TUFLOW 2011/2012

New Features in 2011/2012

BMT WBM TUFLOW

.shp File Support

- Major reworking of GIS input/output including .mif/.mid routines
- .shp file recognition
  - 2011 – Input, Output and Check layers
- Opens up other GIS platforms to be used
  - ArcGIS
  - QGIS (QuantumGIS)
  - SAGA
- Much easier to include other formats into the future

BMT WBM 2 TUFLOW

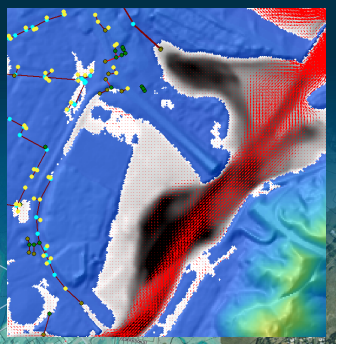
.shp File Support

- New .tcf commands
  - 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
- Input can be a mixture of .mif and .shp files
- TUFLOW_to_GIS now outputs .shp format
- Planning to develop an arcTUFLOW with key miTools functions

BMT WBM 3 TUFLOW

.shp File Support

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



BMT WBM 4 TUFLOW

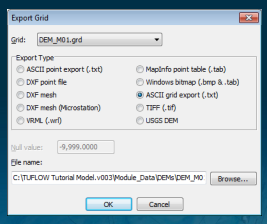
Direct Reading of Grids

- No more 2d_zpt layers! ☺
- Read Grid Zpts [MIN | MAX | ADD] ==
  - Carries out point inspection of DEM
  - Surprisingly fast
    (much faster than Vertical mapper)
  - By default generates an xf file
    - really fast 2nd, 3rd, … time round
    - 20 million points in a couple of seconds
- No limit to number of grids that can be read

BMT WBM 5 TUFLOW

Grid Format

- ESRI ASCII grid format
  (Industry standard)
- Can be any file extension
  (.asc is often used)
- In Vertical Mapper
  - Grid Manager, Tools, Export…
  - Choose ASCII grid export (.txt)
- 12D, Spatial Analyst and most others export ASCII grids
- Same as created by TUFLOW_to_GIS
- Other known formats can be included



BMT WBM 6 TUFLOW

Direct Reading of Grids

- Very easy to
  - Change cell size – simply change one number
  - Change 2D domain origin, orientation and/or grid dimensions
- Specify clip layer
  - Read Grid Zpts == dem\DEM.asc | dem\2d_clip.mif
  - Only Zpts within polygons in 2d_clip are updated
  - Very useful to cut out any poor triangulation effects
  - Layer's attributes not used

BMT WBM 7 TUFLOW

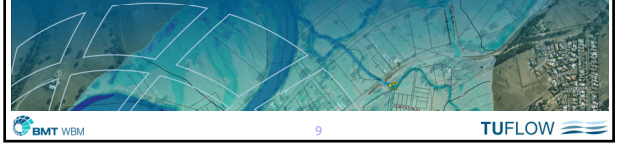
Read Grid .xf File

- Read Grid .xf file
  - Binary dump of all Zpts within DEM
    - Does not use clip layer to exclude Zpts in .xf file (can add, change or remove clip layer and Zpts don't need to be reinspected)
    - Independent of MIN, MAX or ADD options (can change these without needing to reinspect)
  - Stores 2D domain cell size, dimensions and orientation
    - If any of these change, or the date of the original DEM file changes, the .xf file is automatically regenerated
- Use XF OFF to not use .xf file
  - eg. Read Grid XF OFF == …
  - or turn all XF files off using "XF Files == OFF" in .tcf file

BMT WBM 8 TUFLOW

Read Grid for other Inputs

- Next update supports direct reading of grids for
  - Integer grids: Code, Mat, Soil
  - Real grids: IWL, CnM, SRF, FLC, GWL, etc
- For example, reading of material IDs from satellite imagery
  - Read Grid Mat == grid\land_use_imagery.asc
- Clip layers and .xf files supported



BMT WBM 9 TUFLOW

Read TIN Enhancments

- Read TIN Zpts ==
  - Can now specify clip layer as 2nd argument
    (very useful for excluding those long thin triangles around the TIN perimeter)
  - .xf files now available
  - Same functionality as Read Grid

