Hydraulic Modeling: Basic Steps

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The following steps outline the process required to run batches of CHaMP hydraulic models. These instructions cover default models and/or models with non-default flow rates. These instructions do not include steps required to run porous structures within hydro models, as this process is still in development.

1. Launch AWS instance of AMI with the latest Delft and hydro modeling updates. Generally it’s called “Working Copy\_mm\_dd\_yy”. Use the latest date.
   1. For “type” of instance, select “C4.4xlarge”. All else choose default settings.

Notes: For this step, access to the SFR AWS account is required. Contact Carol Volk or Matt Reimer for access instructions. We have instances to be launched with all the required Delft3D Flow software, R, the required R-scripts, and related files all set to go.

1. Connect to remote desktop connection
   1. Connect as “Administrator”
   2. Use password from file “windows\_password.txt”

Notes: I’m not sure why, but I’ve found it’s sometimes necessary to connect as “administrator” rather than the default name.

1. Ensure latest copy of R scripts and related files are downloaded
   1. Open Source Tree and check for updates

Notes: In general, the latest updates of all required files will be present on the latest AWS image. Updates are frequently made where hard-coded specification of boundary conditions are required. Other than that, the default code is quite stable.

1. Ensure folders “C:\Matt-SFR Files\Hydraulic Modeling\champ data from bucket” is empty or non-existent

Notes: This folders are where the hydro prep folders are to be downloaded from the aws bucket. Later processing steps will automatically generate a list of sites to be modeled based on a search of all hydro prep files present in the subfolders of this folder. Anything left in there inadvertently will also be added to the list of sites, so you’ll want to ensure no unwanted hydro prep files are included in this folder.

1. Download hydro prep data from cmsource, aem, or other appropriate aws bucket
   1. Open in Excel: “CHaMP\_and\_AEM\_Metrics.csv”
   2. Open Excel file: “Hydro Modeling Data Pull.xlsx”
   3. Enter list of VisitID’s to model in first column of “Hydro Modeling Data Pull.xlsx”
   4. Auto fill the remainder of the columns from template row(s)
   5. Copy column of AWS download commands for sites to model from “Hydro Modeling Data Pull.xlsx” (Column M) and paste into a command line prompt. This will pull data from the AWS bucket and put it into the correct directory structure.

Notes: This step can be problematic only because, as of Feb 2017, not all hydro prep files are in the same AWS bucket. Column H in this Excel file specifies which AWS bucket to pull from. Options for column H are: “s3://aemdata/QA/” for AEM visits, and either “s3://champdata/CMSource/” or “s3://champdata/QA/” for CHaMP visits. For CHaMP visits, you may need to pull from both sources.

Note: Do NOT run batches with both AEM visits and CHaMP visits in the same batch. At the data upload step (see below) all data is uploaded to either the AEM or CHaMP QA buckets, and the scripts are not able to mix and match results. You do NOT want to accidentally upload AEM results to the CHaMP QA bucket, or vice versa. This is VERY IMPORTANT!

You can run jobs with hydro prep data from both “s3://champdata/CMSource/” and “s3://champdata/QA/”, as results in either case will be uploaded to the CHaMP QA bucket.

1. Generate and Check “CFD\_Site\_List.csv”
   1. Run R-code “Build\_CFD\_Site\_List.R”

The file “CFD\_Site\_List.csv” specifies the list of sites to run hydro models for, as well as the measured and modeled discharges, and D84 value, and misc. other values. It also specifies directories where the hydro prep files are located and drives where the results files will be stored. The R script run here automatically builds this file based on the hydro prep files found from step 6, above. It also queries a .csv copy of the CHaMP/AEM data for discharge and D84 values.

This file can be manually edited as needed. If running non-default flow rates, the user may change the “modeled discharge” to a discharge of their choice. If, along with a change in discharge, a known or estimated change in water surface elevation at the downstream exit boundary is available, that can be entered in this file and it will improve the downstream boundary condition significantly. If a manual D84 value is used (over-riding the default value), then the “roughness” value must also be changed manually: set it to D84\*4/1000.

