



TUFLOW 2011

Selection of New Features in 2010/2011

BMT WBM TUFLOW

This slide features a blue background with a topographic map showing a river network. The text is centered in white. Logos for BMT WBM and TUFLOW are at the bottom.

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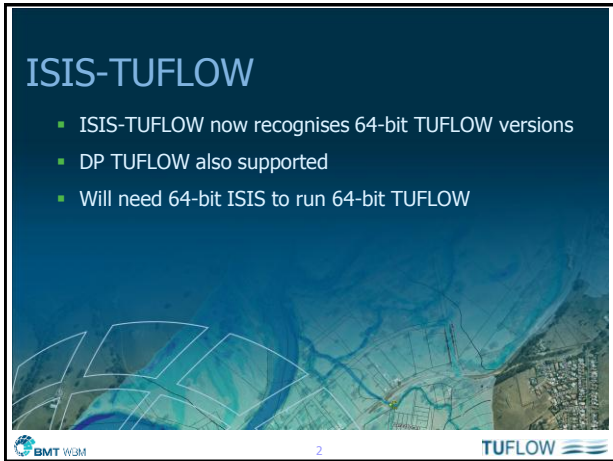
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ISIS-TUFLOW

- ISIS-TUFLOW now recognises 64-bit TUFLOW versions
- DP TUFLOW also supported
- Will need 64-bit ISIS to run 64-bit TUFLOW

BMT WBM 2 TUFLOW

This slide features a blue background with a topographic map. The title is in large white font. A bulleted list of features is in the center. Logos and a page number '2' are at the bottom.

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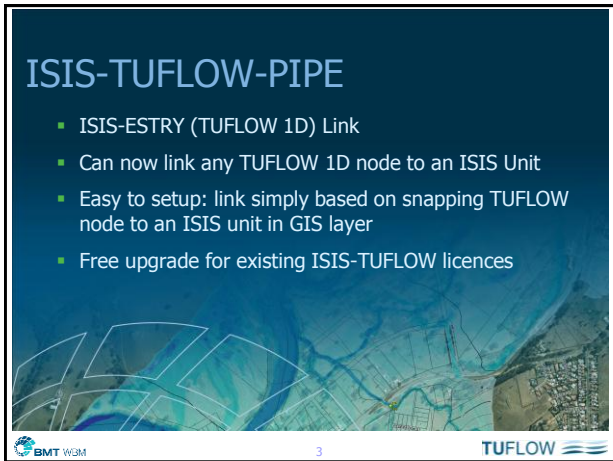
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ISIS-TUFLOW-PIPE

- ISIS-ESTRY (TUFLOW 1D) Link
- Can now link any TUFLOW 1D node to an ISIS Unit
- Easy to setup: link simply based on snapping TUFLOW node to an ISIS unit in GIS layer
- Free upgrade for existing ISIS-TUFLOW licences

BMT WBM 3 TUFLOW

This slide features a blue background with a topographic map. The title is in large white font. A bulleted list of features is in the center. Logos and a page number '3' are at the bottom.

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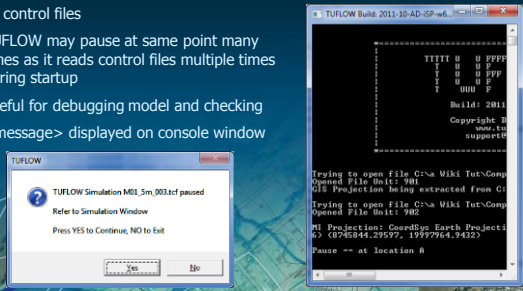
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### Pause == <message>

- Causes TUFLOW to pause and display dialog
- All control files
- TUFLOW may pause at same point many times as it reads control files multiple times during startup
- Useful for debugging model and checking
- <message> displayed on console window



The screenshot shows a TUFLOW simulation window with a dialog box titled 'TUFLOW Simulation M01\_5m\_003.tcf paused'. The dialog box contains the text 'Refer to Simulation Window' and 'Press YES to Continue, NO to Exit'. Below the dialog box is a console window with the following text: 'TTTTT U U FFFF', 'T U U FFF', 'T U U FFF', 'T U U FFF', 'Build: 2011', 'Copyright: B', 'support@', 'Trying to open file C:\na Wiki Tut\Comp', 'Opened File Unit: 901', 'GIS Projection being extracted from G', 'Trying to open file C:\na Wiki Tut\Comp', 'Opened File Unit: 902', 'M1 Projection: CoordSys: Earth Projecti', '62 - G760845-295972 - 1997204,9432', 'Pause -- at location A'.

