivers, estuarine and coastal environments.



Ocean Discharge Pollutant Plume Simulation

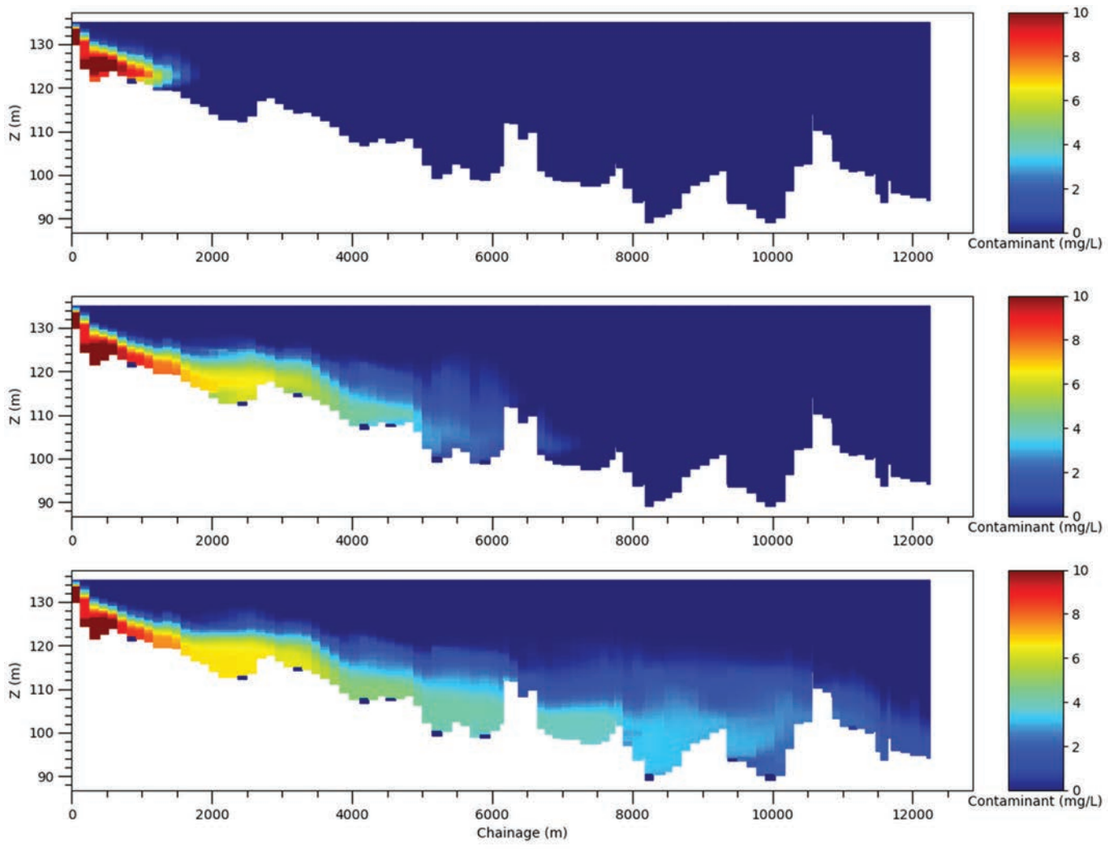
3D Module

For when two-dimensional depth-averaged hydrodynamics are not appropriate, TUFLOW FV has the capability to model 3D hydrodynamics. The 3D module is a fully three-dimensional model that assumes a hydrostatic pressure distribution in the water column, including baroclinic terms. TUFLOW FV's 3D module has the ability to simulate temperature, salinity and sediment-driven density stratification in order to fully resolve baroclinic flows. Linked with this ability is a capability to accept and respond to atmospheric forcing parameters and heat transfer processes (including air temperature, relative humidity, long and short wave radiation and wind speed and direction).



Modules

If desired, TUFLOW FV's 3D module can drive the simulation of sediment transport, particles, advection-dispersion and water quality in 3D.



