

Webinar: RORB essentials for water modelling

Question Details

#	Question	Answers
1	The "Edit Pre-burst Depth" button in RORB says that they are inputted as percentages of the design storm burst depth. Does that mean we need to convert the pre-burst ratio from ARR datahub into percentages?	You don't need to convert the units of the ARR datahub pre-bursts, the program will read them from the datahub text file. The Edit Preburst Depths button is for if you want to manually specify them
2	I think the program will read the median pre-burst but for some of the Victoria regions, ARR recommends using 75 percentile pre-burst. Are there a better way to update those values in RORB?	Probably the fastest way (although it's a little fiddly) is to edit the ARR datahub text file and put the 75th percentile in the median
3	What is the best way in RORB to apply the PMP 11 temporal patterns for events rarer than the 1% AEP as per ARR19?	It's a little more complicated than a typical ARR application, you can edit an Increments.csv file to put the temporal patterns in as the correct format, email enquiries@harc.com.au and I can give more detail after RORB has the preburst temporal patterns specifically for the GSAM Inland and Coastal regions hard coded. want to specify preburst temporal patterns for a different part of the country (i.e. GTSMR) you'll have to manually populate the table
4	How are the pre-burst temporal patterns used? Are they spatially variable, for example, across Australia?	RORB has definitely been used in New Zealand, it's just that the dialog boxes are set up assuming the Austr context for design inputs. You can definitely add in information based on a local context, it's just a bit more manual.
5	Does RORB work for NZ as well?	The Victorian ARR Datahub portal recommends use of 75th percentile pre-burst depths to correct regional losses. The HARC (2020) paper supporting this recommendation excluded urban catchments from their assessment. Is it appropriate to apply 75th percentile preburst depths to the Pervious Area portions of (pre-dominantly) urban catchments in Melbourne?
6	When there is no gauge data to calibrate the model, which method is more appropriate for flood assessment: hydraulic modelling with rain-on-grid or RORB? Thanks!	The Victorian ARR Datahub portal recommends use of 75th percentile pre-burst depths to correct regional losses. The HARC (2020) paper supporting this recommendation excluded urban catchments from their assessment. Is it appropriate to apply 75th percentile preburst depths to the Pervious Area portions of (pre-dominantly) urban catchments in Melbourne?
7	What are the alternative methods to feed temporal patterns and data hub files to non-Aussy models?	I believe this is appropriate given the commentary in the HARC (2020) paper, as this recommendation is lar driven by the split between burst and pre-burst temporal patterns. But I was not involved with this paper.
8	What is the modelling/area resolution for RORB? One of the main limitations for WBNM on small use sites is that it is limited to 100 sq.m increments which sometimes can be an issue on smaller sites.	Let me know if my verbal answer wasn't sufficient
9	What is the best technique for validation of urban flows in ungauged urban catchments?	I'm sorry I don't know what you are referring to with "frequency storm hyetograph"
10	Tony mentioned RORB 6.5 is available, but looking on HARC and Monash website the latest version available for download is 6.45? Is there an updated version that doesn't crash on Windows 11?	Conceptually there is likely a theoretical limit on catchment size (particularly if using regionalised paramete all of those will have been defined using relatively large catchments). E.g. it is likely that Pearse et. al. regionalised Kc is not applicable for really small catchments like that. There is also limited input data at the resolution.
