

HEC-RAS v.5.0.7 Update for the FEWS

Changes from v.5.0.3

December 2020

1 CHANGES

The setup of the HEC-RAS v.5.0.7 in FEWS is similar to that for the HEC-RAS v.5.0.3 implementation. The notable changes in the new version are:

- 1) In v.5.0.3 of the HEC-RAS GUI, the *.p01.tmp.hdf file required for the unsteady flow compute could be generated from the Unsteady Flow Analysis Dialog by a "Geometry Preprocessor" only compute. This no longer works for v.5.1. **A python script is now used to remove the "Results" data group from the *.p01.hdf file generated in the full unsteady compute (Sec 3.1.3).**
- 2) The v.5.0.7 no longer requires the DssWriter in the post processing step.

1.2 Versioning for HEC-RAS Adapter

The new adapter has been tested for Delft-FEWS 2019.02 and 64-bit Java 11.0.4. .

2 HEC-RAS ADAPTER

The HEC-RAS model provides the compute engine for running a hydraulic model schematization for a section of a river or a part of a river system. Two adapters, the FEWS General Adapter and the HEC-RAS Model Adapter form the interface between the FEWS Forecasting Shell and the HEC-RAS model.

The HEC-RAS compute engine is, as its name suggests, the component that performs the HEC-RAS simulation. This simulation is controlled from the adapters, and all run time data such as initial and boundary conditions, and parameter settings are passed through the adapters from and to the FEWS Forecasting Shell.

2.1 Interface between FEWS and HEC-RAS

The Adapters for HEC-RAS form the interface between the FEWS Forecasting Shell and the HEC-RAS model. The FEWS General Adapter of the Forecasting Shell provides the required run-time data to run HEC-RAS, and calls the HEC-RAS Module Adapter. The data is provided in a standardized XML interface format, the FEWS Published Interface. The HEC-RAS Model Adapter transfers the XML-data into the native HEC-RAS file formats.

Once a HEC-RAS run has been completed, relevant results are passed back by the HEC-RAS Module Adapter to the Forecasting Shell (FEWS General Adapter) in the form of the standardized XML interface format.

2.3 Directory structure and model adapter update

The directory structure of HEC-RAS in CHPS is shown in Figure 1. The figure identifies the directories which the content need to be updated:

ColdStateFiles – Should contain the v.5.0.7 of the model *.rst file.

ModuleDataSetFiles – HEC-RAS model input files created by the HEC-RAS GUI v.5.0.7 (Sec 3.1).

Models/HEC-RAS/bin – update or replace the HEC-RAS model adapter files and HEC-RAS executables to the v.5.0.7.

