

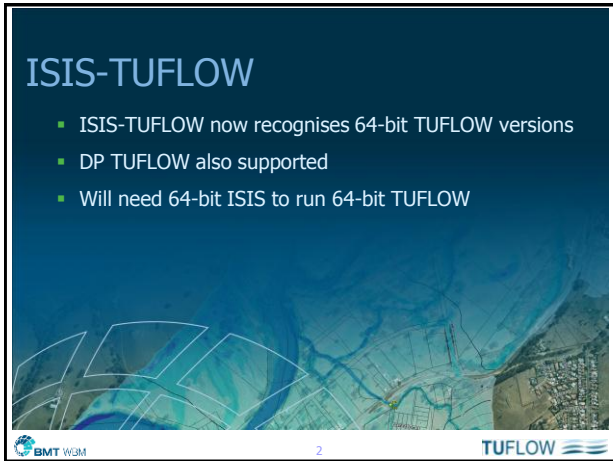


TUFLOW 2011

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.

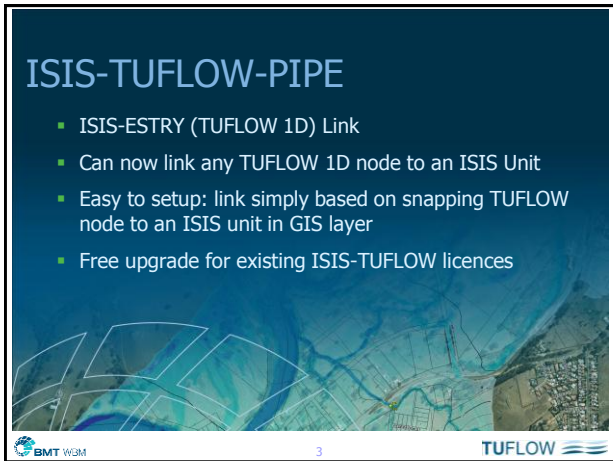


ISIS-TUFLOW

- 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.



ISIS-TUFLOW-PIPE

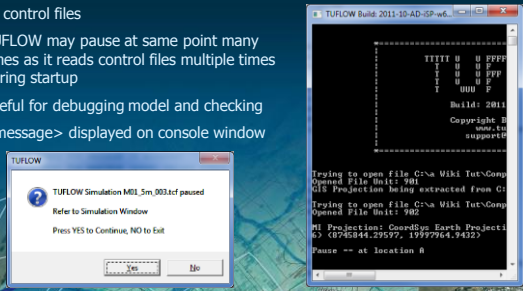
- ISIS-ESTRY (TUFLOW 1D) Link
- Can now link any TUFLOW 1D node to an ISIS Unit
- Easy to setup: link simply based on snapping TUFLOW node to an ISIS unit in GIS layer
- Free upgrade for existing ISIS-TUFLOW licences

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.

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



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Redundant Perimeter Areas

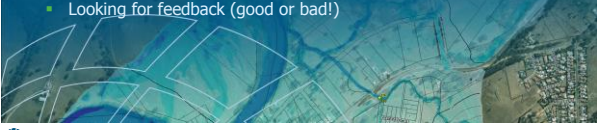
- Ignores any redundant rows/columns around active area
- Reduces simulation times if redundant area significant
- Very useful if just running part of a model (in one case reduced run times by a factor of 15!)
- Some routines scan whole grid (this feature stops this)
- Does not reduce RAM requirement



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Mass Balance Corrector

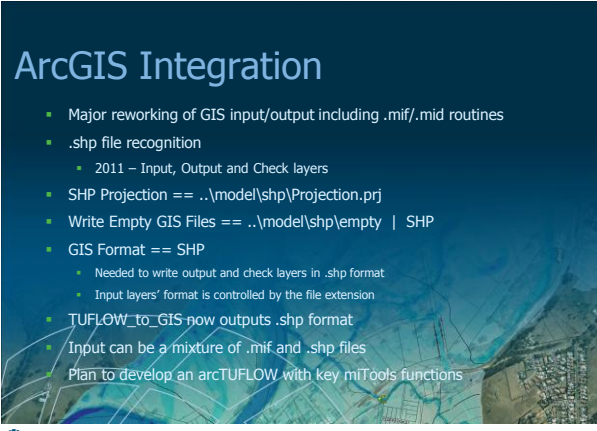
- Carries out an additional 2D mass balance iteration every half timestep
- Can markedly reduce 2D ME% especially for models with steep and/or every shallow flow
- Improved solution and possibly larger timesteps
- Increases run time by ~5% (for same timestep)
- Available in 2011-09-AB as a beta feature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



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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




BMT WBM 7 TUFLOW

Infiltration

(being finalised and tested)