11	What's the differences between RORB and WBNM?	Without data it's hard to validate the model unfortunately. One option might be to check consistency with adjacent gauged catchments, but that is likely rare as well
12	What are the alternative methods to feed temporal patterns and data hub files to non-Aussy models?	There is, but the website hasn't been updated yet. If you email enquiries@harc.com.au I can get the windo fix to you
13	Filtering embedded bursts can result in different results based on the durations in the input IFD table. Is there a recommendation on limiting the minimum duration used for filtering? Is it appropriate to filter a 48hr critical duration catchment for 3hr embedded burst?	It's been a while since I've looked into WBNM but they are similar models in terms of being node-link rainf: runoff models, the difference is how they are parameterised (particularly the routing, from memory)
14	How to apply preburst for durations without a default burst pattern- for example 1.5hour or 4.5hour?	You can manually enter the relevant information in RORB
15	Some experts in the dam industry believe that accuracy of the outcome of hydrological models are not as important as Hydraulic modelling maybe because of floods being routed in the dam reservoirs. How would you assess their belief?	Embedded burst filtering is still a limited area of knowledge in the literature, and filtering embedded burst: have significant impacts on peaks. You should try to filter with all the burst durations you have available, bi shortest will likely be the most critical. But you should also check how sensitive the model is to this assum; as further engineering judgment may be needed (e.g. if the filter is making the temporal patterns uniform)
16	Can an AI Neural Network use RORB and potentially "Min/Max" parameter to give potentially "over optimised" results?	This is a gap in the state of knowledge, so whatever you do is going to require engineering judgment, but o approach would be to redistribute preburst temporal patterns from adjacent durations (i.e. stretch the 1 hc compress the 2 hour pattern).
17	In using individual sub-catchment 'local' flow outputs in Hydraulics, what is the preferred method? The context to my question is in reference to the calculation of the hydrographs outputs for individual sub-catchments, as is calculated using rainfall depth x sub-catchment area (delayed by 1 timestep). Other packages include catchment storage (and a delay), where this is combined into the channel routing (one function) in RORB. Would you recommend applying to all cells in the hydraulic model like the 'SA ALL' function in TUFLOW to account for this?	Any model is going to be a compromise, it depends what it is being used for. Hydrologic models give much insight into the variability of flooding because they can run quickly (i.e. Monte Carlo / Ensemble). Often the variability in flooding is significant.
18	There has been a fair bit of commentary around the fact that RORB is not that suitable for urban area hydrology. Any comment on why this may be?	You could, but I think the effort would be a little wasted. Calibration is a compromise between many goodr of fit metrics (e.g. peak magnitude, volume, peak timing, hydrograph shape). These compromises should b explicitly made with consideration for what you are using the model for. If you use a neural network to opt the model then to some extent the judgments about these compromises are obfuscated. Additionally, in calibration you are primarily trying to set the routing parameters, not the losses - the losses vary from ever event based on antecedent conditions, but you expect that the routing parameters are (largely) a catchme property. Additionally, there is a large risk that the model would become overfit to noise in the observator rather than reflecting the underlying physical processes. So it feels like implementing a neural network wo more effort for a worse outcome. If you have lots of data to calibrate to then a better approach would be t a "verification" step after calibration where you fit a flood frequency curve to the data and compare the m output frequency curve over the AEPs up to 1 in 100
19	How do RORB's results compare with HEC-HMS' results?	If you're just using RORB for rainfall excess there is an option in the catchment graphical editor to export r; csv files in a TUFLOW boundary condition format. This rainfall excess has no attenuation applied to it, it is j the rainfall minus losses, so there is no risk of double counting attenuation
20	In what way is RORB different from WinTR-55/TR-55 for assessing storage volumes in detention ponds for flood management?	Thank you for your answer. My understanding is that double attenuation is more to do with the channel rou which is an issue that modellers do need to watch out for. I was more asking about the catchment storage of the hydrologic calculation (i.e topographic depressions, tree roots, etc). This delays and attenuates the hydrograph to the channel (or outlet of the sub-catchment). Is there a preferred method to apply to the Hydraulic model to account for this?
21	It is good introducing this model it is quit new model for me. My question is is this model works for larger watershed areas? what the difference between HEC-HMS? Thanks.	There are definitely model concepts in RORB which are intended for modelling urban areas (e.g. imperviou fractions, reach types), and RORB is used for urban contexts. But because it is a lumped model it is limited i how it can represent changes in routing over small spatial scales. Urban contexts can also be difficult beca there is rarely gauged data for calibration.