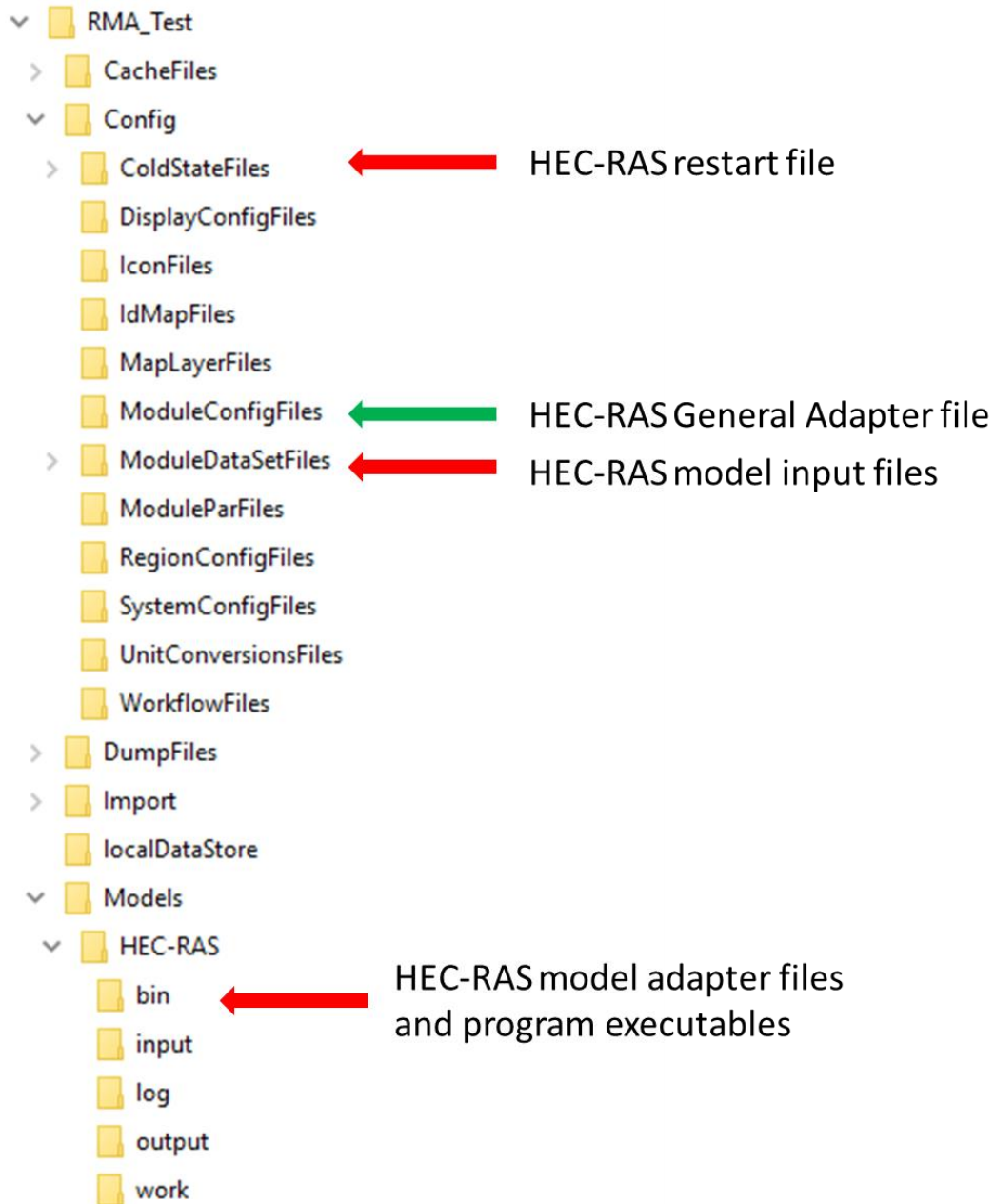


Figure 1 Directory structure for the HEC-RAS in FEWS. The directories requiring updates for the HEC-RAS v.5.0.7 are indicated.

3 HEC-RAS MODEL FILES FOR THE MODULE DATA SET

The HEC-RAS v.5.0.7 GUI is used to produce the base set of model input files for running in the FEWS. The base set of files will be modified by the HEC-RAS adapter to update time series boundary conditions and a few limited set of other runtime parameters such as compute time step.

3.1 Update the v.5.0.7 HEC-RAS model files with the v.5.0.7 HEC-RAS GUI

The required model files for the FEWS are generated by performing an unsteady flow compute through the HEC-RAS GUI.

3.1.2 Generate HEC-RAS model files for v.5.0.7, Overview

The new HEC-RAS model adapter and executables are only able to read v.5.0.7 of the model input files. The older (e.g. v.5.0.3) version of the files will need to be updated using the HEC-RAS GUI v.5.0.7. The text based model files used by the HEC-RAS GUI may not necessarily be updated from earlier version (e.g. from v.5.0.3) by performing the compute. These may need to be updated by save operations in the individual editor. The program version number appears in the text model file and should be 5.07 (Figure 2).