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### Redundant Perimeter Areas

- Ignores any redundant rows/columns around active area
- Reduces simulation times if redundant area significant
- Very useful if just running part of a model (in one case reduced run times by a factor of 15!)
- Some routines scan whole grid (this feature stops this)
- Does not reduce RAM requirement



The image shows an aerial map of a river network. A specific area of the river network is highlighted in a light blue color, indicating the area of interest for the 'Redundant Perimeter Areas' feature.

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### Mass Balance Corrector

- 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!)



The image shows an aerial map of a river network. A specific area of the river network is highlighted in a light blue color, indicating the area of interest for the 'Mass Balance Corrector' feature.

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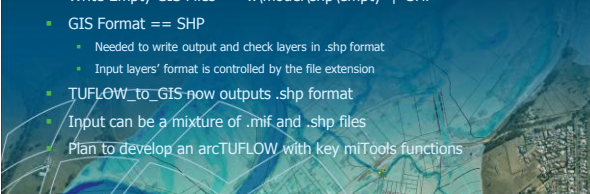
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## ArcGIS Integration

- 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 miTools functions



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## 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



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## SA Minimum Depth ==

- SA Minimum Depth == <depth\_metres>
  - Sets the minimum depth a wet cell must have to apply an SA inflow
  - If all cells have a depth below value, the lowest cell is used
  - Default is zero (backward compatible)
- Solves problem of water creeping up a slope where the SA inflow is very high (eg. an extreme flood)
- Recommended value of 0.1m



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### SA Proportion to Depth ==

- SA Proportion to Depth == [ ON | {OFF} ]
- Proportions SA inflows according to depth
- If hydrographs include routing by hydrologic model
  - This feature minimises duplication of routing
  - Directs more water directly to deeper areas (ie. to bottom of sub-catchment or to river/creek)



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### 1D Structures

(being finalised and tested)

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



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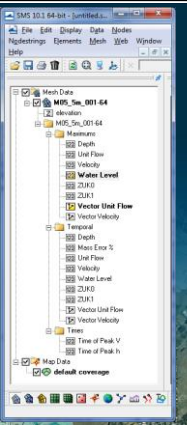
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### X MDF Output Files

- Stores all map (.dat) output in one file (.xmdf)
- Very fast to access
- Allows viewers to use a tree structure (uses a folder structure)
- Can store data as
  - temporal (time) or
  - Static
- TUFLOW\_to\_GIS and dat\_to\_dat updated
- SMS High Res option now supported



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### 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



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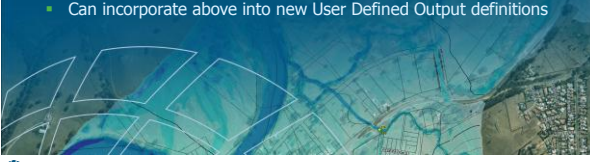
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### Check Files

(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



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### Miscellaneous

(being finalised and tested)

- Zpt Range Check
- Tracking maximums times series output
- Velocity (V\_) LP output (in 2011-09-AA)



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## TUFLOW Wiki

- Covers
  - Messages Database
  - Tutorial Models
  - Tips and Tricks
- Continuously under development
- Need to register (to keep spammers away!)
- Add comments, suggestions



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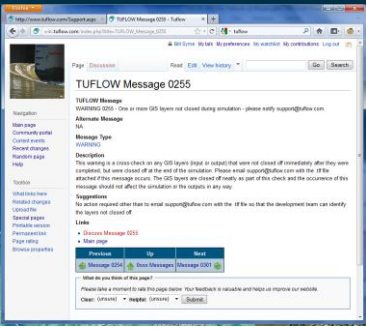
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## TUFLOW Wiki Messages

- Messages Database
- Many messages not yet detailed
- If you need a message detailed please email [support@tuflow.com](mailto:support@tuflow.com)



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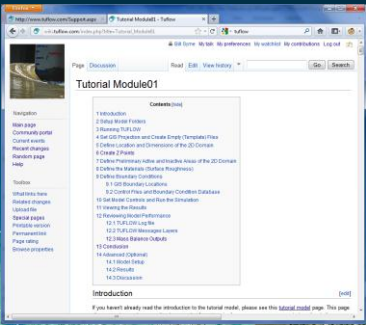
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## TUFLOW Wiki Tutorial Models

- All modules form 2007 tutorial models being updated and incorporated
- Aiming for a new module per month over next year
- Will have around 12 modules all up to cover majority of TUFLOW's features



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## 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](http://www.tuflow.com)



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## 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](mailto:support@tuflow.com) to comment or make suggestions