22	So you don't need a node at the outlet of catchments that just continue downstream into one other catchment? And do you need to use slopes?	There has been some recent work on implementing Australian Rainfall and Runoff methods in HEC-HMS. S recent paper by Jacobs and Ryan (2021) Application of HEC-HMS in Australia including injection of ARR2019 Temporal Patterns, establishment of calibrated parameters and comparison with oth Australian hydrological models. Hydrology and Water Resources Symposium. There is a copy in informit. <a href="https://search.informit.org/doi/10.3316/informit.342971434386005">https://search.informit.org/doi/10.3316/informit.342971434386005</a>
23	When modelling a spillway in RORB, only rectangular shape is available. Is it possible to include more spillway geometry such as piano key, trapizoidal or labyrinth spillways?	I'm sorry I don't know what TR-55 is
24	Is slope considered with the "Natural" reach type?	RORB works well for larger catchments. I am not up to date with HEC-HMS but from memory it is a unit hydrograph method, so it doesn't represent the temporal variability in rainfall using temporal patterns (thc still routes the output from those unit hydrographs through a network similar to RORB)
25	Will future versions of RORB allow display of ensable flows at a location of interest as hydrographs AND scatter plots to allow rapid visual assesment of peak flow variability over various temporal patterns?	There is some discussion of the differences between RORB and HEC-HMS here <a href="https://search.informit.org/doi/10.3316/informit.342971434386005">https://search.informit.org/doi/10.3316/informit.342971434386005</a> RORB models have been used for some large studies. For example, the catchment of Hume Reservoir 16,0 km2. The Swan River in WA 124,000 km2 <a href="https://www.emrc.org.au/Profiles/emrc/Assets/ClientData/Documents/Page_Content/Environmental_Ser Flood_Risk/D-Flood-Study-Hydrology-HARC-Swan-Helena-Rivers-Final-Report-V3-0-WEB.pdf">https://www.emrc.org.au/Profiles/emrc/Assets/ClientData/Documents/Page_Content/Environmental_Ser Flood_Risk/D-Flood-Study-Hydrology-HARC-Swan-Helena-Rivers-Final-Report-V3-0-WEB.pdf</a>

26	In an urban assessment, do you need (minimum) 5 RORB subcatchments upstream of each location you output to a hydraulic model? Frequently in industry practice a single routed subcatchment is output to the hydraulic model. Will this practice typically overestimate flows?	If you're entering rainfall excess into a hydraulic model the 5 subcatchment suggestion isn't as relevant, be the hydraulic model is doing the attenuation / routing. That suggestion is more relevant for ensuring you have enough attenuation being model upstream of a point of interest in the RORB model (i.e. for calibration or c output)
27	Are sub-catchment nodes (e.g. sub-catch B) downstream of another sub-catchment (e.g. A) connect to the downstream end of reach A?	Reaches can connect directly to subarea centroids, but the more likely arrangement is that there will be a reach downstream of subarea A, a reach downstream of subarea B, and these two reaches would connect at a junction node. Catchments can connect in a line or via a junction node.
28	When modelling large reservoirs in RORB, should the reservoir storage area be set to impervious or pervious. Also, do you need to tell RORB what reaches become drowned out by the reservoir or is this done automatically?	Yes, the proportion of the subarea covered by the waterbody should be impervious, and the reaches over the waterbody need to be manually set to drowned
29	Would you be able to give a quick explanation of how the filtered storms function works and when it may be relevant to use?	There is a specific reach type to use when a reach is drowned by reservoir. The paper I mentioned is Addressing embedded bursts in design storms for flood hydrology from HWRS 20 which you can get from the Informit database if you have an EA membership
30	Is it possible to input real-time short-duration rainfall data for hydrologic analysis in RORB?	Thanks Matt ☺ Yes, see the other question about forecasting Yes. RORB can reach a storm file which allows for the input of pluvio data.
31	I don't use Mapinfo any more. Is there a QGIS interface tool for generating input data?	There is not. It is very commonly requested, but we have not found a way to fund development of a QGIS plugin yet.