BMT WBM 10 TUFLOW

>100,000,000 cells

- Next update designed to handle more than 100,000,000 cells
- Yes, someone is running a 120,000,000 cell model!
- TUFLOW_to_GIS extended to 64-bit for post processing this model

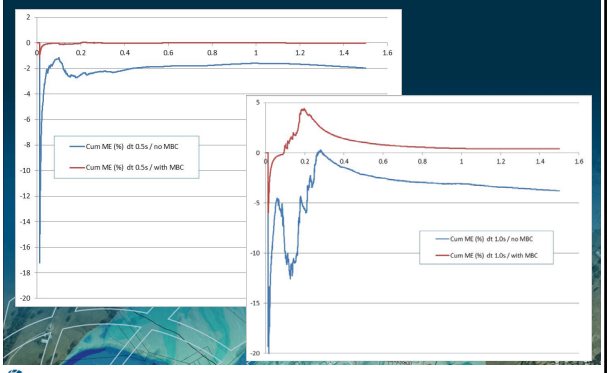
BMT WBM 11 TUFLOW

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% for models with steep and/or very shallow flow
- Improved solution and possibly larger timesteps
- Increases run time by ~5% (for same timestep)
- Available in 2011-09-AB
- Looking for feedback (good or bad!)

BMT WBM 12 TUFLOW

Mass Balance Corrector



BMT WBM 13 TUFLOW

Infiltration
(2011-09-AG or 2012-04-AA)

- Ponded water can be infiltrated into the ground based on
  - Soil properties
  - Imperviousness of the surface
- Can specify saturation depth (eg. to groundwater level)
- Two infiltration methods at present
  - Green-Ampt Method
  - Initial Loss / Continuing Loss
    - Different to IL/CL applied to direct rainfall to generate rainfall excess
    - Can use both IL/CL methods in combination if you so desire!

BMT WBM 14 TUFLOW

Infiltration

- 2d_soil soils layer
  (One attribute being the Soil ID – similar to 2d_mat materials layers)
- Fraction impervious additional materials (.tmf) parameter
- .tcf command
  - Read Soils File == file.tsoilf

BMT WBM 15 TUFLOW

Infiltration

- .tgc commands
  - Set Soil == / Read GIS Soil == / Read GRID Soil ==
  - Set GWL == / Read GIS GWL == / Read GRID GWL ==
  - Set GWD == / Read GIS GWD == / Read GRID GWD ==
  - The higher of GWL and GWD prevails (default is infinitely deep)
  - Soil parameters cell by cell reported in 2d_grd_check layer
- Three new map outputs available
  - "CI" for Cumulative Infiltration
  - "IR" for Infiltration Rate
  - "dGW" for Depth to Groundwater (relative to surface)

BMT WBM 16 TUFLOW

Infiltration – Green-Ampt

- Infiltration based on
  - Surface imperviousness
  - Soil characteristics
    (Suction, Hydraulic Conductivity, Porosity, Initial Moisture)
  - Infiltration rate decreases over time
  - Method accounts for areas "drying out" if repeatedly inundated
  - Option to increase infiltration rate with depth of inundation
  - Saturation Depth
    (once fully saturated, no infiltration)

BMT WBM 17 TUFLOW

Infiltration – IL/CL

- Infiltration based on
  - Surface imperviousness
  - Soil capacity
    (Porosity, Initial Moisture)
  - IL is the initial infiltration amount
  - CL is the on-going (constant) infiltration rate
  - Saturation Depth
    (once fully saturated, no infiltration)