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## New TUFLOW Website

- Needed to accommodate TUFLOW FV and other new products
- Any suggestions/gripes please email [support@tuflow.com](mailto:support@tuflow.com)



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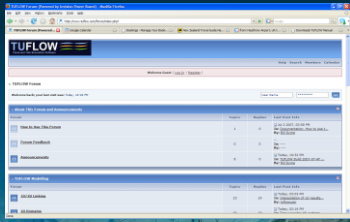
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## TUFLOW Forum

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



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## Under/Future Development

- Inclusion of 2D FV engine as alternative
- 2D Nesting finalised via use of FV engine
- Parallelisation of "Classic" engine
- Arc version of miTools
- GIS time based map outputs
- WQ Modules
- Support for OpenMI...



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## 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



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### Event Definitions

- Event File == my\_events.tcf
- 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 #WT == 0.381
  - Map Output Data Types == h V d Z0 Z1
  - End Define



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### Multiple Event Runs

- Name of event(s) specified either by
  - Using "Model Events == <event1> | <event2> | ..." in .tcf file
  - Using TUFLOW.exe -e1 <event1> -e2 <event2> options to specify the BC Event Name independently of .tcf file
  - -e option in batch line overrides "Model Events ==" values
- Keywords "~e1~", "~e2~", etc in .tcf filename
- For example, if using BR\_exg\_~e1~\_~e2~\_001.tcf
  - Then TUFLOW.exe -e1 Q100 -e2 6h uses output name of "MM\_exg\_Q100\_6h\_001"
  - If no ~e1~ specified, event name added to end
- If you want, only need **one** .tcf file for all events



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### Multiple Scenarios

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



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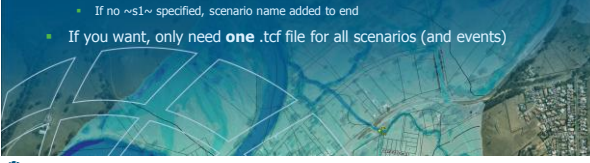
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### Multiple Scenario Runs

- Name of scenario(s) specified either by
  - Using "Model Scenarios == <scenario1> | <scenario2> | ..." in .tcf file
  - Using TUFLOW.exe -s1 <scenario1> -s2 <scenario2> options
  - s option in batch line overrides "Model Scenarios ==" values
- Keywords "~s1~", "~s2~", etc in .tcf filename
- For example, if using BR\_exg\_~s1~\_~s2~\_001.tcf
  - Then TUFLOW.exe -s1 exg -s2 6h uses output name of "MM\_exg\_Q100\_6h\_001"
  - If no ~s1~ specified, scenario name added to end
- If you want, only need **one** .tcf file for all scenarios (and events)



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

Case Study: Richmond River, NSW



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### Richmond River, NSW, Australia

- 6,900km<sup>2</sup> catchment
- 1,000km<sup>2</sup> 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



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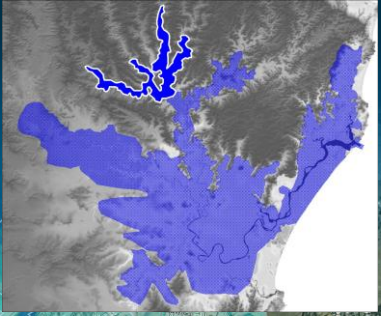
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### Modular Modelling

- 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!



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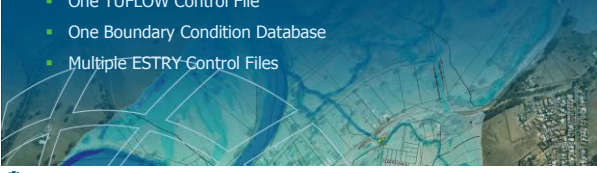
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### How does it work?

- 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



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### 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



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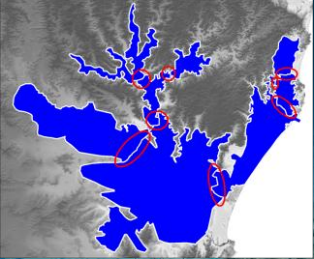
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### Boundary Condition Control File

- 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 == NTH
  READ GIS BC == ..\models_110810q12020124_04_BAL_10w_NTH_20w_001.BCF
  READ GIS BC == ..\models_110810q12020124_04_BAL_10w_NTH_20w_001.BCF
END IF

IF SCENARIO == MID
  READ GIS BC == ..\models_110810q12020124_04_MID_60w_001.BCF
END IF
  
```

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### 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)

Mandatory scenarios

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

Richmond(2009\_CAL)\_005\_CAS+LIS+MID.t1f

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thank you

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