32	For an ungauged catchment area, usage of default parameter kc, how much it impacts the results?	There is a lot of uncertainty involved in modelling ungauged catchments, and the model output is very sensitive to Kc. Regional Kcs are as good as we can do with limited information Kc is a highly significant parameter. Take the time to choose it wisely.
33	What should be the maximum catchment area to use RORB ?	Depends on the input information and the availability of data to validate against. We've run versions of RORB of 10s of thousands of km2. For an ARR context you will likely be limited by the area limit on areal reduction factors. I am not convinced with the ground water issues for large catchments. Nevertheless, I appreciate your reply. Thanks Matt.
34	How is the Performance of ungauged watershed of RORB model?	There is a lot of uncertainty with modelling ungauged catchments. Regional parameters reflect the best at reducing that uncertainty, but there is only so much that can be done given the lack of data That is a tricky question. Its impossible to tell how accurate a model is if there is no data.
35	What's the best way to apply RORB in Africa, in terms of requiring input parameters that you would usually get from ARR?	It depends on the availability of rainfall and streamflow data, and whether the model was being used for a specific event or for a design context. If it's for design and there isn't any rainfall frequency curve information available then there is likely a separate task regarding estimating that (e.g. through frequency curve fitting gauged data)
36	I heard you said those rainfall patterns are probably a mistake in processing. Do you evidence that this is the case? Just removing data you don't agree with sounds like introducing bias to a model.	Tony's paper details this, but the temporal patterns appear to consist of accumulated data because the end of the rainfall is entered in increments spaced 24 hours apart - Yes. We looked at this in detail. See <a href="https://tonyladson.wordpress.com/2021/08/31/a-review-of-temporal-patterns-from-australian-rainfall-and-runoff/">https://tonyladson.wordpress.com/2021/08/31/a-review-of-temporal-patterns-from-australian-rainfall-and-runoff/</a>
37	ARR recommends routing pervious and impervious areas in urban areas taking into account the different response times. My understanding is this isn't possible in RORB unless there is some kind of workaround. What is the recommended approach using the current publicly available version of RORB. When will this be resolved in RORB in a transparent way?	Yes. We looked at this in detail. See <a href="https://tonyladson.wordpress.com/2021/08/31/a-review-of-temporal-patterns-from-australian-rainfall-and-runoff/">https://tonyladson.wordpress.com/2021/08/31/a-review-of-temporal-patterns-from-australian-rainfall-and-runoff/</a> Sorry, do you have the quote from ARR you're referring to? At the moment RORB uses the impervious fraction (directly and indirectly connected) as an input into the losses, but they don't influence the routing / attenuation RORB has options to manually input design rainfall depths / temporal patterns / information from the data file
38	Hi, What are the alternative methods to feed temporal patterns and data hub files to non-Aussy models?	Its possible to manually specify temporal patterns and ARF values in RORB. This is straightforward if you have the values.
39	thoughts on using rain on grid modelling for estimating Kc values	you can validate/compare the shape of your hydrograph from the RoG Model and the peak flow hydrograph from RORB? That would give you an idea if the Kc value in RORB corresponds with the routing undertaken your hydraulic model.
40	How do you use this model in a area with only daily point rainfall data?	If you mean for design (i.e. using IFDs) the areal reduction factors (ARFs) are used to convert point frequency estimates to areal. If you mean for calibration / historic events then you will have to spatially interpolate the point data (e.g. Thiessen Polygons, Krigging)
41	Good Morning, I am Phetviengkham From LaoPDR, Now I am a Ph.D student in Institut Teknologi Bandung in Indonesia. Could you share the presentation and documents related this topic?	Are you working in Australia? Design rainfall is available everywhere. Kindly provided by the Bureau of Meteorology. If you only have daily data, that might be ok for a large catchment where the critical duration is hours or more. For a small catchment, you will need sub-daily data. There are various approaches to disaggregating daily values.
