

AutoRAS1Du Module

User's Manual

(Version 1.1)

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Contents

Introduction.....	1
Installation	3
User Guide to Functions.....	4
Flow data file for a 1D unsteady flow analysis	4
Geometry file for a 1D unsteady flow analysis	5
Plan file for a 1D unsteady flow analysis	6
Project file for a 1D unsteady flow analysis	7
Running a 1D unsteady flow analysis and post-processing.....	8
Application.....	9
Example 1	9
Example 2	10
Issues of Current Version.....	11
References.....	12

Introduction

A python module/package, **Py2HecRas**, which is created based on the HEC-RAS API (RAS507.HECRASController and RAS507.HECRASGeometry), includes several functions that can automate a HEC-RAS 1D unsteady flow simulation:

- 1) **Py2HecRas_1DU_Flow()**: create a 1D unsteady flow data file based on the given HEC-RAS geometry data and boundary data (upstream streamflow data and downstream friction slope which are stored in separate CSV files for each reach);
- 2) **Py2HecRas_1DU_Geo()**: modify the Manning's n (given multiply factor) in the original geometry file and create a new geometry file with new Manning's n;
- 3) **Py2HecRas_1DU_Plan()**: create a HEC-RAS 1D unsteady flow plan file based on a template list in the script;
- 4) **Py2HecRas_1DU_Project()**: modify the original HEC-RAS project file;
- 5) **Py2HecRas_1DU_Run()**: run HEC-RAS 1D unsteady flow analysis and extract unsteady results (WSE, flow, average velocity of flow in main channel, and average velocity of flow in total cross section) from the HEC-RAS HDF file, and save as separate CSV files.

The sketch flowchart for the module code is shown in Figure 1.

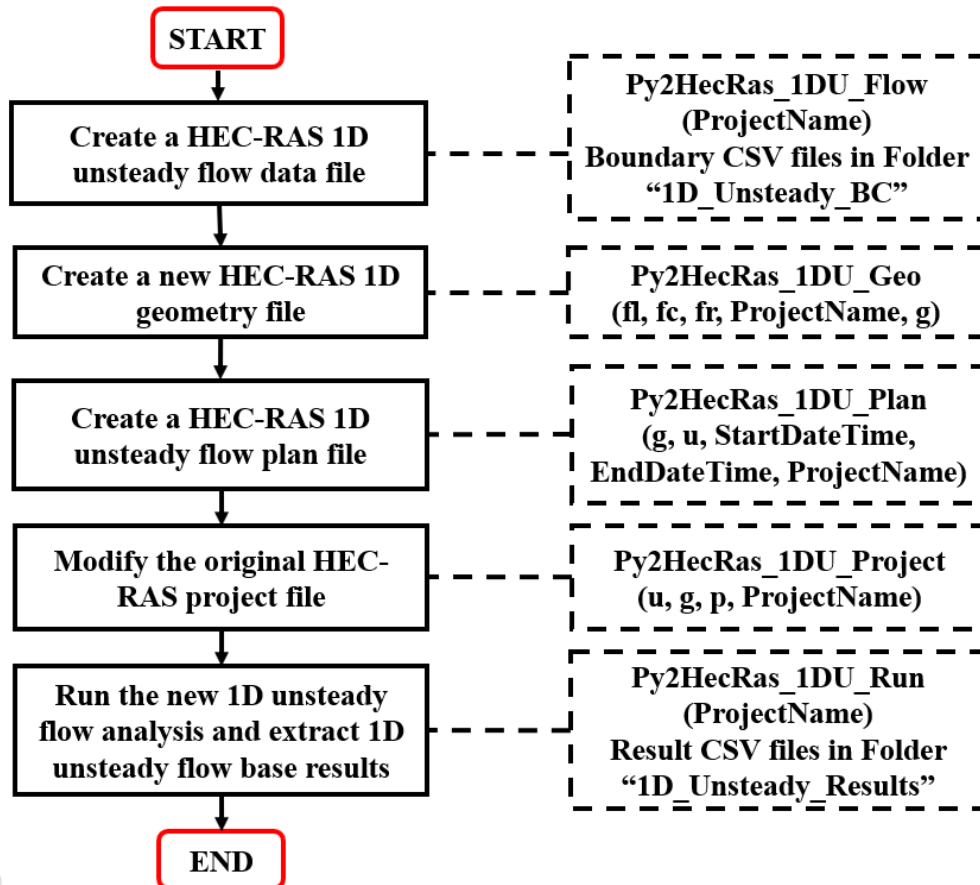


Figure 1. Flowchart for automating HEC-RAS 1D unsteady flow simulations using Python.

