

TUFLOWfv

Flexible Mesh

TUFLOW-FV (Finite Volume) is a hydrodynamic model engine which solves the Non-Linear Shallow Water Equations (NLSWE) on a "flexible" mesh comprising triangular and quadrilateral cells.

The flexible mesh approach has significant benefits when applied to study areas involving complex coastlines and embayments, varying bathymetries and sharply varying flow and scalar concentration gradients:

- Smoothly resolve bathymetric features of varying spatial scales;
- Smoothly and flexibly resolve boundaries such as coastlines;
- Adjust model resolution without resorting to a "nesting" approach.

Background

The BMT WBM experience of using flexible mesh models, starting with the RMA finite-element models over a decade ago, has clearly demonstrated the benefits that they can deliver to complex coastal and estuarine modelling studies. The model "mesh" can be designed and constructed using various freely-available and proprietary software packages. The "SMS" package supplied by Aquaveo is routinely used by BMT WBM for the purpose of constructing generic model mesh files.

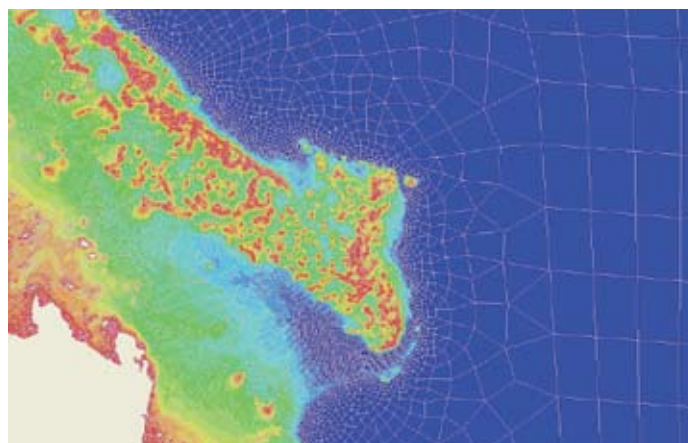
Solution Scheme

The finite volume numerical scheme solves the conservative integral form of the NLSWE. The scheme is also capable of simulating the advection and dispersion of multiple scalar constituents within the model domain. Both first-order and second-order solution schemes are available for use. A 2D vertically-averaged scheme is operational and a 3D scheme is currently under development.

The TUFLOW-FV engine leverages the parallel processing capabilities of modern computer workstations, using the OpenMP implementation of shared memory parallelism. 64-bit, 8-core computers are now routinely used to deliver larger or longer model simulations.

Existing TUFLOW-FV Models:

- Coral Sea and Great Barrier Reef
- Persian Gulf
- South China Sea and Java Sea
- Port Curtis (various EIS assessments)
- Cairns Regional Council (storm tide inundation)
- Murray Mouth and Lower Lakes (salinity intrusion)
- Hunter River (salinity intrusion)
- South Alligator River (climate change impacts)
- Lihir Island (tsunami runup)



Capabilities

Similar to the original TUFLOW model, the TUFLOW-FV model is controlled via a fully-featured text-file interface. This allows the user to flexibly and efficiently control model configuration, boundary condition specification and output requirements.

Closed (reflective) boundaries:

- Full-slip and no-slip conditions.

Open boundaries:

- Fully open (non-reflective).
- Specified water level.
- Specified discharge.

Miscellaneous forcing:

- Global cell inflows and outflows (e.g. rainfall, evaporation).
- Cell inflows/outflows (e.g. pollutant source/sinks).
- Wind stress.
- Atmospheric pressure.
- Wave radiation stress.
- Holland parametric cyclone wind and pressure model is integrated into the code.
- Various gridded forcing (e.g. spatially and temporally varying wind).

Additional Modules

- Cohesive Sediment Module
- Advection Dispersion

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