Webinar QandA: Maximising the Accuracy of Hydraulic Models- Australian Water School - *Wednesday, 16 June, 2021*

Question	Answer(s)	
you mention bend loss values. Where are there published tables of losses? also anything for 1D hec ras models?	There was also a paper prepared for the 2017 Hydraulics in Water Engineering Conference in Sydney which included a summary of bend losses and other interesting observations from the Brisbane River modelling. Here's a link: https://www.tuflow.com/media/5099/2017-brisbane-river-catchment-flood-study-calibration-of-hydraulic-models-rodgers-et-al-hiwe-sydney.pdf	There was a good piece of research out of Kansas University. Here's a link: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjX_emYpaDxAhXn3zgGHeETBUkQFjAAegQIBBAF&url=https%3A%2F%2Frosap.ntl.bts.gov%2Fview%2Fdot%2F16654%2Fdot_16654_DS1.pdf&usg=AOvVaw0SeiPZ9nxEyKuvE1D1rbUk
Not a modeller but a procurer of modelling. Is it off topic to ask for suggestions on how to optimise specifications w.r.t. setting reasonable expectations for accuracy'. Is it just a function of doing the the contributing components well?	You'll see shortly in the presentation that there is more to it than simply setting the components well. The tool (software) you use will also influence the accuracy in addition to the quality of the data and the schematisation assumption by the modeller. Peer review of someone's work can be a way to check these things. Nevertheless without calibration data it is difficult to ask for a specific level of accuracy in a project brief (e.g. +-0.5m). To set a desired accuracy in a brief you ultimately need something to measure the model result against.	
How long did it take for that Brisbane River Hydraulic Model to run to completion?	There were multiple models used in the study. A 1D only model was used for Monte Carlo simulation of 11,340 models, each of these simulated a period of 10 days, runtimes were less than 10 minutes. The 30m 2D model that Bill mentioned was using TUFLOW Classic and from memory runtimes for the same 10-day duration were in the order of 12-18 hours (depending on the event magnitude!). This was completed in 2016 before the release of the TUFLOW HPC solver on GPU. More information can be found on the QLD government website here: https://www.qra.qld.gov.au/brcfs	
What are flood marks of good to reasonable accuracy?	They can be, though there is also varying degrees of reliability associated with them. I addressed this in my AWS calibration webinar two months ago. There is link in the presentation to USGS document providing specific info on the reliability of different types of flood marks. I'll post a link to that webinar shortly below.	Here's the link: https://www.tuflow.com/library/webinars/#202104_cal
What was the grid size in 2016 model? what was the grid size and SGS size in 2020 model?	If I recall correctly, we used the grid size of 30m in 2016' model. The modelling results Bill showed in the first few slides also has the grid size of 30m. But he'll also show how the results converge when the grid size is changed from 100m to 10m later.	
Hi, Did you do sensitivity analysis on parameters such as n, infiltration parameter. if so, what is the procedure you followed ? thanks.	Bill has since spoken about sensitivity testing on Manning's n - hopefully this clarified?	

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Beyond the differences in terms of length of the modelling time, is there any benefit of using an explicit model (TUFLOW 2020) compared to an implicit model (TUFLOW 2016) in terms of accuracy? I guess some differences in terms of accuracy the turbulence model may play a role, but if we used the same turbulence model, would you expect any major differences between the implicit or explicit models?	I'll remember to ask Bill this one in the Q&A portion of the webinar since he lives and breathes the math. My take on it is, everything else being equal (same cell design etc., 2nd order), you will get different results comparing implicit to explicit. That being said, both estimates are valid. If you compare Classic (implicit) to HPC (explicit) you get similar, though not identical answers. The one situation where I feel explicit is better is high gradient/shock situations. In this case the finer resolution grid and timestep typical of an explicit model will represent the "shock" more accurately.	
Model is 2D? In 1D/2D model, what is your suggestion when there are much difference between river survey data and dem?	The original model in 2016 was 1D/2D model. The Brisbane River cutdown benchmark model Bill was showing is a pure 2D model for simplicity.	DEM data based on Airborne LIDAR capture techniques is often very poor at defining bed level's below the water surface. The river survey data would be more trustworthy as a bathyemtery dataset. This issue/concept is discussused in last month's calibration webinar, it's worth a watch: Here's the link: https://www.tuflow.com/library/webinars/#202104_cal
when we are modelling bridge, do you advise to adopt both form loss and blockage? or does form loss already include blockage? We use TUFLOW spreadsheet for form loss and blockage calc.	when we are modelling bridge, do you advise to adopt both form loss and blockage? or does form loss already include blockage? We use TUFLOW spreadsheet for form loss and blockage calc.	You should apply both. The form loss value will estimate an approach head loss due to the additional form loss. Velocity is a key input to that calculation. The blockage value you enter will influence (fine tune) the velocity estimate, as such it's an important additional input you should be using
What are the advantages of Cut-Down Model ?	Hi Vinay, It allows a number of test cases to be run quickly in the test area, whist still taking boundary conditions from the large model. For example, being able to run a test in 20mins compared to several hours or longer.	It runs much faster and is less complexed :). It's really good for playing around with model parameters such as manning's n, cell size, model scheme, and to understand how they impact the modelling results.
Where would you recommend obtaining model calibration data in Australia? Specifically in Victoria?	It is always best to start by approaching the local Council or in Victoria specifically the Catchment Management Authority.	https://data.water.vic.gov.au/ is also a source of data in Victoria.