42	You just mentioned that the losses from the datahub tend to be too big. Recommended adjustments to the losses typically reduce the losses because of this. It seems kind of counterintuitive to increase the CL's for model timesteps smaller than 1 hour (i.e., critical durations < 12 hours).	Yes, the presentation will be turned into a pdf and shared. I think this is conflating two separate things: the need to alter the regional losses as demonstrated by user experience / the benchmarking study (implemented by increasing preburst), and the need to increase CL for shorter durations because of the timestep dependence on effective CL (for finer timesteps there are more increments of rainfall which cannot have any loss, so for a given CL the volume of loss is less when the storm represented at a finer timestep compared to a longer timestep)
43	How do people generally look at the CL adjustments recommended by ARR19 Guidelines?	These are two separate issues. 1) loss values specified in the data hub that are too high and 2) adjusting the model time step. There is improved guidance on loss values via the Jurisdiction Specifics page on the data hub. Regarding the CL adjustment for model timestep. Have a look at the paper where this was proposed: <a href="https://search.informit.org/doi/10.3316/informit.81528978352611">https://search.informit.org/doi/10.3316/informit.81528978352611</a>
44	Could you please share your experience regarding the performance of the RORB model for flood forecasting and early warning purposes?	Yes, we have been involved with setting RORB up for real time flood forecasting for one gauge catchment and are aware of two others. The real time calibration performance has worked really well I think URBS is commonly used by the Bureau of Meteorology for flood warning.
45	What types of sensitivity analysis or tests are needed with RORB ??	Calibration and verification are forms of sensitivity analysis, additionally for ungauged catchments you may try different Kc values to quantify model uncertainty
46	Are there any plans to develop a QGIS plugin for RORB (i.e. QGIS version of MiRORB)?	We discussed the need to plot and check temporal patterns. You may like to check the sensitivity of results to other parameters. Have a look in Australia Rainfall and Runoff and search for "Spider" diagram and "Tornai diagram."
47	Comparing RORB with other models ??	Hope I answered this verbally There is discussion of this in the manual under section 4.5 There are a few papers that look at this. Best to search informit. A couple of examples. <a href="https://search.informit.org/doi/10.3316/informit.342971434386005">https://search.informit.org/doi/10.3316/informit.342971434386005</a> <a href="https://search.informit.org/doi/10.3316/informit.692456518081652">https://search.informit.org/doi/10.3316/informit.692456518081652</a>
48	With regards to ARF, for a catchment which has an area of >1km2 but which has sub-catchment areas <1km2. If we assign point IFDs for each sub-catchment, rather than a single IFD for the whole catchment, should we still be applying the ARF to these sub-catchments?	Yes. Take an AEP of 1 in 100 as an example. The goal is to model a catchment average rainfall of 1 in 100, which will be less than the point 1 in 100 rainfall occurring everywhere in the catchment at the same time (hence the ARFs). Or in other words, if you assign the point 1 in 100 rainfall to each subarea the catchment average rainfall will be rarer than 1 in 100. You need to apply the ARF that is appropriate for the point where you care about the hydrography. Consider the catchment area upstream of that point of interest.
49	Is there any way to model changes in stream velocity along different reach lengths, other than changing the routing type?	Consider the influence of reach type, reach length and the routing parameter Kc
50	Is it possible to use local temporal patterns/ifds/losses that are not from the datahub?	Losses can be local (i.e. informed by calibration) Temporal patterns and IFDs use regionalised information to trade space for time, if you just use local information the uncertainty in the temporal patterns and IFDs will be higher and less appropriate for rarer events <a href="https://www.tuflow.com/media/5014/2016-impact-of-natural-variability-on-design-flood-flows-and-levels-nathan-et-al-hwrs-nz.pdf">https://www.tuflow.com/media/5014/2016-impact-of-natural-variability-on-design-flood-flows-and-levels-nathan-et-al-hwrs-nz.pdf</a>
51	Do you have comparison of the mean of the ensemble method results against the MC results	That information is in the output files. I agree that is a useful check. Its common to run the ensemble of temporal patterns for the critical duration identified by the Monte Carlo analysis. Usually you need to specify design flood hydrograph to take forward to the next stage of analysis.
