TUFLOW
Managing Multiple Events and Scenarios
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Multiple Events and Scenarios
Run all your simulations from one .tcf file
Yes, it is possible!
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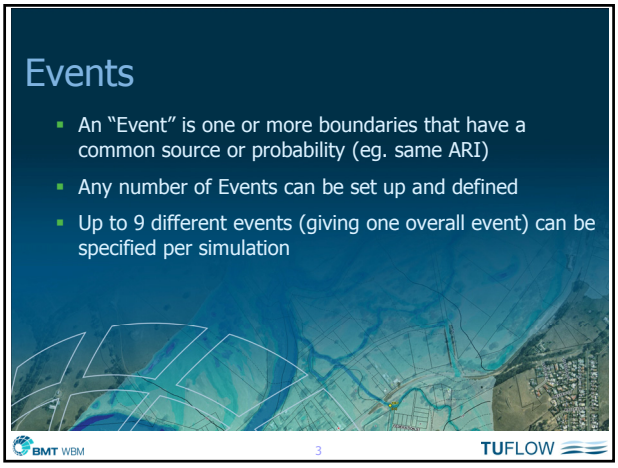
Events
An "Event" is one or more boundaries that have a common source or probability (eg. same ARI)
Any number of Events can be set up and defined
Up to 9 different events (giving one overall event) can be specified per simulation
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Example of Combined Events

- Study area has two sources of water:
  - from the river
    - Different rainfall/runoff probabilities
    - Different duration storms
  - into or from the ocean
    - Different tidal or storm surge conditions
- TUFLOW simulation uses a combination of above

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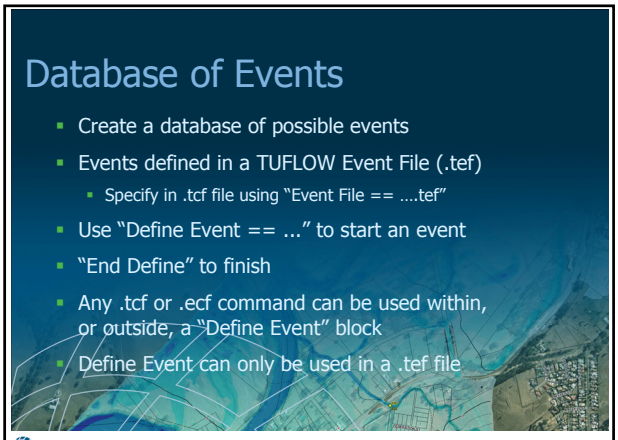
Database of Events

- Create a database of possible events
- Events defined in a TUFLOW Event File (.tef)
  - Specify in .tcf file using "Event File == ….tef"
- Use "Define Event == ..." to start an event
- "End Define" to finish
- Any .tcf or .ecf command can be used within, or outside, a "Define Event" block
- Define Event can only be used in a .tef file



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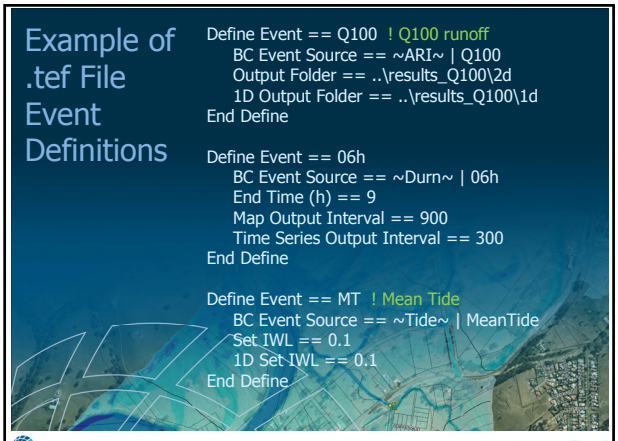
Example of .tef File Event Definitions

```
Define Event == Q100  ! Q100 runoff
    BC Event Source == ~ARI~ | Q100
    Output Folder == ..\results_Q100\2d
    1D Output Folder == ..\results_Q100\1d
End Define

Define Event == 06h
    BC Event Source == ~Durn~ | 06h
    End Time (h) == 9
    Map Output Interval == 900
    Time Series Output Interval == 300
End Define

Define Event == MT  ! Mean Tide
    BC Event Source == ~Tide~ | MeanTide
    Set IWL == 0.1
    1D Set IWL == 0.1
End Define
```