Flexible Mesh Generation Packages

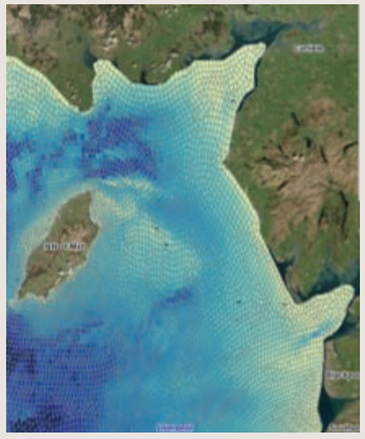
TUFLOW FV uses a flexible mesh, which employs a combination of triangular and quadrilateral elements to describe bathymetric features of importance: TUFLOW FV meshes can be built to fit nature's curves, rather than attempting to artificially make nature fit a fixed grid model. A number of third-party meshing software products can be used to this end. We continuously work with third-parties, who themselves are users of TUFLOW FV, to provide the best in meshing techniques and approaches to provide efficient workflows for mesh generation which reflects the underlying topography whilst maintaining computational performance.

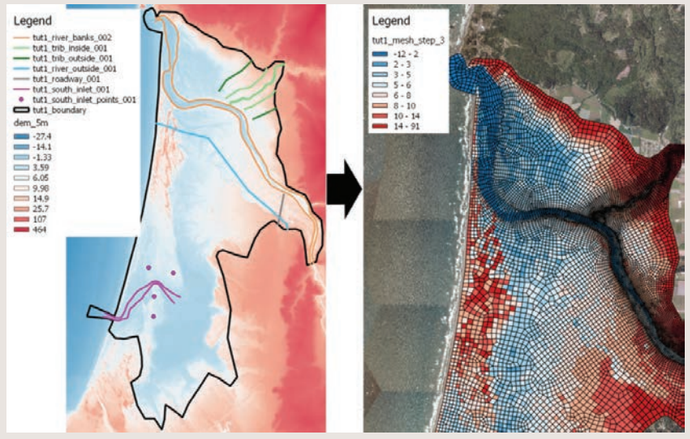
SMS

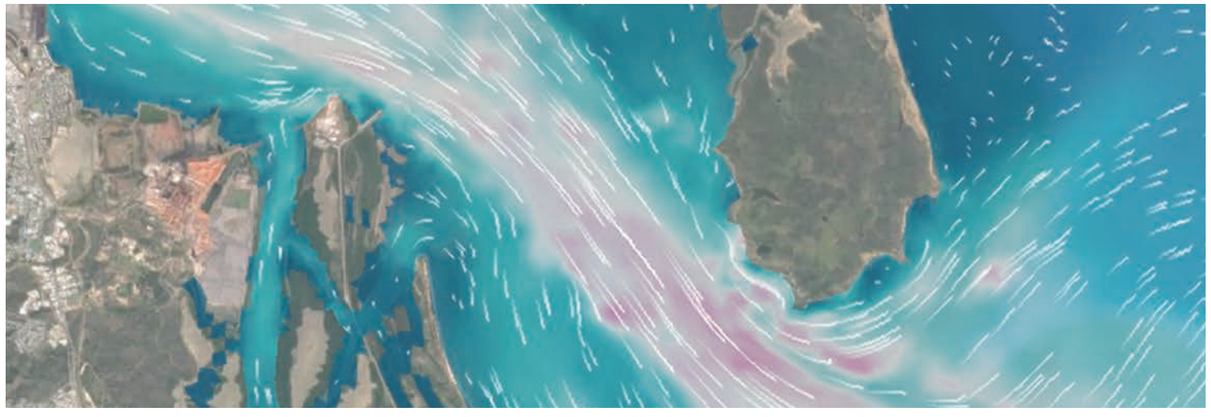
Aquaveo are developers and suppliers of SMS, a leading application for the generation of flexible meshes. SMS also includes a range of mesh checking tools, and can be used to view 2D TUFLOW and TUFLOW FV results.

GIS Mesher

Rising Water software are the developers of GIS Mesher. GIS Mesher builds meshes for TUFLOW FV that use a combination of quadrilateral and triangular elements. Spatial data is provided to GIS Mesher as GIS layers including spatial units, breaklines and nested mesh size locations. Any GIS application can be used to build quality meshes quickly and easily. Solution guided meshing uses results from initial mesh solutions to iteratively improve meshes, making it easy to generate good meshes for even complicated hydrodynamics.