The sketch data structure of a HEC-RAS plan HDF5 file for the datasets of flow, water surface elevation, average velocity of flow in main channel, and average velocity of flow in total cross section is shown in Figure 2.

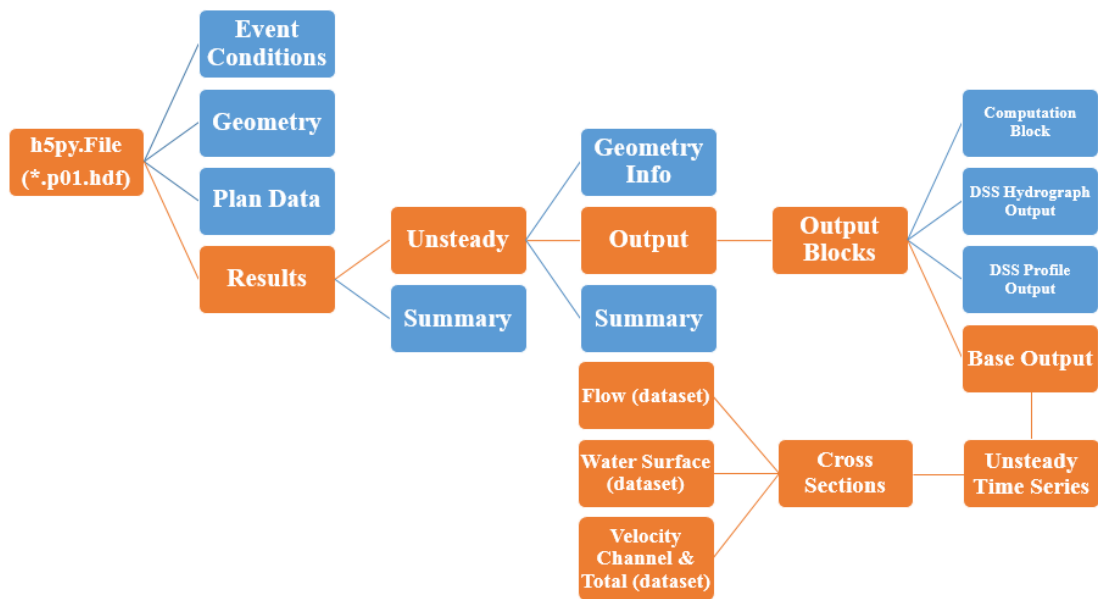


Figure 2. Sketch data structure of HDF5 file for base results of a plan file in HEC-RAS.

Table 1. Introduction.

Installation

User Guide to Functions

Flow data file for a 1D unsteady flow analysis

Py2HecRas_IDU_Flow (ProjectName): create a 1D unsteady flow data file based on the given HEC-RAS geometry data and boundary data (upstream streamflow data and downstream friction slope which are stored in separate CSV files for each reach).

Parameters:

ProjectName is the name (without ".prj") of a HEC-RAS project.

Input:

Given HEC-RAS geometry data and boundary data (CSV files for each reach).

Output:

Creating a new 1D unsteady flow data file.

Geometry file for a 1D unsteady flow analysis

Py2HecRas_IDU_Geo (*fl*, *fc*, *fr*, *ProjectName*, *g*): modify the Manning's n (given multiply factor) in the original geometry file and create a new geometry file with new Manning's n.

Parameters:

fl is the multiply factor for the LOB Manning's n.

fc is the multiply factor for the LOB Manning's n.

fr is the multiply factor for the LOB Manning's n.

ProjectName is the name (without ".prj") of a HEC-RAS project.

g is the new number of geometry files.

Input:

Given HEC-RAS geometry data.

Output:

Creating one or more new 1D geometry files.

Plan file for a 1D unsteady flow analysis

Py2HecRas_IDU_Plan (*g*, *u*, *StartDateTime*, *EndDateTime*, *CI*="1HOUR", *HI*="1DAY", *MI*="1DAY", *DI*="1DAY", *ProjectName*="test"): create a HEC-RAS 1D unsteady flow plan file based on a template list in the script.