BMT WBM 18 TUFLOW

Infiltration - .tsoilf File

Example Soils File.tsoilf

```
! Example TUFLOW .tsoilf (Soils) file

! Comments (after a ! or #) and blank lines are allowed in this file
! First value is the Soil ID (any integer between 1 and 32767), the remaining numbers as described below
! Second argument is the infiltration method where:
! "ILCL" = Initial Loss / Continuing Loss approach
! "GA" = Green Ampt approach

  1, ILCL, 20.0, 3.  ! Use IL/CL with IL = 20mm and CL = 3mm/hr.  Porosity and Initial Moisture = default values of 1.0 and 0.0
  2, ILCL, 0.0, 5., 0.4  ! Use IL/CL with IL = 0mm, CL = 5mm/hr and Porosity = 0.4 (40%).  Initial Moisture = default value of 0.
  3, ILCL, 0.0, 5., 0.4, 0.1  ! Use IL/CL with IL = 0mm, CL = 5mm/hr, Porosity = 0.4 (40%) and Initial Moisture = 0.1 (10%)
 11, GA, *SAND*  ! Use the USDA soil type *SAND*.  Initial Moisture and max ponding depth = default values of 0.0 and 0.0m
 12, GA, *SILTY CLAY*, 0.2  ! Use the USDA soil type *SILTY CLAY* with an Initial Moisture of 0.2 (20%).  Max ponding depth = def
 13, GA, *SILT LOAM*, 0.2, 0.5  ! Use the USDA soil type *SILT LOAM* with an Initial Moisture of 0.2 (20%) and max ponding depth
 21, GA, 200., 1.4, 0.3  ! Customised soil type with Suction, Hydraulic Conductivity and Porosity specified.  Initial Moisture and
 22, GA, 200., 1.4, 0.3, 0.1  ! Customised soil type with Suction, Hydraulic Conductivity, Porosity and Initial Moisture specifie
 23, GA, 200., 1.4, 0.3, 0.1, 1.0  ! Customised soil type with Suction, Hydraulic Conductivity, Porosity, Initial Moisture and MA

! Pre-defined soil types
! Soil Name          Suction  HydCond  Porosity
!                       mm     mm/hr  (fraction)  (if using English Units these values are automatically changed)
! CLAY                316.3      0.3     0.385
! SILTY CLAY          292.2      0.5     0.423
! SANDY CLAY          239.0      0.6     0.321
! CLAY LOAM           208.8      1.0     0.309
! SILTY CLAY LOAM     279.0      1.0     0.432
! SANDY CLAY LOAM     218.5      1.5     0.330
! SILT LOAM           166.8      3.4     0.486
! LOAM                 88.9      7.6     0.434
! SANDY LOAM          110.1     10.9     0.412
! LOAMY SAND           61.3     29.9     0.401
! SAND                 49.5    117.8     0.417
```


Storage Reduction Factor (SRF)

- Reduces (or increases) the storage of 2D cells
- Does not change conveyance
- Examples
  - Hypothetical partial filling of floodplain to model say 20% reduction in storage from long-term rural residential development
  - Reduce storage due to solid objects (eg. houses) in urban areas
- Set SRF == / Read GIS SRF == / Read Grid SRF ==
- GIS layer's first attribute used
- SRF value of 0.1 will reduce storage by 10%
- SRF value of -0.1 will increase storage by 10%
- Reported in 2d_grd_check layer

1D Structures

(being finalised and tested)

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

User Defined Output
(being finalised and tested)