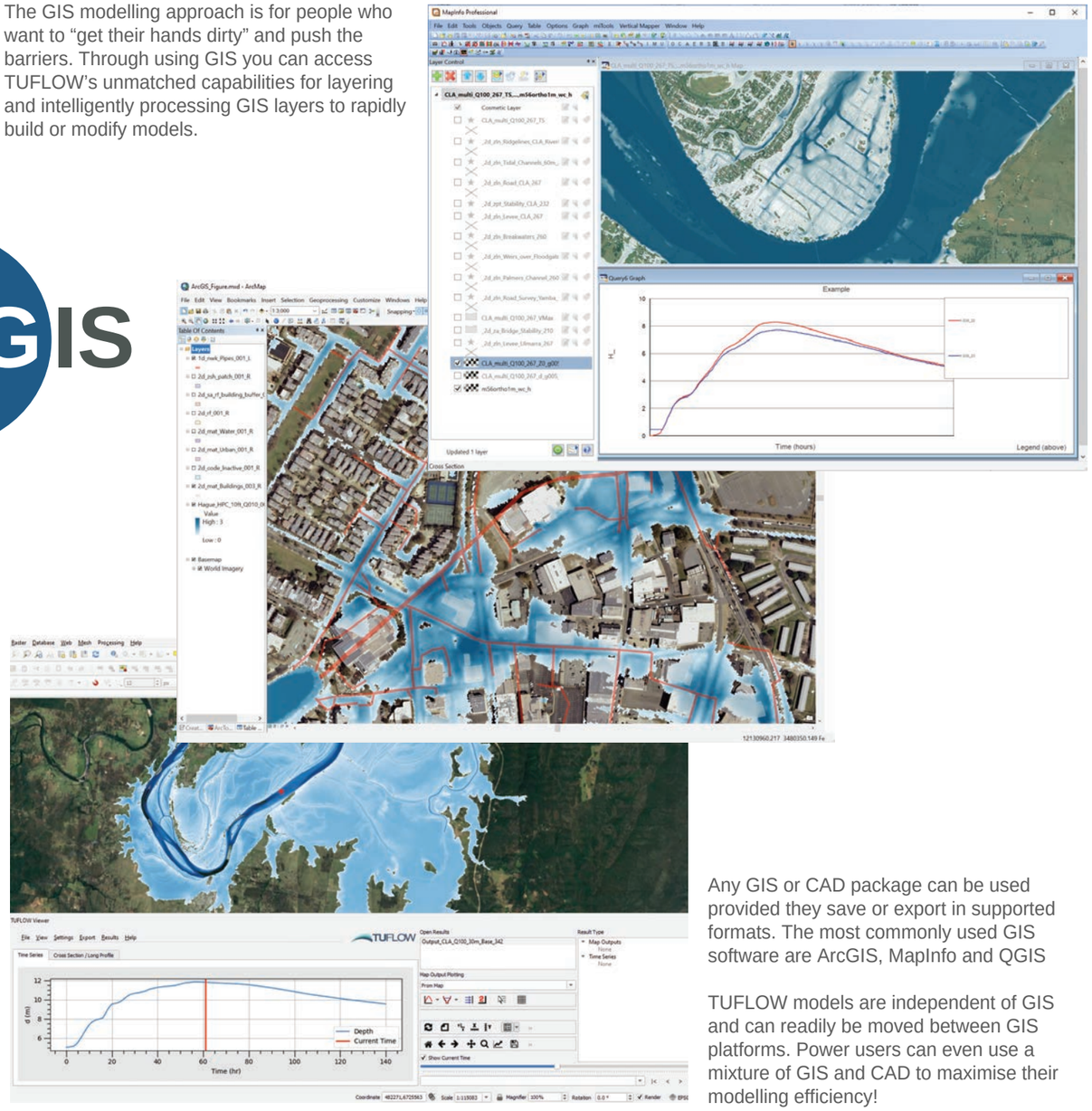
Model Development Environments

Geographic Information Systems (GIS)

Using GIS as your TUFLOW and TUFLOW FV modelling environment gives you maximum flexibility and efficiency, especially for detailed, complex models or modelling investigations with numerous events and scenarios.

The GIS modelling approach is for people who want to “get their hands dirty” and push the barriers. Through using GIS you can access TUFLOW’s unmatched capabilities for layering and intelligently processing GIS layers to rapidly build or modify models.

