Flood and Tide Simulation Software

TUFLOW

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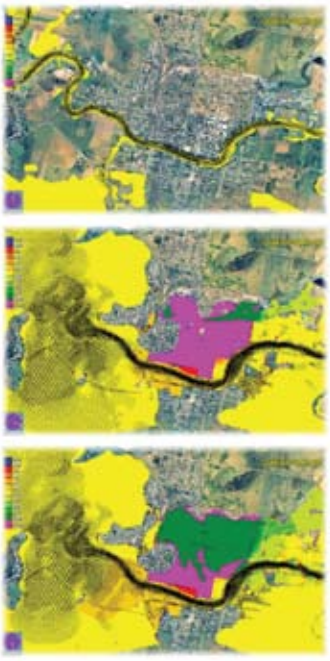

Computer animation stills showing the effect of a proposed levee for Casino, Richmond River, NSW. The three stills are at the start, before the peak and at the peak of the flood.

Yellow indicates <5cm change in flood level, red/orange shades indicate an increase and green shades a decrease. Pink areas were previously flooded, but are now flood-free if the levee is built.

TUFLOW The Basics

Floods and storm tides cause extensive damage, stress, loss of life-and-limb and dislocate communities. To understand and manage these risks requires modelling software that takes on the challenge of accurately predicting inundation patterns from floods and storm tides.

TUFLOW meets this challenge effectively, reliably and within an economical cost structure.

TUFLOW models: flooding in major rivers through to complex overland and piped urban flows; estuarine and coastal tide hydraulics; and storm tide inundation.

TUFLOW is one-dimensional (1D) and two-dimensional (2D) flood and tide simulation software. It simulates the complex hydrodynamics of floods and tides using the full 1D St Venant equations and full 2D free-surface shallow water equations.

Capabilities – An Overview

- robust and rapid wetting and drying
- superior 1D and 2D linking options
- multiple 2D domains of any orientations and cell sizes
- 2D representation of hydraulic structures
- automatic flow regime switching over levees and embankments
- 1D and 2D supercritical flow and weir flow
- flexible and effective data management
- constructs models from layers of GIS data
- quality control outputs.

A proven and reliable solution for modelling

- flooding in major rivers
- complex overland and piped urban flows
- storm tide inundation of coastal plains
- estuarine and coastal tidal hydraulics.

Links to other software

- Dynamic links to the ISIS and XP-SWMM 1D schemes offers unparalleled performance in 1D/2D hydraulic modelling.
- Construct models using the SMS or XP-SWMM Graphical User Interfaces or alternatively use a GIS for data management, manipulation and presentation.

GIS presentation of TUFLOW results, Goulburn River, Victoria

TUFLOW

BMT WBM

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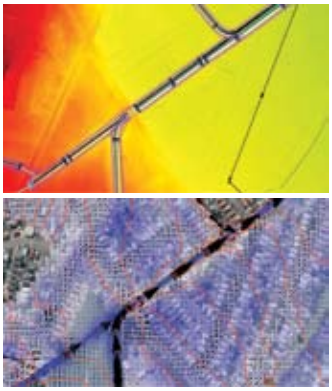


The top image shows GIS layers for a 1D domain that is carved through a 2D domain.

The lower image shows the 1D and 2D velocities as arrows, depth of inundation as blue shades and water levels as red contours.

Dynamic Linking

The dynamic linking capability between 2D and 1D domains is a major strength of TUFLOW. With the adaptation of TUFLOW to floodplain modelling, more flexible and complex linking was developed.

The advanced linking functions have been extensively applied to a wide range of models varying from major river systems to fine-scale urban flood models to coastal storm tide inundation.

Linking of 1D and 2D Domains

1D and 2D domains can be linked anywhere along the perimeter of the active 2D cells. The links can be at any orientation to the 2D grid, start completely dry, and wet and dry during a simulation.

1D Elements Inside 2D Domains

Internal links are used to model flowpaths within or under the 2D domains that are better represented using a 1D solution. This may be a culvert through an embankment, or a complex underground pipe network.

Multiple 2D Domains (Optional Module)

The study area can be divided into any number of 2D domains, with each domain having its own orientation and cell resolution. These domains can be linked to form one overall model.

1D Waterway in a 2D Floodplain

More advanced linking allows the modelling of a waterway in 1D and overbank areas in 2D. This is useful where the drain, creek or river is too coarsely represented by the 2D resolution and is better represented by 1D cross-sections and structures.

Background

TUFLOW was originally the product of a joint project between WBM Pty Ltd and The University of Queensland in 1989/1990 to develop a 2D modelling system with dynamic links to a 1D system. TUFLOW stood for Two-dimensional Unsteady FLOW.

The project was successful and the software widely applied by WBM within the Australian industry through the 1990s. Since 1997 there have been considerable improvements to the software, especially in the areas of flood modelling and GIS linkages.

Solution Scheme

TUFLOW's 2D solution is based on the Stelling finite difference, alternating direction implicit (ADI) scheme that solves the full 2D free surface shallow water flow equations over a regular grid. The 1D scheme is a finite difference, second-order, Runge-Kutta solution.

The schemes have been improved to handle upstream controlled flow regimes (eg. supercritical and weir flow), bridge decks, box culverts, robust wetting and drying, and other key features.

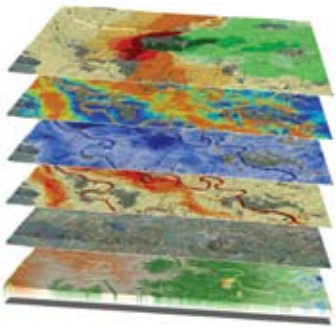
1990 flood, Throsby Creek, Newcastle, Australia. Reproduced by TUFLOW.

Results Presentation

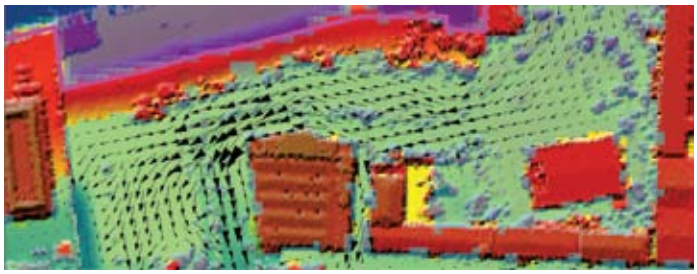
TUFLOW outputs SMS and GIS formatted files containing a variety of data, such as water levels, velocity vectors, depths, unit flow vectors, energy level, flood hazard categories, Froude number and other data types.

The user can readily:

- Display DTMs, aerial photos and other GIS data in the background.
- Create computer animations showing the rise and fall of the flood using SMS, WaterRIDE or XP-SWMM.
- Interactively select and graph time-series results from the 1D and 2D domains.
- Produce high quality maps for reports, plans and public displays using GIS.



Flood risk mapping from TUFLOW results. Herbert River, Queensland, Australia



TUFLOW modelling of storm tide inundation from a hypothetical breach along the River Thames, London (courtesy Halcrow, HR Wallingford, UK Environment Agency)

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