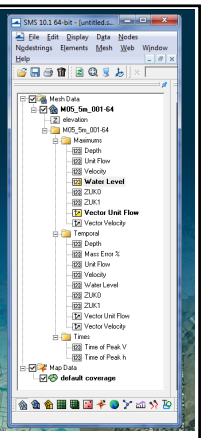
- Model Output == Area1 | Area2
- Output Control File == a.toc
  that contains blocks such as:

```
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 22 TUFLOW

XMDF 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 23 TUFLOW

People Hazard Categories
Engineers Australia AR&R Project 10 Recommendations

- ZPA – Hazard to Adults
- ZPC – Hazard to Children
- ZPI – Hazard to Infants and elderly

BMT WBM 24 TUFLOW

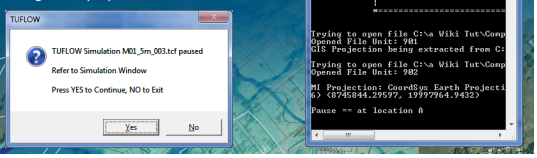
Check Files
(being finalised and tested)

- 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 25 TUFLOW

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



BMT WBM 26 TUFLOW

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

BMT WBM 27 TUFLOW

Miscellaneous

- Hazard (VxD) can now be used for cut-off values for evacuation routes
- Variable Z Shapes can now be restored
  - Reinstatement of a levee breach
  - Repeated opening and closing of a lagoon entrance
- SA inflows can now be based on the 2d_po water level or flow elsewhere
  - Use "Read GIS SA PO == ..." in .tbc file
- Tracking maximums 2d_po times series output
  - Specify in .tcf file "Maximums and Minimums Time Series == ON" – will be default in future
- Velocity (V_) LP output

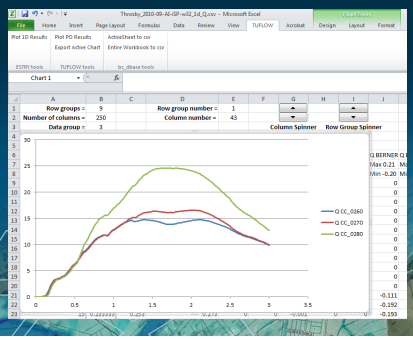
BMT WBM 28 TUFLOW

Miscellaneous

- UK Market
  - ISIS now compatible with TUFLOW 64-bit and DP
  - ISIS 1D now linked to TUFLOW 1D (ESTRY)
    (Primarily to use TUFLOW pipe routines)
- USA Market
  - US Customary (Imperial) Units supported

BMT WBM 29 TUFLOW

TUFLOW Tools.xls



BMT WBM 30 TUFLOW

Excel Animations

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

BMT WBM 31 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 32 TUFLOW

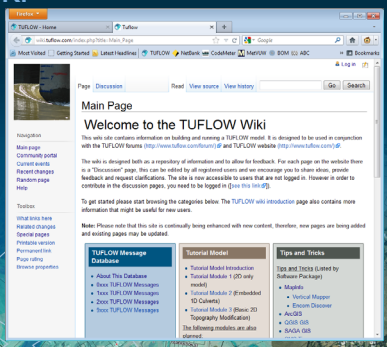
SA Proportion to Depth ==

- 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 33 TUFLOW

TUFLOW Wiki

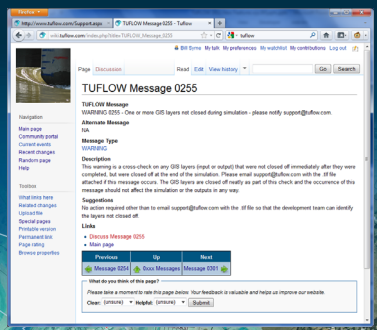
- Covers
  - Messages Database
  - Tutorial Models
  - Tips and Tricks