The column “model” simply indicates whether to include a visitID in the hydro model runs. Thus the user may turn off or on individual visit ID’s when running the model.

If editing the file “CFD\_Site\_List.csv”, I f find it easiest to copy and paste “CFD\_Site\_List.csv” file to my local PC, modify columns as needed, then copy and paste “CFD\_Site\_List.csv” back to the AWS PC

1. Run “Build\_Input\_Files.R” on AWS PC (will take hours for more than a few sites)

Notes: This is the key pre-processing step that generates all the input files for Delft 3D flow, as well as batch files and xml files needed. It also generates a suite of QA files.

1. QA check #1: Check boundary conditions jpg file for proper BC

The pre-processing R-script generates a file called “Boundary\_Conditions.jpg” for each visitID being modeled. A simple way to check all of these boundary conditions is to run the R-script “BC\_jpg\_copy.R”. This will copy all of the boundary condition QA files into a single directory to make it easy for users to scroll through them and examine them as a batch. The directory they’ll be stored in is “C:\Matt-SFR Files\Hydraulic Modeling\BC Copies”.

If you are unfamiliar with what to look for when performing QA assessments, contact Matt Nahorniak for training.

If needed and if possible, manually adjust boundary conditions by varying the trim length in “CFD\_Site\_List.csv” and repeat “Run Build Input Files.R” step. Please contact Matt Nahorniak if boundary conditions are changed, or if you’re unable to achieve satisfactory boundary conditions by adjusting the trim length. In cases where manual over-ride of the exit boundary face (north, south, east, or west) is required, this will need to be hard-coded into the pre-processing R script – please contact Matt Nahorniak in this case as well.

1. Run batchfile “batchprocess.bat” in the directory: “C:\Matt-SFR Files\Hydraulic Modeling\R Code to Build Input Files” (Note: may take anywhere from 10 minutes to may hours to run each site; this it can take many days for batches of more for 20-30 sites)
2. Upon completion of the batchprocess.bat script, run the script “vs.bat” in the directory: “C:\Matt-SFR Files\Hydraulic Modeling\R Code to Build Input Files”

This converts Delft 3D output to text output. This step should take only a few seconds per visitID modeled.

1. Run “Post\_Processing.R”

This will may take several hours for batches of 10 or more sites. This script converts the text outputs from Delft 3D Flow into results translated back onto the original DEM grid, and generates the full suite of hydro modeling results files.

1. QA check #2

Users should examine the full suite of QA files. As in QA check #1, users can run the script “BC\_jpg\_copy.R” to copy all QA files into the directory “C:\Matt-SFR Files\Hydraulic Modeling\BC Copies”. Examine each file to ensure the full site is wetted, and there are no outrageous errors obvious for which results should not be used. Again, consult Matt Nahorniak for guidance on the QA process.

If results fail QA, they will need to be removed. Find the VisitID in question from the subdirectories of “C:\Matt-SFR Files\Hydraulic Modeling\champ data from bucket”. Go into the “results” folder for the model in question, and delete the results. Also contact Matt Nahorniak with the visitID and details about why the model in question failed.

1. Upload results to appropriate bucket

Be careful to upload results to the appropriate bucket!!! If these are AEM sites (downloaded from the AEM aws bucket), run the batch file “Results\_to\_AEM\_QA\_bucket” in the directory “C:\Matt-SFR Files\Hydraulic Modeling”. If these are CHaMP sites, run the batch file “Results\_to\_CHaMP\_QA\_bucket” from that same directory.

If you ran models from both the AEM and CHaMP buckets, delete all your results, go sit in a corner, and think about what you’ve done; then re-read step 5; then begin again, running AEM and CHaMP sites on different aws instances.

1. Shut down and Terminate AWS Instance

Be sure to shut down and terminate the AWS instance upon completion! Failure to do so will result in continuous accrual of charges for using the instance!