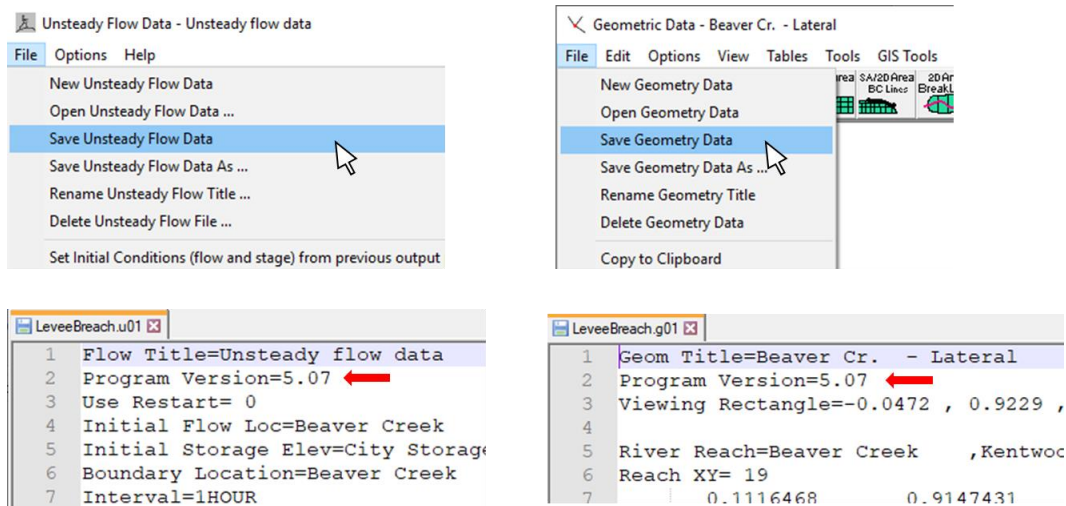


Figure 2 Update of the Unsteady Flow Data (left) and Geometry Data (right) text files through the HEC-RAS data editors

The HEC-RAS GUI generates several text based and two HDF5 format model files that will be transferred to the HEC-RAS/CHPS "ModuleDataSetFiles".

Presently the new HDF5 format files primarily store data pertinent to the HEC-RAS 2-D regions. Over the longer term, the HDF5 format files are intended to replace the text based input files in future versions of the HEC-RAS.

The text based files required by the HEC-RAS in FEWS are divided into two groups. For the example "LeveeBreach" project these are:

- 1) The model files input to the HEC-RAS GUI:

LeveeBreach.prj
LeveeBreach.p01
LeveeBreach.g01
LeveeBreach.u01

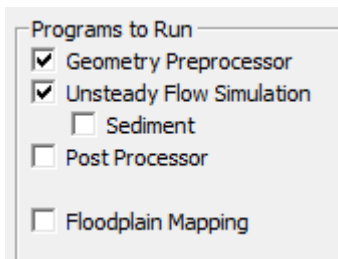
- 2) The text based input files generated by the HEC-RAS GUI for a Geometry Preprocessor (*.x01) and Unsteady flow run (*.b01):

LeveeBreach.x01
LeveeBreach.b01

- 3) The HDF5 format files required by the HEC-RAS geometry and unsteady programs:

LeveeBreach.g01.hdf
LeveeBreach.p01.tmp.hdf

The Geometry Preprocessor and Unsteady Flow Simulation computes will need to be run to create the updated model input files for the HEC-RAS model in the FEWS – the *.x01, *.b01, *.g01.hdf and *.p01.tmp.hdf files discussed above. The generation of a HEC-RAS restart file may also be needed for the HEC-RAS setup in the FEWS. Run the compute with both the “Geometry Preprocessor” and “Unsteady Flow Simulation” boxes both checked:



The compute will generate a *.p01.hdf file with the plan information and the computed results. The *.p01.hdf will need to have the “Results” HDF data group removed and the file renamed to *.p01.tmp.hdf. In the v.5.0.3 GUI, a *.p01.tmp.hdf could be created by only running the Geometry Preprocessor step. **This is no longer the case with the v.5.0.7 GUI.**