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Specifying Events

- Name of event(s) specified either by
  - Using "Model Events == <event1> | <event2> | …" in .tcf file
  - Or using -e <event> option when running TUFLOW
  - -e option(s) override "Model Events ==" command
- Keys "~e1~", "~e2~", etc
  - Use keys in .tcf filename to control where event name is inserted
  - Keys are optional – if not included, event name is added to end of .tcf file

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Specifying Events Example

- Simulation to be carried out is for the Q100 storm, for a 6 hour duration, with a mean tide at the outlet
- The .tcf file is named "BR_exg_~e1~_~e2~_~e3~_001.tcf"
- To run this simulation either
  - Specify "Model Events == Q100 | 06h | MT" in .tcf file and run TUFLOW
  - or use a .bat file line like
    TUFLOW.exe -e1 Q100 -e2 6h -e3 MT BR_exg_~e1~_~e2~_~e3~_001.tcf
- Output files will be named "BR_exg_Q100_06h_MT_001"

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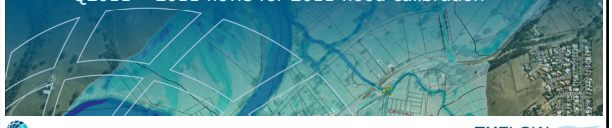
USA – Use Short Acronyms!

- Q100 – 100 year ARI flow event
- Q020 – 20 year ARI flow event
- 03h – 3 hour duration storm
- QPMF – Probable Maximum Flood flows
- H050 – 50 year Storm Tide
- Q2011 – 2011 flows for 2011 flood calibration



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Managing Scenarios

- A scenario is a essentially a configuration of TUFLOW inputs
- A scenario may be simulated multiple times using different combinations of events
- Any number of scenarios can be set up and defined
- Up to 9 different scenarios (giving one overall scenario) can be specified per simulation

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Examples of Scenarios

- Could be simply testing a different timestep
- Usually different topographic configurations
  - Existing situation
  - Proposed development options
  - 1974 topography

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USA – Use Short Acronyms!

- exg – Existing topography
- OpA – Development Option A
- st3 – Sensitivity Test 3
- c11 – 2011 topography for 2011 flood calibration

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Setting Up Scenarios

- You have to become a bit of a programmer!
- Defined by building logic into any TUFLOW control file
- Use "If Scenario == " constructs

```
If Scenario == OpA
    Read Grid Zpts == dem\DEM_OpA.asc
End If
```

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If Scenario Construct

- If Scenario == s1 | s2 | …
  …
  {Else If Scenario == s3 | s4 | …}
  …
  {Else}
  …
  End If
- Can nest If Scenarios within If Scenarios if you want!

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Specifying Scenarios

- Name of scenario(s) specified either by
  - Using "Model Scenarios == <s1> | <s2> | …" in .tcf file
  - Or using -s <scenario> option when running TUFLOW
  - -s option(s) override "Model Scenarios ==" command
- Keys "~s1~", "~s2~", etc
  - Use keys in .tcf filename to control where scenario name is inserted
  - Keys are optional – if not included, scenario name is added to end of .tcf file

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Specifying Scenarios Example

- Simulation to be carried out is for the existing topography (Scenario "exg") for the Q100 6h storm with a mean tide at the outlet
- The .tcf file is named "BR_~s1~_~e1~_~e2~_~e3~_001.tcf"
- To run this simulation either
  - Specify "Model Scenario == exg" and "Model Events == Q100 | 06h | MT" in .tcf file and run TUFLOW
  - or use a .bat file line like TUFLOW.exe -s1 exg -e1 Q100 -e2 6h -e3 MT BR_~s1~_~e1~_~e2~_~e3~_001.tcf
- Output files will be named "BR_exg_Q100_06h_MT_001"

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

Case Study: Richmond River, NSW

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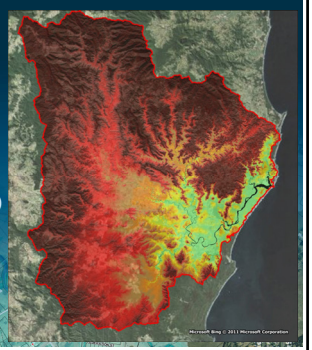
Richmond River, NSW, Australia

