

Culvert Capacity and Area

- _ccA.mif (or .shp)
- Colour Coded

Channel:	DP1134601
pFull_Max:	100
pFull_Time:	95
Area_Max:	0.535
Area_Culv:	0.535
Time_Full:	8.017
Time_10pFull:	8.426

BMT WBM 4 TUFLOW

Urban Areas – Buildings and Fences

BMT WBM 5 TUFLOW

Modelling Buildings

- University of NSW, Water Research Laboratory
 - Physical Model, TUFLOW and MIKE21
- Up to 10m cells OK for reproducing peak levels
 - Building resistance represented through increased roughness, sides blocked out or other method
- 2m or less required for adequately representing flow patterns

BMT WBM 6 TUFLOW

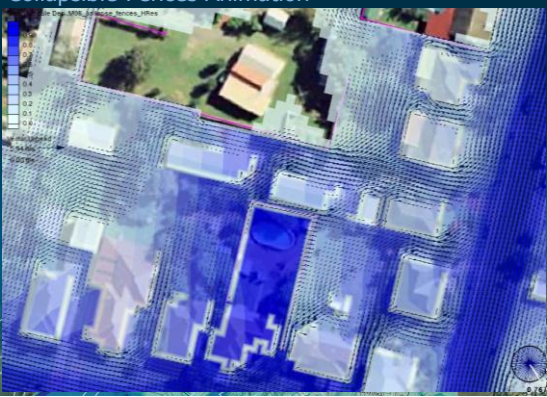
Modelling Fences in TUFLOW

- Able to raise element sides
- Element sides wet and dry
- Layered parameters
 - eg. vary blockage and losses with height
- Collapse element sides
- Switch between u/s and d/s controlled weir flow for overtopping



BMT WBM 7 TUFLOW

Collapsible Fences Animation



BMT WBM 8 TUFLOW

Modelling Blockages!?

(These rails are recommended because they don't collect debris...)



BMT WBM 9 TUFLOW

2D Layered Adjustments (2d_lfcsh layers)

- Blockage = 0%
FLC = 0
- Blockage = 50%
FLC = 0.5
- Blockage = 100%
FLC = 0.8
- Blockage = 5%
Form Loss Coeff = 0.1

BMT WBM 10 TUFLOW

ISIS-TUFLOW-PIPE

- ISIS-ESTRY (TUFLOW 1D) Link
- Allows TUFLOW urban pipe network models to be directly linked to ISIS river models
- Can link any TUFLOW 1D node to an ISIS Unit
- Easy to setup: link simply based on snapping TUFLOW node to an ISIS unit in ISIS-TUFLOW GIS layer
- Free upgrade for existing ISIS-TUFLOW licences

BMT WBM 11 TUFLOW

ISIS-TUFLOW


- ISIS-TUFLOW now recognises 64-bit TUFLOW (w64) versions
- DP TUFLOW also supported
- Will need 64-bit ISIS v3.5.1 to run 64-bit TUFLOW
- 64-bit TUFLOW 20 to 50% faster than 2009-07 32-bit

BMT WBM 12 TUFLOW

Infiltration

(being finalised and tested)

- Green-Ampt Method coded and being tested
 - Soils layer
- Infiltration based on
 - Depth
 - Soil Type
 - Duration of Inundation
 - Saturation Depth
- Simplified Scheme
 - Saturation depth
 - Surface/ground infiltration rates for each material




BMT WGM 13 TUFLOW

1D Structures

(being finalised and tested)

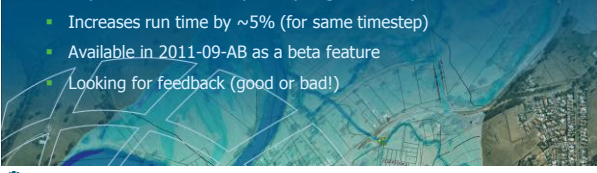
- Sluice gates
- Range of weirs
- User defined controls
- Others...



