Rother Valley Railway

Technical Note on the wetting and drying of cells in TUFLOW software

Confirmation has been requested by Mr Jenkins (Inspector appointed by the Secretary of State for Transport) of the cell wet/dry parameter used in TUFLOW modelling software and specifically in the Rother Valley Railway model. This technical note sets out the approach used in TUFLOW Classic and is based on information provided in the TUFLOW Classic/HPC User Manual Build 2018-03-AD.

The TUFLOW classic software uses a regular grid to represent the floodplain. The model topography in a 2D domain is defined by elevations at the grid cell centres, mid-sides and corners. Each grid cell has elevations assigned to it, as shown in Figure 1:

• ZC point – middle of cell

• ZU point – middle right of cell

• ZV point – middle top of cell

• ZH point – top right-hand corner of cell (These points do not have a role in the hydraulic calculations)

In the Rother model a 5 m grid resolution is used to represent the study area. Each ZC point (illustrated in Figure 1) is 5 m from the ZC points in the adjacent (vertical and horizontal) cells. The ZV and ZU points are 2.5m from the ZC point. Each of the 'Z' points shown below are allocated an elevation based on topographic data. In the case of the Rother model the floodplain topography has been informed by LiDAR.

Figure 1: Example of TUFLOW model grid with computation points (Source Figure 6.1 TUFLOW Build 2018-03-AD Manual)

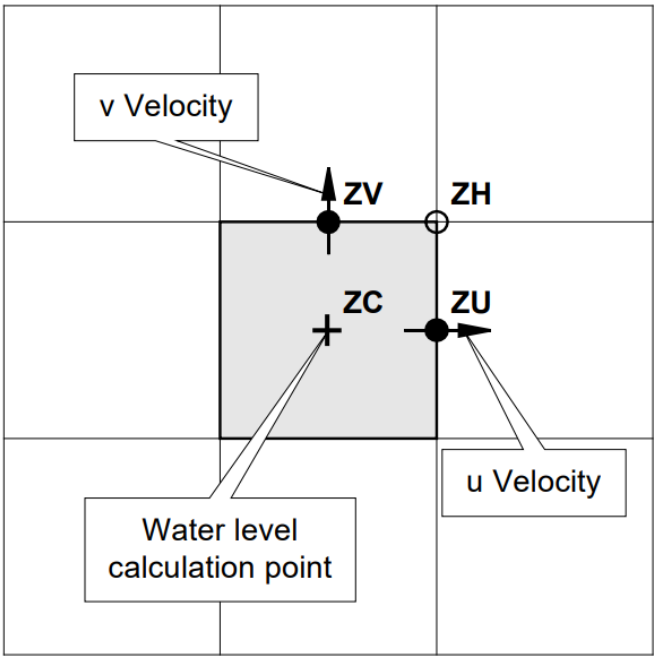

Figure 6-1 Location of Zpts and Computation Points

The ZC point defines the volume of active water (cell volume is based on a flat square cell that wets and dries at a height of ZC plus the Cell Wet/Dry Depth). The ZC point also controls when a cell becomes wet and dry (note that cell sides can also wet and dry).

The ZU and ZV points control how water is conveyed from one cell to another. They represent where the momentum equation terms are centred and where upstream controlled flow regimes are applied. They deactivate if the cell has dried (based on the ZC point) and water cannot flow between the cells. They also wet and dry independently of the cell wetting or drying. This allows for the modelling of "thin" obstructions such as fences and thin embankments relative to the cell size (e.g. a concrete levee)

The cell wet/dry depth is a parameter which can be set by the modeller. The cell wet/dry depth is used for determining when a cell wets and dries. The default is 0.002m (2mm). It should be noted that the wet/dry depth parameter should be selected according to the magnitude of flooding depths. For broad-scale models with large cell sizes values of up to 0.05m can be used, while for models using the direct rainfall approach, or that have a high proportion of steep flow, a wet/dry depth of less than a mm (e.g. 0.0002m) may be required due to the substantial amount of shallow sheet flow.

The default cell wet/dry depths of 2mm were applied in the Rother model as shown in the extract from the TUFLOW Log File (this file is produced during a model simulation) in Figure 2.

Figure 2: Extract from TUFLOW Log File showing the default values were used for cell wet/dry depth parameter

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!______________________________________________________________________
! 2D DOMAIN DEPENDENT COMMANDS
! Note:  Set / Read MI/GIS FC, PO, LP, GLO, IWL commands not shown - use check files to verify.
! Found 2 2D Domain(s)

Start 2D Domain == 5m_Rother
   Geometry Control File == \\csleatcif01.adcsl.capita.co.uk\eg_data\ZTWE\04_PROJECTS\2020\CS099746_RotherValleyRa
   BC Control File == \\csleatcif01.adcsl.capita.co.uk\eg_data\ZTWE\04_PROJECTS\2020\CS099746_RotherValleyRailwayI
   Cell Wet/Dry Depth (m) == 0.002
   Cell Side Wet/Dry Depth (m) == 0.001
   ! Instability Water Level == <default>  ! ie. will use highest Zpt
   ! Morphology Control File ==  ! None specified
   ! AD Control File ==  ! None specified
End 2D Domain == 5m_Rother

Start 2D Domain == 20m_Rother
   Geometry Control File == \\csleatcif01.adcsl.capita.co.uk\eg_data\ZTWE\04_PROJECTS\2020\CS099746_RotherValleyRa
   BC Control File == \\csleatcif01.adcsl.capita.co.uk\eg_data\ZTWE\04_PROJECTS\2020\CS099746_RotherValleyRailwayI
   Cell Wet/Dry Depth (m) == 0.002
   Cell Side Wet/Dry Depth (m) == 0.001
   ! Instability Water Level == <default>  ! ie. will use highest Zpt
   ! Morphology Control File ==  ! None specified
   ! AD Control File ==  ! None specified
End 2D Domain == 20m_Rother
```

Essentially a dry grid cell adjacent to a 'flooded' or wet cell will become wet once the water level in the wet cell is greater than the ZC elevation (ground elevation) of the dry cell plus the cell wet/dry depth (default 2mm).

At the edge of the floodplain where the topography begins to rise more steeply a small difference in water levels will have a lesser impact on the flood extent than in flatter areas of the floodplain.