- 6,900km^2 catchment
- 1,000km^2 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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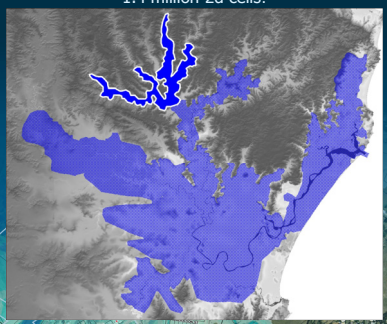
Modular Modelling

- 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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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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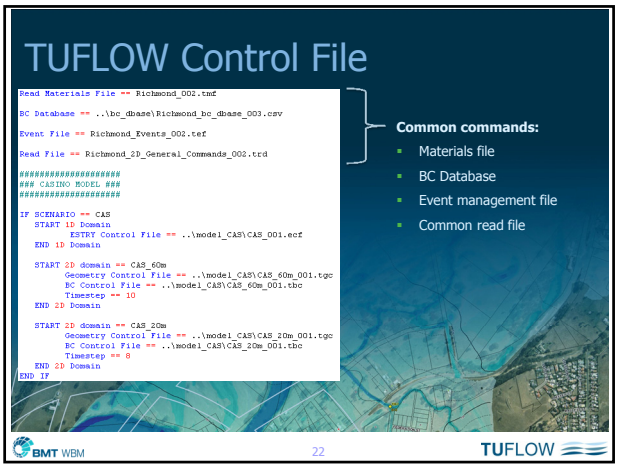
TUFLOW Control File
Read Materials File == Richmond_002.tmf
BC Database == ..\bc_dbase\Richmond_bc_dbase_003.csv
Event File == Richmond_Events_002.tef
Read File == Richmond_2D_General_Commands_002.trd
####################
CASINO MODEL
####################
IF SCENARIO == CAS
START 1D Domain
ESTRY Control 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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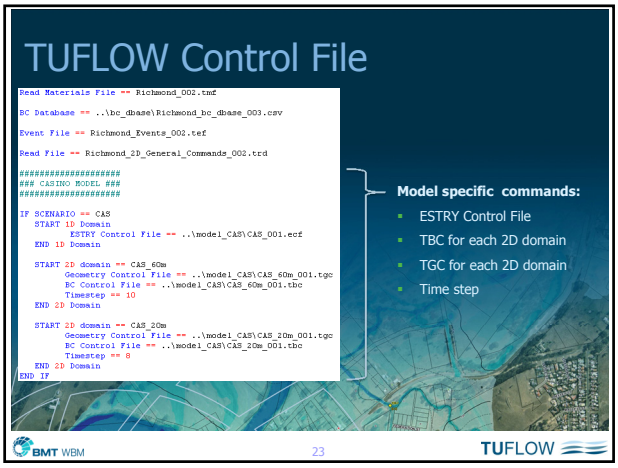
TUFLOW Control File
Read Materials File == Richmond_002.tmf
BC Database == ..\bc_dbase\Richmond_bc_dbase_003.csv
Event File == Richmond_Events_002.tef
Read File == Richmond_2D_General_Commands_002.trd
####################
CASINO MODEL
####################
IF SCENARIO == CAS
START 1D Domain
ESTRY Control 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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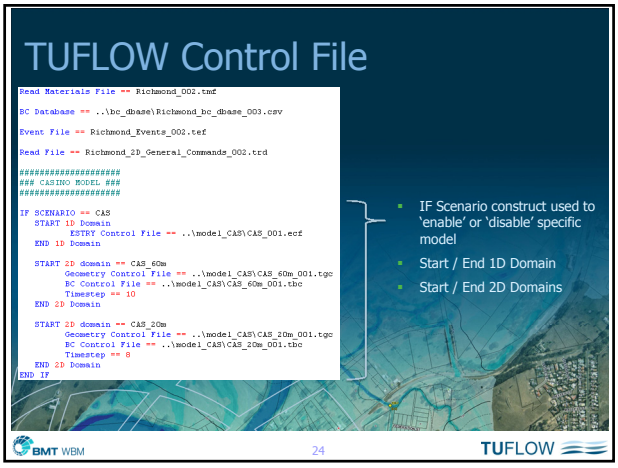
TUFLOW Control File
Read Materials File == Richmond_002.tmf
BC Database == ..\bc_dbase\Richmond_bc_dbase_003.csv
Event File == Richmond_Events_002.tef
Read File == Richmond_2D_General_Commands_002.trd
####################
CASINO MODEL
####################
IF SCENARIO == CAS
START 1D Domain
ESTRY Control 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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Event Management File – part 1