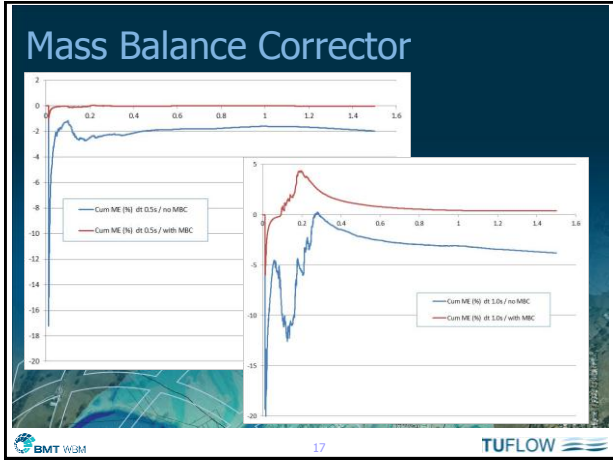
BMT WGM 14 TUFLOW

Mass Balance Corrector

- Mass Balance Corrector == ON (.tcf file)
- Carries out an additional 2D mass balance iteration every half timestep
- Can markedly reduce 2D ME% especially for models with steep and/or every shallow flow
- Improved solution and possibly larger timesteps
- Increases run time by ~5% (for same timestep)
- Available in 2011-09-AB as a beta feature
- Looking for feedback (good or bad!)



BMT WGM 16 TUFLOW

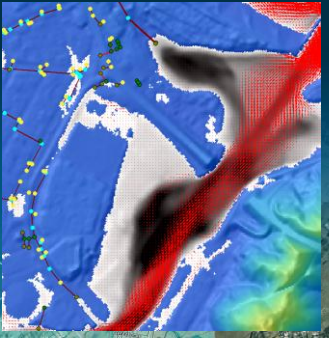


- ### ArcGIS Integration
- Major reworking of GIS input/output including .mif/.mid routines
 - .shp file recognition
 - 2011 – Input, Output and Check layers
 - SHP Projection == ..\model\shp\Projection.prj
 - Write Empty GIS Files == ..\model\shp\empty | SHP
 - GIS Format == SHP
 - Needed to write output and check layers in .shp format
 - Input layers' format is controlled by the file extension
 - TUFLOW_to_GIS now outputs .shp format
 - Input can be a mixture of .mif and .shp files
 - Plan to develop an arcTUFLOW with key mTools functions
- BMT WBM 18 TUFLOW

- ### ArcGIS file formats
- Now written (and read) by TUFLOW for GIS based TUFLOW outputs
 - 1D results, messages, check files
 - GIS Format == SHP
 - SHP Projection == Projection.prj
 - TUFLOW_to_GIS
 - Now writes out shape files with -shp option
- BMT WBM 19 TUFLOW

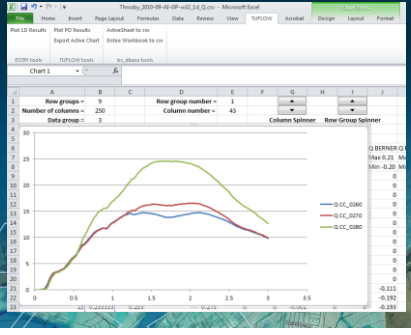
ArcGIS file formats

- Three file types
 - _P (points)
 - _L (lines)
 - _R (regions)



BMT WGM 20 TUFLOW


TUFLOW Tools.xls



BMT WGM 21 TUFLOW

Excel Animations

- Profile, tidal model
- Profile (multiple events)
- Cross-section, levels

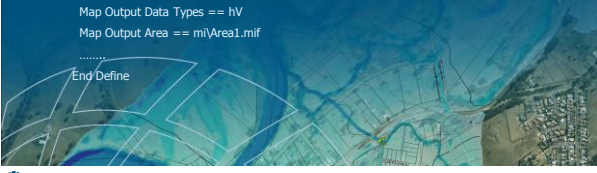


BMT WGM 22 TUFLOW

User Defined Output

(being finalised and tested)