Parameters:

g is the number of geometry data files.

u is the number of unsteady flow data files.

StartDateTime is the starting simulation datetime(YYYY-MM-DD,HH:mm).

EndDateTime is the ending simulation datetime(YYYY-MM-DD,HH:mm).

CI is computation interval.

HI is hydrograph output interval.

MI is mapping output interval.

DI is detailed output interval.

ProjectName is the name (without ".prj") of a HEC-RAS project.

Input:

None.

Output:

Creating a new plan file for the 1D unsteady flow analysis.

Project file for a 1D unsteady flow analysis

Py2HecRas_IDU_Project (*u*, *g*, *p*, *ProjectName*): modify the original HEC-RAS project file.

Parameters:

u is the added number of unsteady flow data files.

g is the added number of geometry files.

p is the added number of plan files

ProjectName is the name (without ".prj") of a HEC-RAS project.

Input:

None.

Output:

Adding new content to the original project file for the 1D unsteady flow analysis.

Running a 1D unsteady flow analysis and post-processing

Py2HecRas_IDU_Run (ProjectName): run HEC-RAS 1D unsteady flow analysis and extract unsteady results (WSE, flow, average velocity of flow in main channel, and average velocity of flow in total cross section) from the HEC-RAS HDF file, and save as separate CSV files.

Parameters:

ProjectName is the name (without ".prj") of a HEC-RAS project.

Input:

Given a HEC-RAS flow data file, a geometry file, and a plan file for the 1D unsteady flow analysis.

Output:

Extracting the basic unsteady results (WSE, flow, average velocity of flow in main channel, and average velocity of flow in total cross section) of all the cross sections from the plan HDF file. These results are saved as CSV files in the results folder - '*ID_Unsteady_Results*'.