- Continuously under development
- Need to register to be able to contribute
- Add comments, suggestions



BMT WBM 34 TUFLOW

TUFLOW Wiki Messages

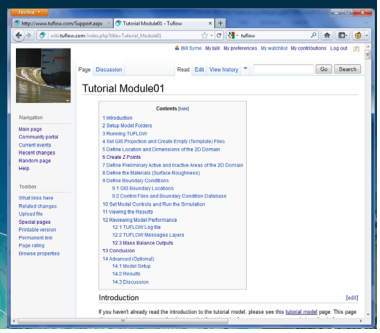
- Messages Database
- Many messages not yet detailed!
- If you need a message detailed please email support@tuflow.com



BMT WBM 35 TUFLOW

TUFLOW Wiki Tutorial Models

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



BMT WBM 36 TUFLOW

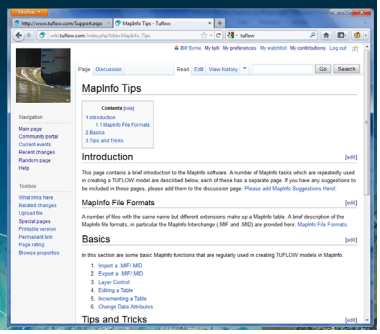
Wiki Tutorial Model

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

BMT WBM 37 TUFLOW

TUFLOW Wiki Tips and Tricks

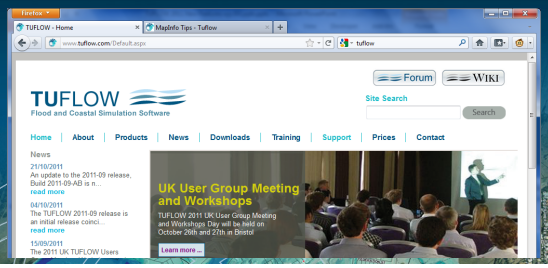
- Tips and Tricks from Chapter 12 of the TUFLOW manual added
- New ones added and will continuously be added
- Use Discussion page or email support@tuflow.com to comment, add a tip, or make suggestions



BMT WBM 38 TUFLOW

New TUFLOW Website

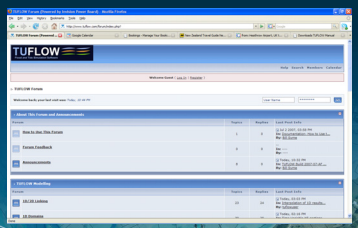
- Needed to accommodate TUFLOW FV and other new products
- Any suggestions/gripes please email support@tuflow.com



BMT WBM 39 TUFLOW

TUFLOW Forum

- Running for a few years
- >1,000 Members
- Browse, post and reply to topics
- Receive emails of TUFLOW updates and announcements
- www.tuflow.com\forum



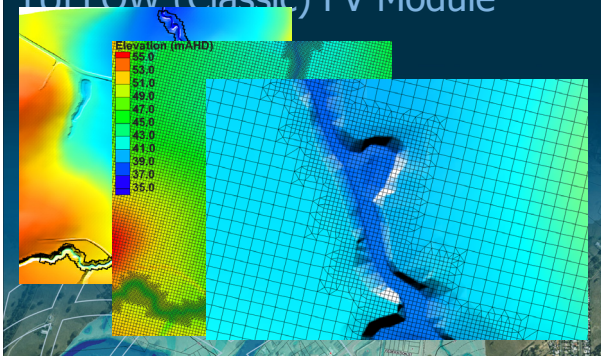
BMT WBM 40 TUFLOW

Under/Future Development

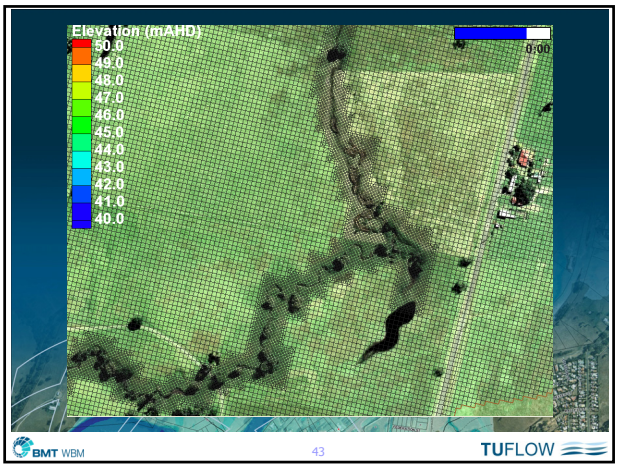
- Inclusion of 2D FV engine as alternative
- 2D Nesting revisited
- Parallelisation of "Classic" engine
- Arc version of miTools
- GIS time based map outputs
- FEWS Plugin
- WQ Modules
- Support for OpenMI...

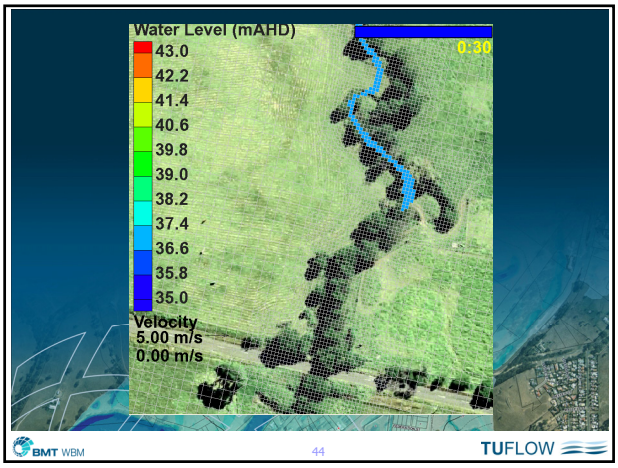
BMT WBM 41 TUFLOW

TUFLOW (Classic) FV Module



BMT WBM 42 TUFLOW


Elevation (mAHD)
50.0
49.0
48.0
47.0
46.0
45.0
44.0
43.0
42.0
41.0
40.0
0:00
BMT WBM
43
TUFLOW


Water Level (mAHD)
43.0
42.2
41.4
40.6
39.8
39.0
38.2
37.4
36.6
35.8
35.0
0:30
Velocity
5.00 m/s
0.00 m/s
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44
TUFLOW


the end
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45
TUFLOW