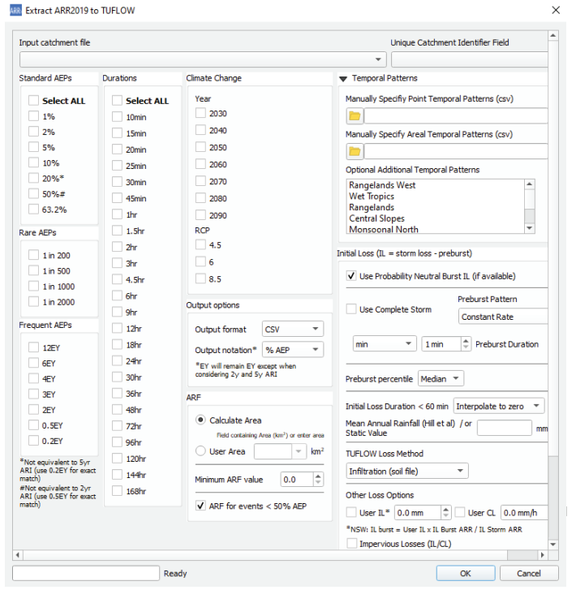
GIS



MapInfo (top right), ArcGIS (middle) and QGIS (bottom left)

Any GIS or CAD package can be used provided they save or export in supported formats. The most commonly used GIS software are ArcGIS, MapInfo and QGIS

TUFLOW models are independent of GIS and can readily be moved between GIS platforms. Power users can even use a mixture of GIS and CAD to maximise their modelling efficiency!



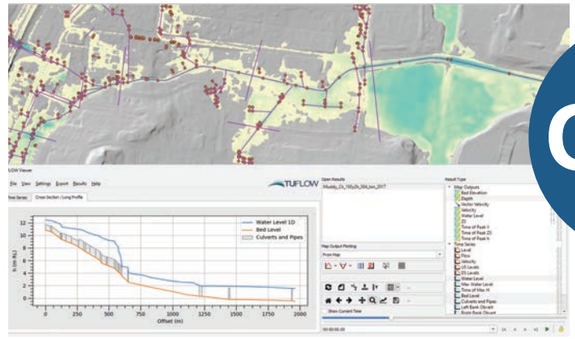
QGIS TUFLOW Plugins
QGIS TUFLOW Viewer Plugin and its ARR2019 datahub interface

QGIS Plugins

QGIS is an open source GIS package and increasingly used by many to create TUFLOW models. In addition to the basic GIS package, a variety of useful free QGIS plugins are available including the QGIS TUFLOW Viewer plugin.

New for 2019, the TUFLOW Viewer plugin can be used to configure a TUFLOW project, import and update template GIS files and also run simulations. The plugin also includes a powerful 1D and 2D results viewer allowing the user to analyse and present result outputs.

QGIS and the TUFLOW Viewer plugin make QGIS a complete 1D and 2D model build and result viewing platform.



G

ArcGIS Toolbox

The ArcGIS toolbox is a free ArcGIS add-on. It includes a range of tools to improve efficiency of building, running, and viewing results of TUFLOW models within ArcGIS.

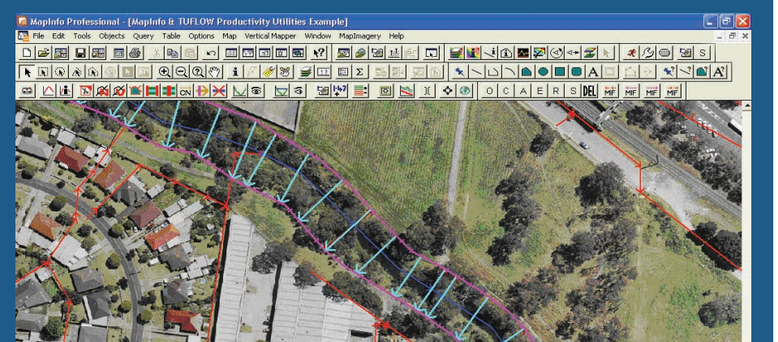
ArcTUFLOW Toolbar allows users to initiate TUFLOW utilities with a single click, further improving the ease of access of building models within ArcGIS.

Available tools include a 1D and 2D time series results viewer, as well as a range of new model build tools. For Australian users, the toolbox also now includes options to source hydrologic inputs from Australian Rainfall and Runoff (2019) datahub. The datahub outputs are automatically formatted into the correct format for TUFLOW modelling.