- Model Output == Area1 | Area2
- Output Control File == a.toc that contains blocks such as:
Define Output == Area1
Start Map Output == 1
Output Folder == .\results\area1 | Send TUFLOW 2D output to this folder
Map Output Format == xmdf
Map Output Data Types == hV
Map Output Area == mi\Area1.mif
.....
End Define




BMT WBM 23 TUFLOW

Check Files

(being finalised and tested)

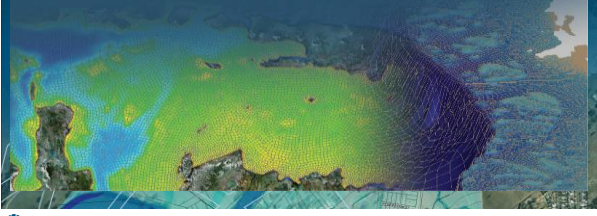
- Write Check Files == 1d_nwk | 2d_dom
 - Writes those check files specified
- Write Check Files Exclude == 2d_zpt | 2d_grd | 2d_uvpt
 - Does not write those check files specified
- Can use above commands repeatedly to turn on/off which check files to write
- Can incorporate above into new User Defined Output definitions



BMT WBM 24 TUFLOW

TUFLOW FV


- Now available 2D/3D fully flexible mesh engine



BMT WBM 25 TUFLOW

Wiki Tutorial Model


- Very useful for in-house training
- Designed for
 - MapInfo with Vertical Mapper
 - MapInfo with Discover 3D
 - ArcGIS with Spatial Analyst
 - SAGA (free open source GIS)
- Can simulate models without a TUFLOW licence
- Download files/models from Downloads page on www.tuflow.com



BMT WBM 29 TUFLOW

TUFLOW Wiki Tips and Tricks

- Tips and Tricks from Chapter 12 of the manual being added
- New ones added and will continuously be added
- Use Discussion page or email support@tuflow.com to comment or make suggestions



BMT WBM 30 TUFLOW

New TUFLOW Website

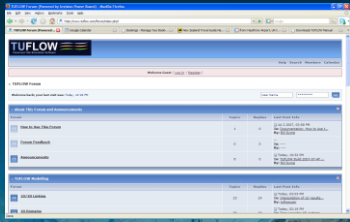
- Needed to accommodate TUFLOW FV and other new products
- Any suggestions/gripes please email support@tuflow.com



BMT WBM 31 TUFLOW

TUFLOW Forum


- Running for a few years
- ~900 Members
- Browse, post and reply to topics
- Receive emails of TUFLOW updates and announcements
- www.tuflow.com/forum



BMT WBM 32 TUFLOW

Multiple Events and Scenarios

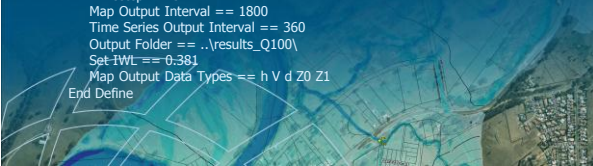
- Run all your simulations from one .tcf file
- Events defined using "Define Event == " in a TUFLOW Event File (.tef)
- Scenarios defined via "If Scenario == " in control files



BMT WBM 33 TUFLOW

Event Definitions


- Event File == my_events.tef
- Define Event == Q100R
 - BC Event Source == _River_ | Q100_24h
 - BC Event Source == _Local_ | Q010_06h
 - BC Event Source == _Tide_ | Tspring
 - BC Event Source == _Surge_ | S010
 - Start Time == 0.0
 - End Time == 36
 - Timestep == 5
 - Map Output Interval == 1800
 - Time Series Output Interval == 360
 - Output Folder == ..\results_Q100\
 - Set-IWL == 0.381
 - Map Output Data Types == h V d Z0 Z1
 - End Define



BMT WBM 34 TUFLOW

Multiple Scenarios


- If Scenario == s1 | s2 | ...
...
{Else If Scenario == s3 | s4 | ...}
...
{Else}
...
End If
- 2011-09-AA – nested If Scenarios
(i.e. If Scenarios inside If Scenarios)