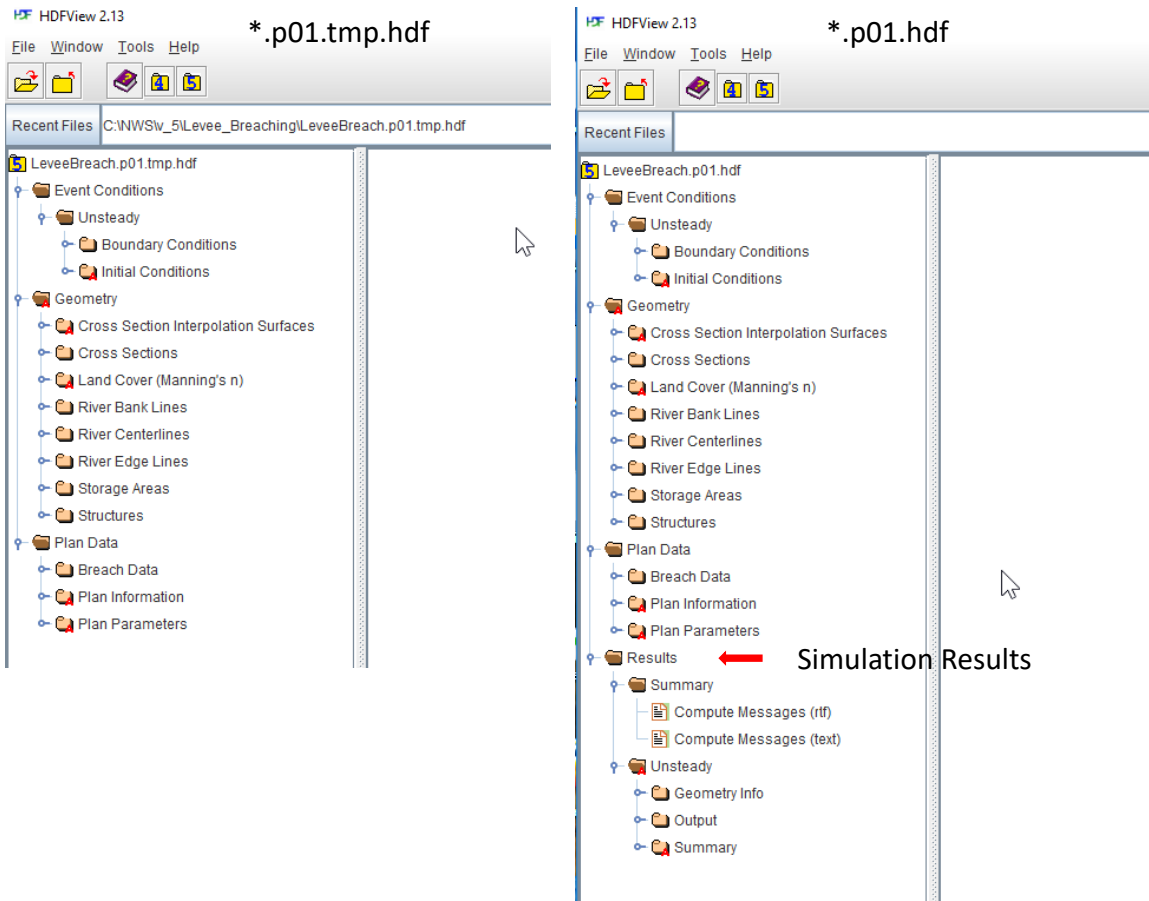


Figure 3 Comparison of the contents for the *.p01.tmp.hdf (left) and the *.p01.hdf (right) HDF5 files.

The “*.p01.tmp.hdf” file contains only the input run information and can be a much smaller file, especially for 2-D models. The contents of the two plan HDF files are compared in Figure 3. **The RasUnsteady compute will not proceed if the “Results” data group is detected in the plan hdf file.**

The “Results” data group can be removed from the plan hdf file using a small Python program (Figure 4):

```
C:>python remove_HDF5_Results.py LeveeBreach.p01.hdf
```

In this case, the output of the program is the file, LeveeBreach.p01.tmp.hdf.

```

remove_HDF5_Results.py
1  '''
2  Created on Mar 29, 2019
3
4  @author: scott
5  '''
6  import h5py
7  import sys
8  from shutil import copyfile
9  import os
10
11  filename = sys.argv[1]
12
13  fsource = h5py.File(filename, 'r')
14  fdest = h5py.File(os.path.splitext(filename)[0] + '.tmp.hdf', 'w')
15
16  # copy attributes
17  for fattr in fsource.attrs.keys() :
18      fdest.attrs[fattr]= fsource.attrs.get(fattr)
19
20  # copy groups, except Results
21  for fg in fsource.keys() :
22      if fg != "Results" :
23          fsource.copy( fg, fdest )
24
25  fdest.close()
26  fsource.close()

```

Figure 4 Python script for creating the *.p01.tmp.hdf file from the computed *.p01.hdf file with the “Results” data group removed. The command line argument is the name of the *.p01.hdf file for processing. The Python utility requires the “h5py” library.

3.2 Copy the HEC-RAS data to the CHPS environment

The HEC-RAS model files discussed in Sec. 3.1 must be copied from the local work directory to the CHPS environment. These file are:

- .prj
- .p01
- .g01
- .u01
- .b01
- .x01
- .p01.tmp.hdf
- .g01.hdf

The numbering can be different. Since the HEC-RAS GUI is Windows based, these files are Windows based as well. After the procedures below the files will be copied to the "Config/ModuleDataSetFiles" directory.

If used, the HEC-RAS restart file (e.g. "*.p01.rst") will be copied to the "Config/ColdStateFiles" directory.