MapInfo miTools

The MapInfo and TUFLOW Poductivity Utilities (miTools) is a TUFLOW Software Product that has been developed to specifically improve the efficiency of setting up and reviewing TUFLOW models, as well as improving the day to day ease of using MapInfo Professional (MI Pro).

The suite of utilities enables ‘automation’ of many of the common repetative tasks, saving valuable time and therefore money. The utilities also enable efficient creation and visualisation of key TUFLOW model inputs/outputs within the MapInfo environment. Other tools provide data checking and quality assurance functionality, thus helping to minimise modelling errors.



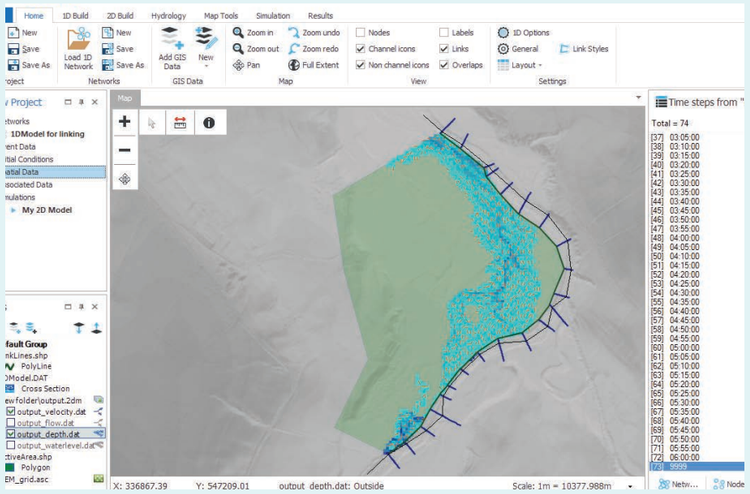
Model Development Environments

Third Party Links and Interfaces

TUFLOW has unrivalled development environment flexibility. Numerous other software use TUFLOW as the computation engine within a Graphical User Interface (GUI) environment, and/or offer dynamic links to TUFLOW's 1D and 2D schemes.

Flood Modeller

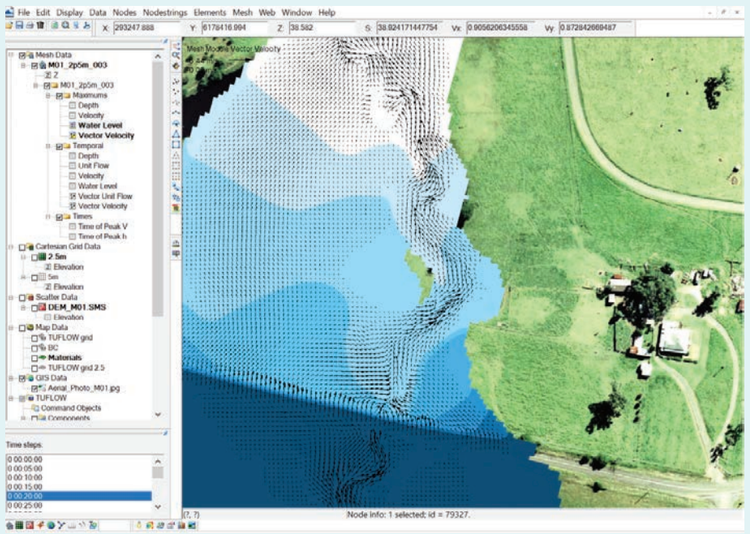
Flood Modeller (previously known as ISIS), was linked to TUFLOW's 2D scheme in 2004 and to TUFLOW's 1D scheme in 2010. TUFLOW's 2D and excellent 1D pipe network modelling capabilities allow Flood Modeller 1D models to be improved to represent out-of-bank areas as 2D domains and linking to urban pipe networks to allow integrated catchment models to be developed.



Interfaces

SMS

Aquaveo released a customised GUI for TUFLOW 'Classic' 1D and 2D within their SMS Surfacewater Modelling System in 2006. SMS is popular with TUFLOW GIS based modellers for viewing and animating results and increasingly for developing TUFLOW models. The ability to move TUFLOW GIS layers between SMS and GIS provides the modeller with even more functionality. SMS's powerful flexible mesh capabilities and generic interface provides an excellent model build environment for TUFLOW FV users.