- IF Scenario construct used to define event based on Existing (EXG) or Mitigated (INT) scenario
- Therefore, design event boundary conditions to be used
- Event definitions used within the single BC database

```
If Scenario == EXG | INT

  Output Folder == \TUFLOW_Des\results_des\2d\
  Write Check Files == \TUFLOW_Des\check_des\2d\
  Log Folder == \TUFLOW_Des\log_des\
  1D Output Folder == \TUFLOW_Des\results_des\1d\
  1D Write Check Files == i\TUFLOW_Des\check_des\1d\

  Start Time == 0
  Start Map Output == 30

  Define Event == 100yr_A_z1
    BC Event Source == ~River_ARI~ | 100yr
    BC Event Source == ~Rain_ARI~ | 100yr
    BC Event Source == ~Ocean_ARI~ | 10yr
    BC Event Source == ~Dur~ | 72hr
    BC Event Source == ~Zone~ | z1
    End Time == 120
  End Define

  Define Event == 100yr_B_z1
    BC Event Source == ~River_ARI~ | 10yr
    BC Event Source == ~Rain_ARI~ | 100yr
    BC Event Source == ~Ocean_ARI~ | 10yr
    BC Event Source == ~Dur~ | 12hr
    BC Event Source == ~Zone~ | z1
    End Time == 70
  End Define

  Define Event == 100yr_C_z1
    BC Event Source == ~River_ARI~ | 10yr
    BC Event Source == ~Rain_ARI~ | 10yr
    BC Event Source == ~Ocean_ARI~ | 100yr
    BC Event Source == ~Dur~ | 12hr
    BC Event Source == ~Zone~ | z1
    End Time == 70
  End Define

Else If Scenario == CAL
```


Event Management File – part 2

```
Else If Scenario == CAL

  Output Folder == \TUFLOW_Cal\results_cal\2d\
  Write Check Files == \TUFLOW_Cal\check_cal\2d\
  Log Folder == \TUFLOW_Cal\log_cal\
  1D Output Folder == \TUFLOW_Cal\results_cal\1d\
  1D Write Check Files == \TUFLOW_Cal\check_cal\1d\

  Define Event == 1974
    BC Event Source == ~Event~ | 1974
    Start Time == 5.4
    End Time == 205
    Start Map Output == 5.5
  End Define

  Define Event == 1976
    BC Event Source == ~Event~ | 1976
    Start Time == 3
    End Time == 74
  End Define

  Define Event == 2005
    BC Event Source == ~Event~ | 2005
    Start Time == 12.5
    End Time == 120
  End Define

  Define Event == 2008
    BC Event Source == ~Event~ | 2008
    Start Time == -5
    End Time == 300
  End Define

  Define Event == 2009
    BC Event Source == ~Event~ | 2009
    Start Time == -5
    End Time == 150
  End Define

End If
```

- IF Scenario construct used to define Historic event (CAL) scenario
- Event definition used within the single BC database
- Start and End simulation times specified

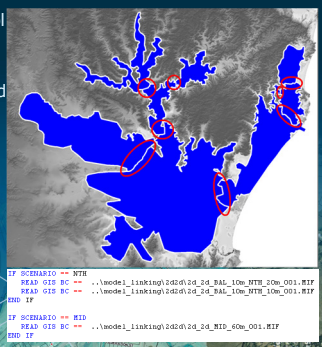
Geometry Control File

- Single geometry control file for each 2D domain
- If Scenario construct used to adjust geometry based on historic, existing or mitigated catchment

```
If Scenario == EXG
    Read GIS Z Shape MIN == \2d_zsh\2d_zsh_LIS_5m_old_sth_lis_levee_remove_001.MIF
Else If Scenario == INT
    Read GIS Z Line thick == \2d_zln\2d_zlr_LIS_5m_levee_001.MIF
End If
```

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 ==  ..\model_linking\2d2d\2d_2d_BAL_10m_NTH_20m_001.MIF
   READ GIS BC ==  ..\model_linking\2d2d\2d_2d_BAL_10m_NTH_10m_001.MIF
END IF

IF SCENARIO == MID
   READ GIS BC ==  ..\model_linking\2d2d\2d_2d_MID_60m_001.MIF
END IF
```


Batch files and output

Start TUFLOW in batch mode

TCF = Richmond_~e1~_~s1~_005.tcf

```
start TUFLOW_iSP_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.tlf
```