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could we rely on water depth results that larger than 2d cell size when we are doing 2d modelling (shallow water eqs)?	Shallow Water Equation works under the assumption that the horizontal length scale of the phenomenon is much greater than the vertical length scale. SWE works even if the 2d cell size is less than the depth. I presume the concern about using very small cell size is related to the instability of the model at small cell size, especially if improper turbulence scheme or spatial discretisation scheme is used. If the model converges and stays stable at small cell size, the modelling result should be trustworthy. However, if the model does not converge or become unstable when you conduct the mesh size sensitivity test, you should not rely on the result and probably need to reconsider the input parameters and model schemes used.	
Will the recording be available after?	Thanks, yes we will publish this webinar on our YouTube channel. Subscribe to receive updates when new webinars become available: https://www.youtube.com/c/AustralianWaterSchool	
What are the industry guidelines for manning's n ?	Check out the following guidelines listed in our guideline document page of the Wiki: https://wiki.tuflow.com/index.php?title=Industry_Modelling_Guidelines -BCC Manning's Roughness Guideline -ODOT Manning's Roughness Guideline -Photographic Guidance for Selecting Flow Resistance Coefficients in High-Gradient Channels	
is 2020 has the 30m grid size? and what is the SGS size?	Hi Ali, For the 2020 a range of cell sizes were tested, Bill is speaking about this now. For the SGS sampling distance, I'll have to get back to you on this, but most likely at the DEM resolution.	
are we going to get this ppt pls ?	Yes we will publish a copy of the presentation on our website after the webinar.	
just ot be clear we apply the K value in 2d Tuflow as form loss?	Yes this is correct. Defining the 3D losses around bends in TUFLOW (2D scheme) is done be defining a K as a form loss. This is an important distinction from using Manning n as a way to represent the loss. This is due to the form loss being applied vs V^2/2g. This is a far better representation of the physic compared to Manning n.	
what was the base DEM grid?	For this practice, we used 5m dem and 5m bathymetry data	
Should we apply manning's value for the whole domain or we could make several section on our domain and apply the suitable manning's based on the observation data?	You should always be using spatially varied definition of manning n (in the horizontal plane). A single manning n for an entire domain should never be used in a real-world model	

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For instream boulders/rock and curve losses etc., were the 2D losses (k) applied within the model, or were these only calculated from one end of the bend to the other (or one side of the rock to the other)? If they were not applied within the 2D model, is there any guidance on how this could be done (for similar models which have sharp bends or prominent rock features instream) - to force such losses (k) to occur around the bend?	There was also a paper prepared for the 2017 Hydraulics in Water Engineering Conference in Sydney which included a summary of bend losses and other interesting observations from the Brisbane River modelling. Here's a link: https://www.tuflow.com/media/5099/2017-brisbane-river-catchment-flood-study-calibration-of-hydraulic-models-rodgers-et-al-hiwe-sydney.pdf	
Are there any procedures for risk analysis of the assumed data?	I don't understand this question can you explain it more? If I interpret it correctly, sensitivity testing to assess the relative influence of inputs and assumptions is the way to quantify result uncertainty	
are you allowed to say what the other solver used is?	We won't be naming the other software. We are teaching what numerical assumptions are important and what things to look out for when you are doing your own accuracy testing. At the end of the day you need to be confident that the software you are using is accurate.	
Thanks Chris. I understand results may never be identical, so just wanted to have an idea of how large differences would be expected to be? Or if you would think that they would be relatively minor.	This may be unique to each model/parameter and may benefit from your own sensitivity analysis of spatiotemporal resolution and key parameters.	
I expect you would recommend depth-varying roughness as opposed to constant roughness?	For direct rainfall model, yes. For the manning's n inside the Brisbane River, using a depth-varying one is not that important	
for SGS as a rule of thumb should we go third of the size of the computational grid to get at least three points within each cell to get a curve at cell size?	Yes, with the current default method, the SGS sampling interval will be set as at least 3 points along cell faces. If your DEM is finer than that, e.g. 10m grid and 1m DEM, it's beneficial to set the sampling distance same as the 1m DEM resolution to fully utilise that topographic data and generate more realistic level vs flow area curve for faces and level vs storage curve for cells.	
Does HPC correctly model flow over a weir in the 2D domain?	In addition to Bill's response, can you please refer to the section 5.7 of the latest release note for how to adjust the 2D Weir Flow Factor in HPC.	
Based on your extensive modelling experience of Brisbane River. Please what would be your estimate regrading flushing of the Brisbane River with a minimum flow value? Say 150 m3/sec would flush Brisbane river salt out of the river?	This may be unique to each model/parameter and may benefit from your own sensitivity analysis of spatiotemporal resolution and key parameters.	
Was 2nd order accuracy only introduced in 2020 in HPC 2020 Tuflow engine?	The 2nd order spatial accuracy is there since the first HPC release 2017-09	
Refer to what you mention about data input especially DEM data is one of major driving force effect to the result. So do you have any recommendations how to get or generate a good and accurate DEM?	ELVIS is a common source of data in Australia. Remember to quality check the accuracy of the data using other data sources (e.g. survey data). https://www.tuflow.com/library/videos#geoscience_topo	

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Wondering, Does the "Other Solver" include MIKE 21? :)	As Chris pointed out in other question, we won't be naming the other software. We are teaching what numerical assumptions are important and what things to look out for when you are doing your own accuracy testing. At the end of the day you need to be confident that the software you are using is accurate.	
Comment on uncertainties in hydrology/flows, particularly for longer river modelling...and do you use flow as a calibration parameter for sensitivity analysis?	It is common practise to sensitivity test flows, yes. Vary the flows by 10% to see how much the results change. This is a good way to learn what part of your catchment are more sensitive to variations in flow than other parts.	
In what calibration context were you doing Monte Carlo simulations? Were you running them in 1D?	The monte Carlo modelling for the Brisbane River study was used for design event simulations, not calibration.	