BMT WBM 36 TUFLOW

Modular flood modelling using TUFLOW's new EVENT and SCENARIO management


Case Study: Richmond River, NSW



BMT WBM TUFLOW

Richmond River, NSW, Australia

- 6,900km² catchment
- 1,000km² floodplain
- 5 Local Councils
- Over 13 flood models built in 20 years for different areas
- Various software and various schemes (1d, quasi-2d, 1d/2d)
- Discrepancies with results along model boundaries

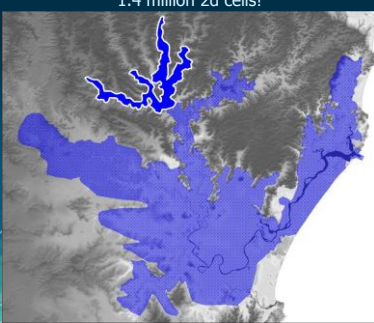


BMT WBM 39 TUFLOW

Modular Modelling

- Ballina (10m, 20m, 40m)
- Newrybar (10, 20m)
- Mid Richmond (60m)
- Casino (20m, 60m)
- Lismore (5m, 20m, 60m)
- Wilsons River (20m)
- Leycester Creek (20m)

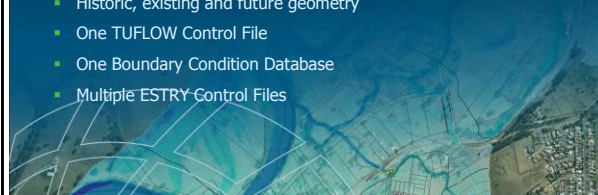
1.4 million 2d cells!



BMT WBM 40 TUFLOW

How does it work?


- 7 models
- Can be run individually or in combination with other neighbouring models
- 5 historical events and design events
- Historic, existing and future geometry
- One TUFLOW Control File
- One Boundary Condition Database
- Multiple ESTRY Control Files



BMT WBM 41 TUFLOW

Scenarios and Events

- Scenario 1 – CAL | EXG | INT
 - Calibration, existing or mitigated
- Scenarios 2 to 8 – BAL | NEW | MID | CAS | LIS | WIL | LEY
 - At least one of the 7 model areas
- Event 1
 - Historic event; or
 - Design event
 - Source of flooding (local catchment, regional or storm surge)
 - Return period and rainfall duration
 - Design rainfall zone



BMT WBM 42 TUFLOW

TUFLOW Control File

```

Read Materials File == Richmond_002.tmf
BC Database == ..\bc_dbase\Richmond_bc_dbase_003.csv
Event File == Richmond_Events_002.tef
Read File == Richmond_2D_General_Commands_002.trd

#####
### CASINO MODEL ###
#####


IF SCENARIO == CAS
START 1D Domain
  ESTRY Control File == ..\model_CAS\CAS_001.ecf
END 1D Domain

START 2D domain == CAS_60m
  Geometry Control File == ..\model_CAS\CAS_60m_001.tgc
  BC Control File == ..\model_CAS\CAS_60m_001.tbc
  Timestep == 10
END 2D Domain

START 2D domain == CAS_20m
  Geometry Control File == ..\model_CAS\CAS_20m_001.tgc
  BC Control File == ..\model_CAS\CAS_20m_001.tbc
  Timestep == 8
END 2D Domain
END IF
    
```

Common commands:

- Materials file
- BC Database
- Event management file
- Common read file



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TUFLOW

TUFLOW Control File

```

Read Materials File == Richmond_002.tmf
BC Database == ..\bc_dbase\Richmond_bc_dbase_003.csv
Event File == Richmond_Events_002.tef
Read File == Richmond_2D_General_Commands_002.trd

#####
### CASINO MODEL ###
#####


IF SCENARIO == CAS
START 1D Domain
  ESTRY Control File == ..\model_CAS\CAS_001.ecf
END 1D Domain

START 2D domain == CAS_60m
  Geometry Control File == ..\model_CAS\CAS_60m_001.tgc
  BC Control File == ..\model_CAS\CAS_60m_001.tbc
  Timestep == 10
END 2D Domain

START 2D domain == CAS_20m
  Geometry Control File == ..\model_CAS\CAS_20m_001.tgc
  BC Control File == ..\model_CAS\CAS_20m_001.tbc
  Timestep == 8
END 2D Domain
END IF
    
```