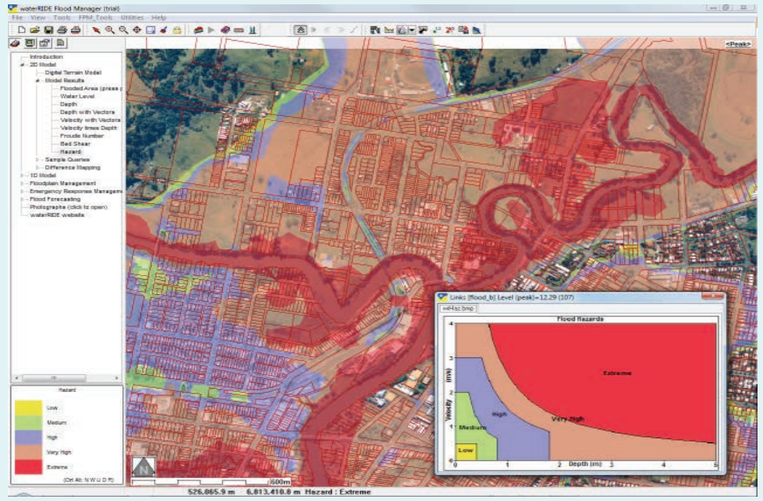
> We focus on highly accurate, work flow efficient, numerical engines and choose interfaces that best suit our modelling requirements

XP-2D

XP-SWMM 1D scheme was dynamically linked to TUFLOW's 2D solution in 2004, and in 2006 they released the XP-2D GUI. Today, XP-SWMM (now part of the Innovyze software) has an extensive 1D/2D modelling user base throughout the world. XP-SWMM 1D users can easily add 2D domains to their 1D models within an intuitive and easy to use GUI to more accurately model urban and river flooding. XP-2D (TUFLOW) was granted US National FEMA approval in 2010.

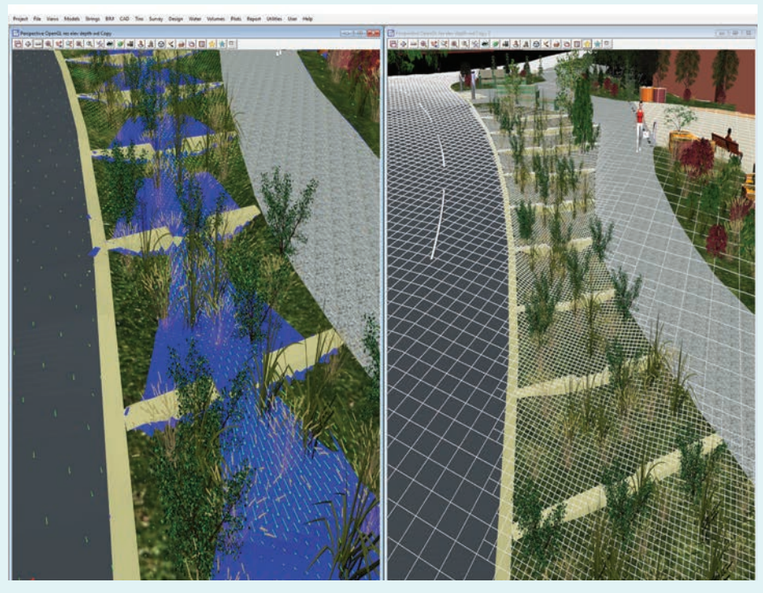
waterRIDE

waterRIDE FLOOD provides a unique, highly visual environment to integrate time-varying 1D and 2D model results with GIS capabilities. It is a dedicated floodplain management tool that allows you to review and integrate your TUFLOW and TUFLOW FV results and communicate 'what the flooding means'. TUFLOW offers a direct output to waterRIDE proprietary formats.



12D

12D Solutions Dynamic Drainage Analysis (DDA) 1D solver has been dynamically linked with TUFLOW's 2D scheme, and the 12D GUI adapted for 1D/2D modelling. The TUFLOW integration allows modellers to easily interchange with GIS and offers an intuitive interface for working with TUFLOW's powerful scripting capabilities.



