

# TUFLOW GPU – Continuing the Evolution of Flood Modelling to Assist Catchment Floodplain Management

C Huxley<sup>1</sup>  
<sup>1</sup> TUFLOW (BMT WBM)

## Background

Flood modelling is a useful tool for supporting evidence based floodplain management decision making. It has been the industry standard assessment approach to estimating flood behavior for over 20 years. However, data limitations, computation overhead and hardware constraints have historically limited either the spatial coverage or resolution of modelling efforts. A range of factors have combined over the past five years to fuel major advances in 2D flood modelling that largely remove these limitations. The factors are primarily:

- Computer Graphics Processor Unit (GPU) hardware improvement;
- GPU flood modelling software development; and
- Significant increases in data availability and accuracy.

## TUFLOW GPU Overview

TUFLOW's GPU Module is a powerful new 2D solver that value adds to the TUFLOW "Classic" product.

The 2D solver is an explicit solution of the full 2D Shallow Water Equations, including sub-grid scale eddy viscosity. The scheme is volume and momentum conserving, is 1st order spatially and 4th order in time. Adaptive (conditionally stable) or fixed time-stepping options are available. The solver has been designed for high-speed solutions of complex 2D flow behaviour.

TUFLOW GPU now supports multiple GPU card parralisation. Hardware benchmarking has shown the software is up to 100 times faster than TUFLOW CPU!

GPU is well-suited to modelling direct rainfall applications. Green-Ampt, Horton and IL/CL infiltration options are available, Manning's n can be varied with depth, and spatially and temporally varying rainfall grids can also be utilised.

The GPU solver is built inside TUFLOW Classic, therefore the powerful pre and post-processing capabilities that make TUFLOW hydraulic modelling highly work flow efficient are available.

## TUFLOW GPU Applications

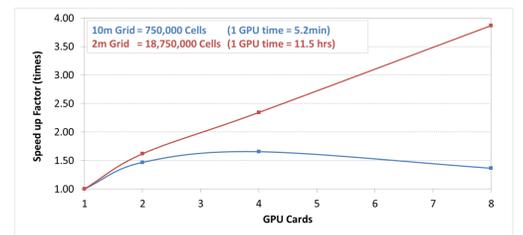
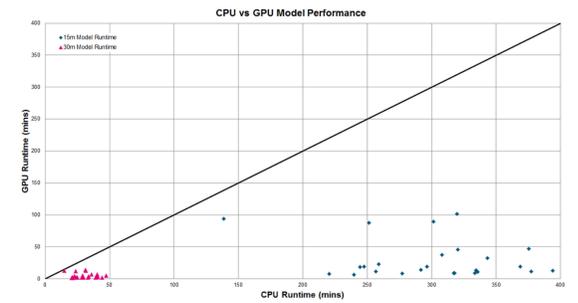
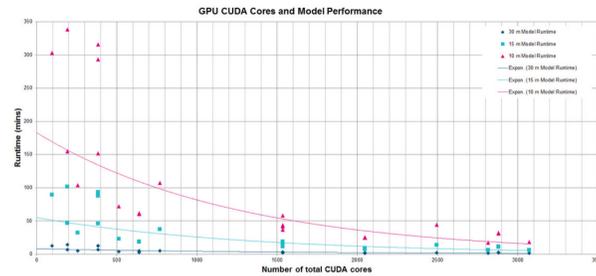
TUFLOW GPU is well suited to model applications requiring either millions to 100s of millions of calculation cells, or quick run solutions. Applications where GPU are currently being used include:

1. Broad-scale regional rapid hydraulic solutions;
2. As an alternative to using hydrologic models (i.e. whole of catchment modelling);
3. Real-time flood inundation forecasting
4. High resolution 2D solutions.

## Benchmarking

TUFLOW have complete hardware benchmarking using over 30 different computer configurations. This is a valuable resource for people wishing to purchase dedicated modelling computers. See the TUFLOW Wiki for more details:

[http://wiki.tuflow.com/index.php?title=Hardware\\_Benchmarking](http://wiki.tuflow.com/index.php?title=Hardware_Benchmarking)

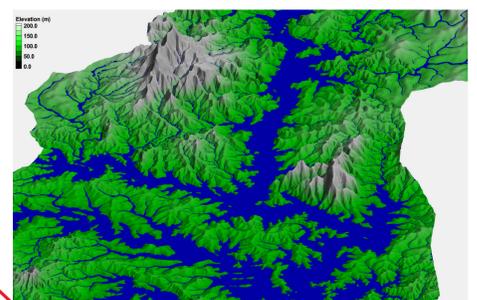
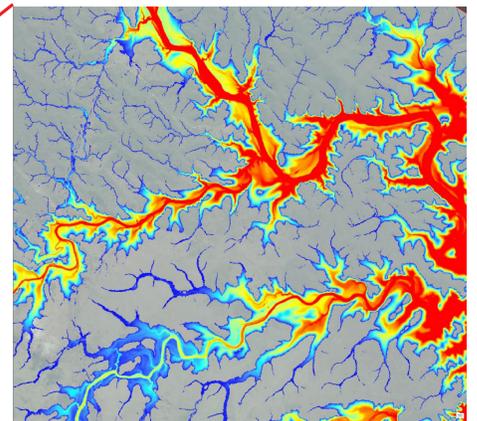
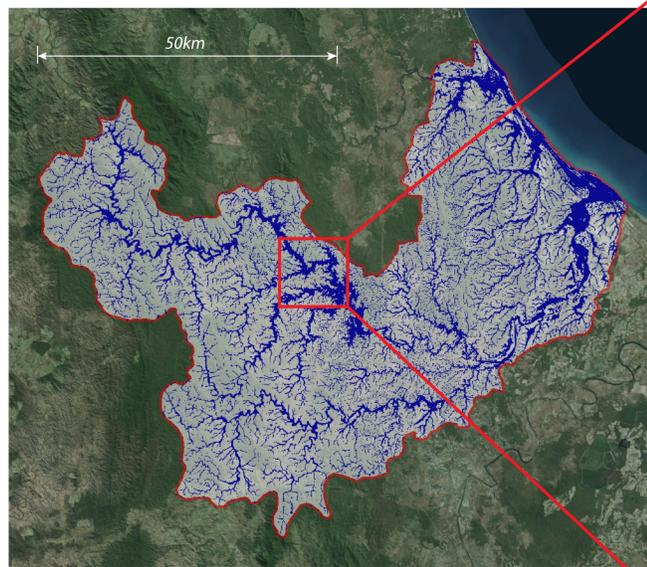


## Catchment Scale Rapid Hydraulic Assessment Example

- 10,000km<sup>2</sup>
- 20m cell resolution
- 15,000,000 cells
- 24 hour storm simulation in 10 hours

### Applications

- Flood forecasting
- Regional flood risk
- Water reservoir management



## Urban High Resolution Assessment Example

- 100km<sup>2</sup>
- 5m cell resolution
- 3,000,000 cells
- 12 hour storm simulation in 4 hours

### Applications

- Landuse planning
- Development assessments
- Infrastructure planning