Model specific commands:

- ESTRY Control File
- TBC for each 2D domain
- TGC for each 2D domain
- Time step



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TUFLOW

TUFLOW Control File

```

Read Materials File == Richmond_002.tmf
BC Database == ..\bc_dbase\Richmond_bc_dbase_003.csv
Event File == Richmond_Events_002.tef
Read File == Richmond_2D_General_Commands_002.trd

#####
### CASINO MODEL ###
#####

IF SCENARIO == CAS
START 1D Domain
  ESTRY Control File == ..\model_CAS\CAS_001.ecf
END 1D Domain


START 2D domain == CAS_60m
  Geometry Control File == ..\model_CAS\CAS_60m_001.tgc
  BC Control File == ..\model_CAS\CAS_60m_001.tbc
  Timestep == 10
END 2D Domain

START 2D domain == CAS_20m
  Geometry Control File == ..\model_CAS\CAS_20m_001.tgc
  BC Control File == ..\model_CAS\CAS_20m_001.tbc
  Timestep == 8
END 2D Domain
END IF
    
```

▪ IF Scenario construct used to 'enable' or 'disable' specific model

▪ Start / End 1D Domain

▪ Start / End 2D Domains

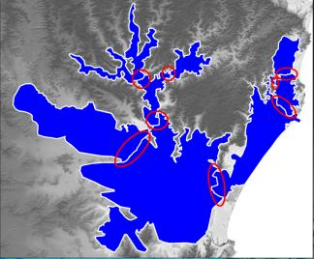


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TUFLOW

Boundary Condition Control File

- Single boundary condition control file for each 2D domain
- If Scenario construct used to adjust boundary conditions based on historic, existing or mitigated catchment
- If Scenario construct used to assign 2d2d boundaries for adjoining models



```

IF SCENARIO == BTR
  READ GIS BC == ..\models_1118110712420124_04_BAL_low_NTR_25w_001.BTF
  READ GIS BC == ..\models_1118110712420124_04_BAL_low_NTR_25w_001.BTF
END IF

IF SCENARIO == MID
  READ GIS BC == ..\models_1118110712420124_04_MID_60w_001.BTF
END IF
    
```

BMT WBM 49 TUFLOW

Batch files and output

Start TUFLOW in batch mode TCF = Richmond_~e1~_~s1~_005.tcf

```

start TUFLOW_1SP_w32.exe -b -e1 2009 -s1 CAL -s2 CAS -s3 LIS -s4 MID Richmond -e1 -s1 -005.tcf
    
```

Event 1 = 2009
(historic rainfall)

Scenario 1 = CAL
(calibration)

Scenario 2 = CAS
Scenario 3 = LIS
Scenario 4 = MID
(models)

Optional scenarios

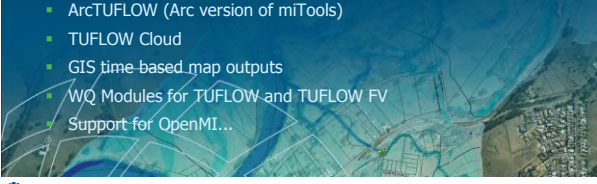
Mandatory scenarios

Richmond(2009)CAL_005_CAS+LIS+MID.t1f

BMT WBM 50 TUFLOW

Beyond 2011

- Inclusion of 2D FV engine as alternative
- 2D Nesting via use of FV engine
- Parallelisation of "Classic" engine
- Started GPU version of FV engine
- FEWS ESTRY and TUFLOW Plugin for flood forecasting
- ArcTUFLOW (Arc version of miTools)
- TUFLOW Cloud
- GIS time-based map outputs
- WQ Modules for TUFLOW and TUFLOW FV
- Support for OpenMI...



BMT WBM 51 TUFLOW