> Our priority is to make the TUFLOW modelling experience an enjoyable one

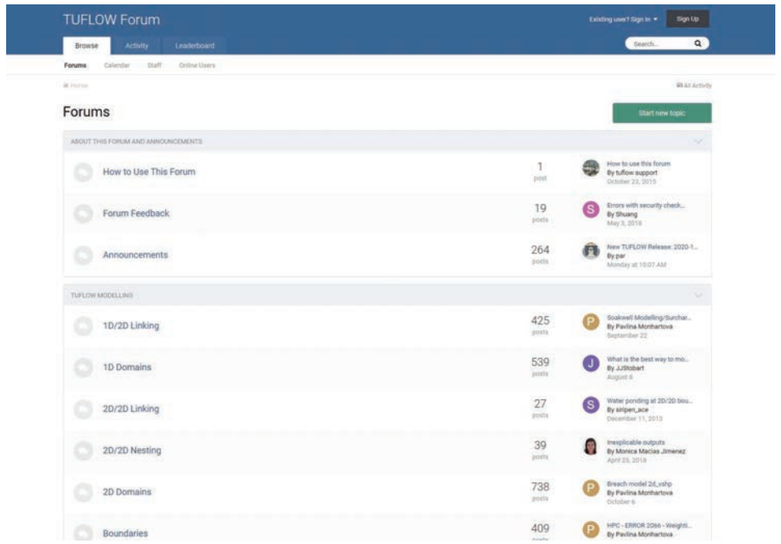
Join the TUFLOW User Community

There is a large and enthusiastic community of TUFLOW users. The TUFLOW forum has over 2500 members and is a great source of knowledge, support and advice. The TUFLOW Wiki and LinkedIn User groups also provide excellent online support.

Sign up today:

www.tuflow.com/forum
wiki.tuflow.com
https://www.linkedin.com/groups/1908583

User feedback is taken seriously at TUFLOW. Our products develop year on year almost entirely on user's needs and recommendations.



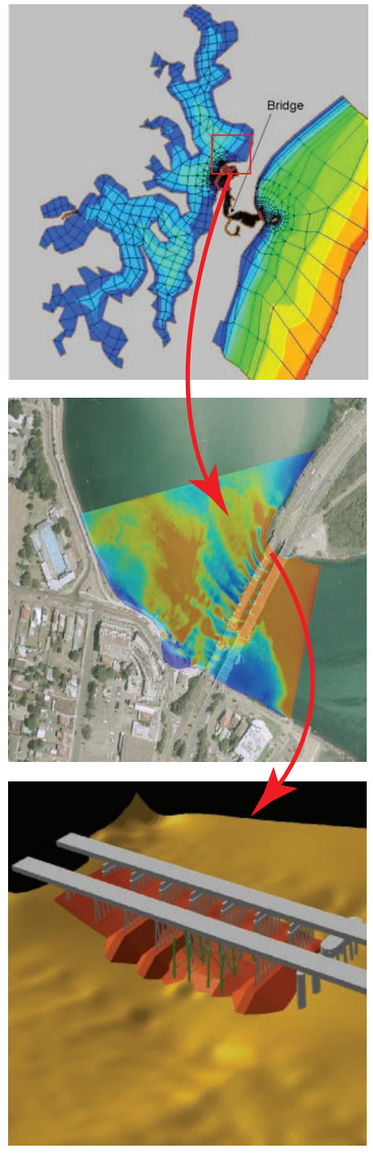
> The Support team are amazing! They're always quick to respond, friendly and have outstanding knowledge of TUFLOW and hydraulics. Their guidance has helped me become a better modeller.

TUFLOW SaaS

Need a large number of simulations conducted in a short amount of time?

We can use our expertise of the Microsoft Azure to run your TUFLOW models on virtual machines within the Cloud.

Whether it's for high-intensity, high-volume runs or even to take the load off your existing hardware, TUFLOW SaaS is a cost-effective solution to providing results to meet your deadlines



Customised TUFLOW

We are constantly developing products to satisfy demands from modellers; this is the key to TUFLOW's success.

If your organisation has specific requirements, we can work with you to deliver these features. Please contact us at *support@tuflow.com*.

Customised modelling application

CFD was applied to establish complex hydrodynamics around bridge piers, driven by boundary conditions provided by a TUFLOW FV simulation.

Training and Support

Training

We run annual release workshops and training in Australia, China, New Zealand, the United Kingdom and United States of America. There is also a TUFLOW User conference in the United Kingdom every second year.

In addition to these regular scheduled events, we also offer customised project based training. See the TUFLOW website or email *training@tuflow.com* for event and/or customised training details.

Support

Support is provided by the experts that develop and use the software.