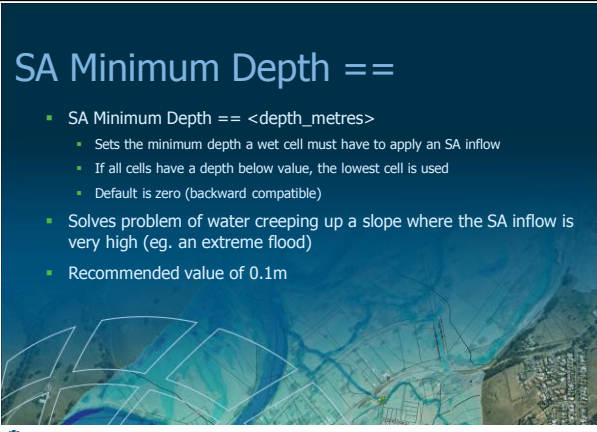
- Green-Ampt Method coded and being tested
 - Soils layer
 - Infiltration based on
 - Depth
 - Soil Type
 - Duration of Inundation
 - Saturation Depth
- Simplified Scheme
 - Saturation depth
 - Surface/ground infiltration rates for each material



BMT WBM 8 TUFLOW

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



BMT WBM 9 TUFLOW

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)




BMT WBM 10 TUFLOW

1D Structures

(being finalised and tested)

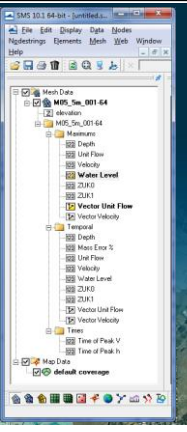
- Sluice gates
- Range of weirs
- User defined controls
- Others planned



BMT WBM 11 TUFLOW

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




BMT WBM 12 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
```

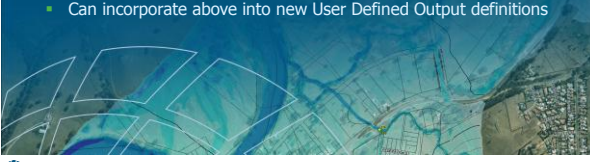


BMT WBM 13 TUFLOW

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 14 TUFLOW

Miscellaneous

(being finalised and tested)


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



BMT WBM 15 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 19 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 20 TUFLOW

New TUFLOW Website

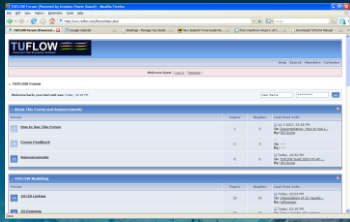
- Needed to accommodate TUFLOW FV and other new products
- Any suggestions/gripes please email support@tuflow.com



BMT WBM 21 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 22 TUFLOW

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...



BMT WBM 23 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 24 TUFLOW

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

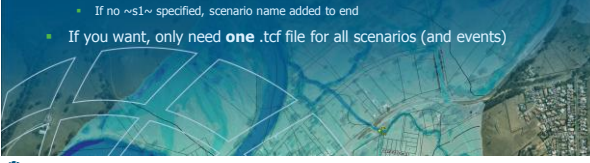
- If Scenario == s1 | s2 | ...
 - ...
 - {Else If Scenario == s3 | s4 | ...}
 - ...
 - {Else}
 - ...
 - End If
- 2011-09-AA – nested If Scenarios (ie. If Scenarios inside If Scenarios)

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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)



BMT WBM 28 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

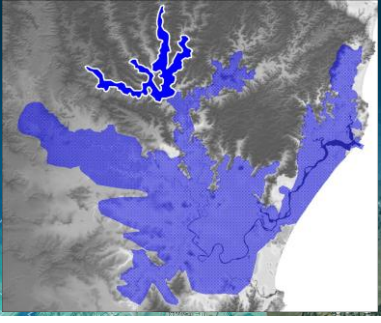


BMT WBM 30 TUFLOW

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)

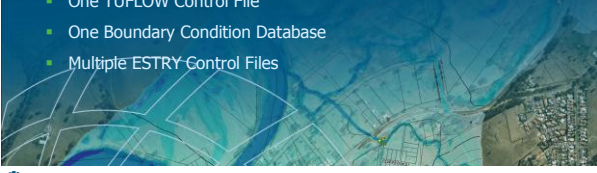
1.4 million 2d cells!



BMT WBM 31 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 32 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 33 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
ENTRY 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

BMT WBM 34 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
ENTRY 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

BMT WBM 35 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
ENTRY 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
    
```

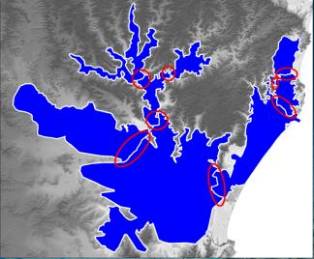
IF Scenario construct used to 'enable' or 'disable' specific model

- Start / End 1D Domain
- Start / End 2D Domains

BMT WBM 36 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 == 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
    
```

BMT WBM 40 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)

Mandatory scenarios Optional scenarios

Richmond(2009) CAL_005 CAS+LIS+MID.t1f

BMT WBM 41 TUFLOW

thank you

BMT WBM 42 TUFLOW