52	Can users access the back end of the program and alter parameters like gravity and viscosity?	No
53	Do you have any plan to include ArcRORB in any upcoming webinar?	These are more important in hydraulic modelling. RORB is solving the routing equation i.e. inflow during dt = outflow during dt = change in storage during dt, along with a relationship between storage and flow S = Kc Gravity and viscosity are specified explicitly. Not at this stage

53	In calibration the flow hydrographs produced by ARR patterns and BoM IFD against gauge flow hydrograph frequency, are we using max/min/average/median value to plot against the gauge frequency curves?	I'm a bit unclear on the question referring to both hydrographs and frequency curves, so maybe let me clarify like this: You can calibrate the model parameters using historic storms by comparing hydrographs at points of interest and changing parameter values. This will primarily help with the routing parameters (i.e. Kc) because losses will change from event to event due to antecedent conditions. You can verify the model against a frequency curve fitted to gauge data (i.e. a GEV fitted by L moments to annual maxima peak flows at the gauge) by running the model as you would for design (i.e. Monte Carlo or Ensemble) and comparing to the gauged frequency curve (changing losses as needed).
54	What is the least catchment area RORB is applicable?	We are plotting the Monte Carlo peak estimates for a given AEP against the Flood frequency curve. See question above about RORB for small areas
55	Does RORB apply the ARF to the rainfall excess as well? If so, is there a way to switch off applying the ARF in RORB, so that we can use the rainfall excess as local inflows in a hydraulic model for sub-catchments with areas less than 1km <sup>2</sup> ?	You can use the option to replace the catchment with a different area for the ARF calculation in the ARR20 run specification, but remember that the catchment of interest you are modelling should define the ARF, not subarea size. See the other question asking about ARFs above.
56	1. please, how do you convert stage readings in a river to discharges for calibration? 2. Can the ARF formula shown be used outside Australia?	The limit is probably the rainfall. Have a look at the shortest duration temporal patterns. I imagine you could probably use RORB to calculate roof drainage which as a critical duration of 5 to 10 mins. Check AS/NZS 3500.3:2021 1. You need a rating curve 2. The ARFs are Australia specific (and any areal reduction depends on the form: the design depths i.e. that they are point estimates). The ARFs from ARR87 may be a bit more widely applicable but it does really depend on storm mechanism
57	Since in many countries don't have site BOM or ARR to upload data, can we upload data such as rainfall/depth/intensity by manual to the RORB model?	To convert stage readings to flood you need a rating table or rating curve. This is established by undertaking measurements for a range of stage readings. Regarding ARF values. Start by searching for published relationships. In Australia we used ARFs from the US for many years. Not sure this was well justified, but it's the only information available.
58	Is there any right or wrong Kc?	There are options in RORB to enter your own temporal patterns / design rainfall curves etc., it's just that the dialog is set up for the Australian context / design input formats. So you can definitely do it, it's just more of a manual process. If you have data it is best to calibrate the model to test Kc. But Kc is also normalised by average flow distant the nearest gauge in RORB, which gives another quantity C. There is a lot of literature about regionalisation. Some of it is summarised in RORB by clicking the ?? button next to where you set the Kc value. Kc is a highly significant parameter. Take the time to choose it wisely.
59	The Area Reduction Factor gets complex if you want to analyse flows throughout the whole catchment rather than only at the outlet. If you break the catchments into small sub-catchments then they may all need to be calculated with an ARF of 1.0. If you then route all the flows down towards the outlet with all ARF's equal to 1.0 then the flow will be over-estimated more as you go down the catchment. How do you manage the ARF throughout the whole catchment? This applies to hydraulic routing also.	Have a look at the Appendix to the RORB manual. There is information on how Kc was derived.
60	Thank for this Webinar.	Yes this is a challenge if you have multiple points of interest. RORB has an ARF option to "replace the catchment with an area equal to a number" which you can use to pick an ARF relevant to a portion of a catchment with a larger model
61	Thank you.	Our pleasure!