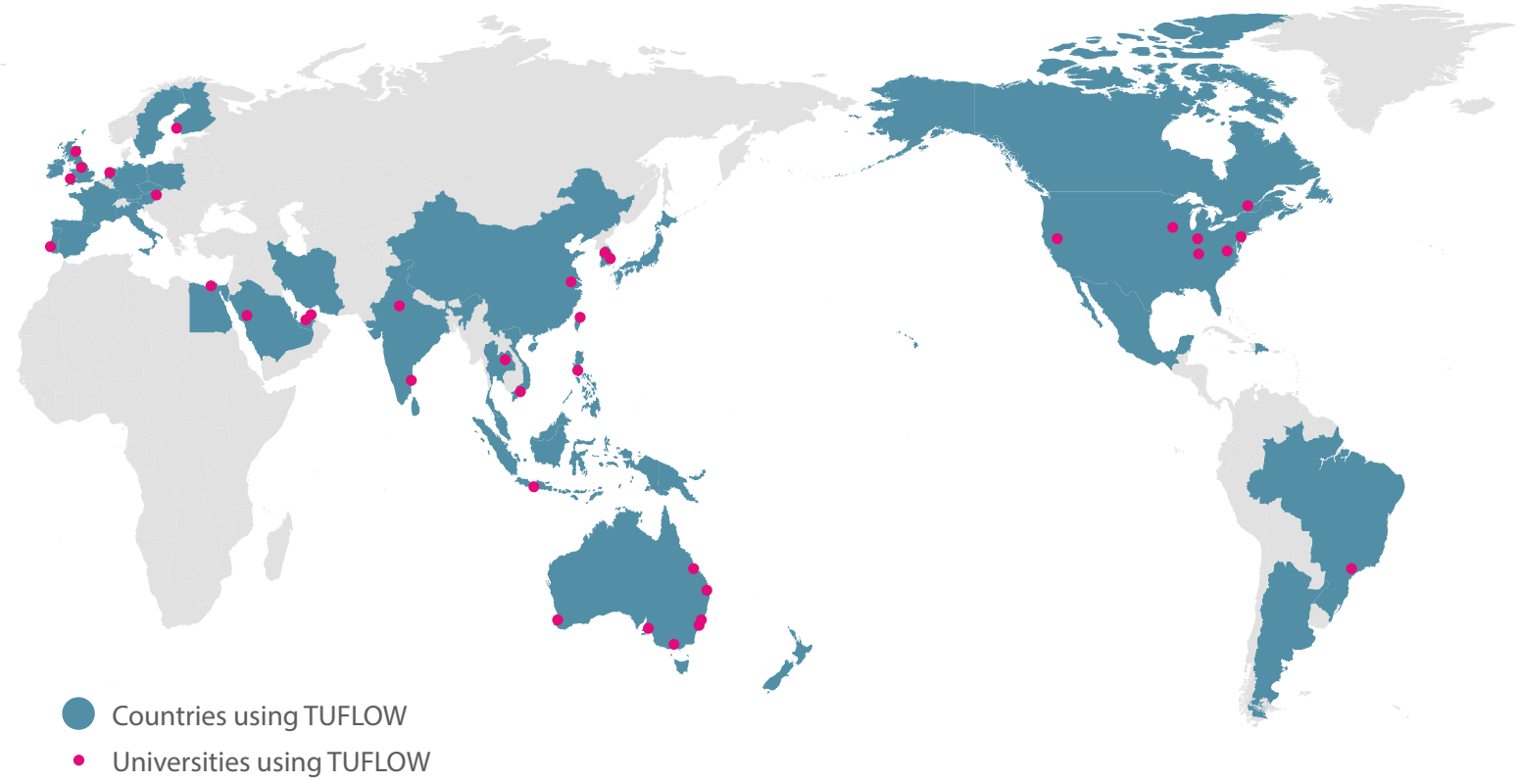
There is a strong support network through our company and our third party partners.

Contact *support@tuflow.com*.

Model Reviews

Model reviews are an excellent way to ensure that you are using the best and latest features, modelling efficiently and producing quality models. Reviews include constructive feedback so that the modeller benefits from the review process.

TUFLOW is developed by BMT. We offer more than just TUFLOW; we are a global organisation with a heritage and reputation for innovation and technical excellence. Find out more at www.bmt.org



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