Application

Example 1

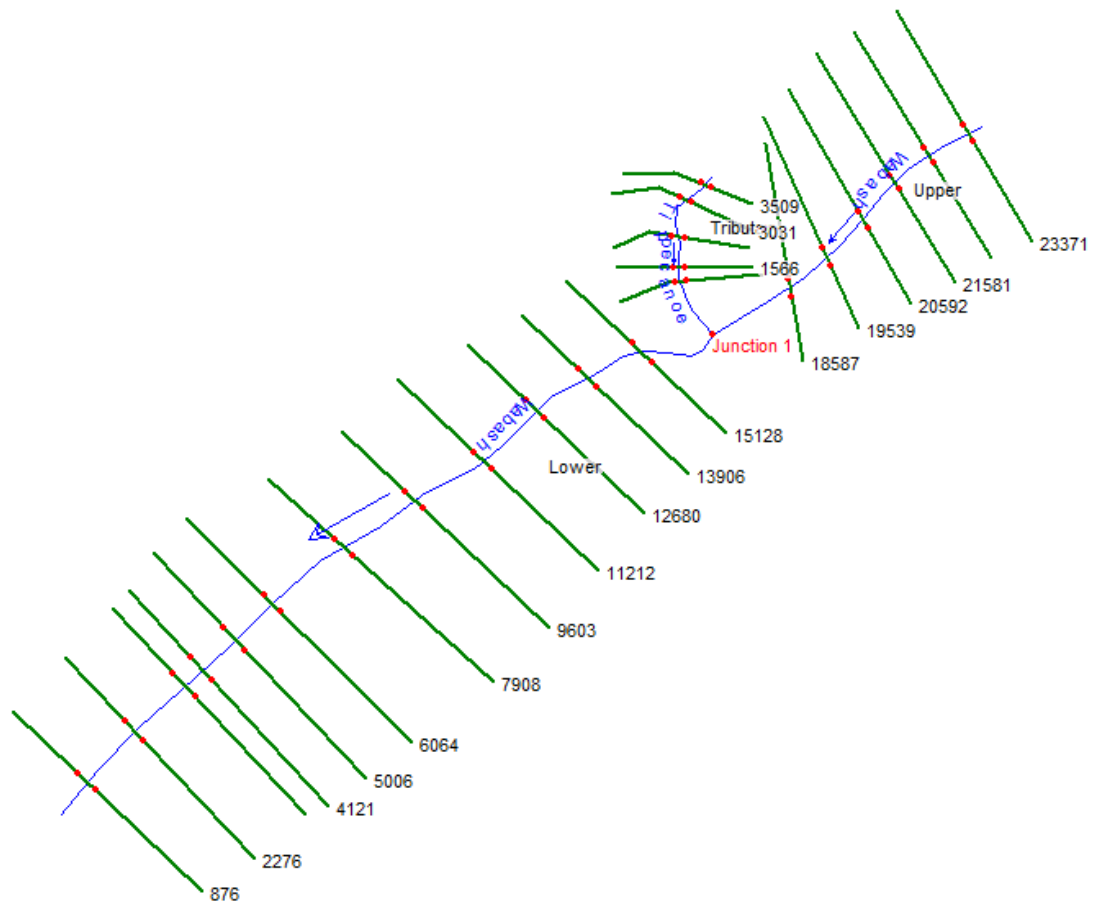


Figure 3. River network of HEC-RAS model-1.

Example 2

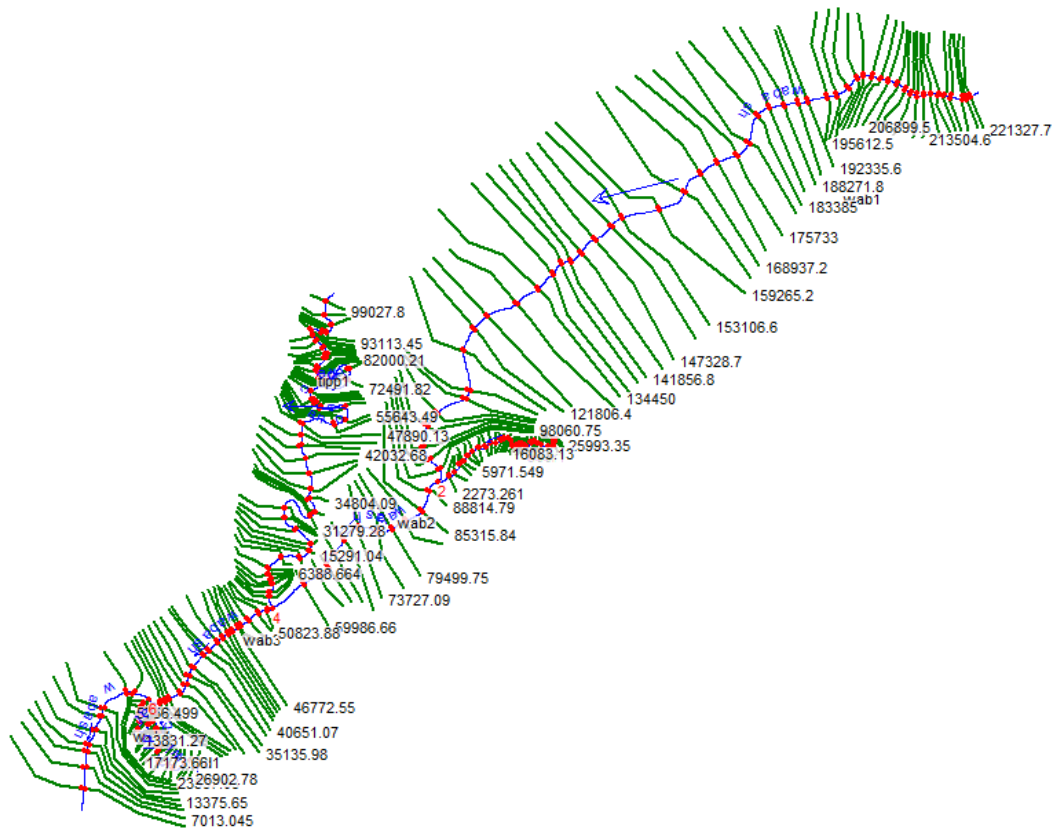


Figure 4. River network of HEC-RAS model-1.

```
>>> import AutoRAS1Du as ARu

>>> # Create a 1D unsteady flow data file based on given boundary data
>>> ARu.Py2HecRas_1DU_Flow(ProjectName="WabashAndTributarie")

>>> # Create a HEC-RAS 1D unsteady flow plan file
>>> ARu.Py2HecRas_1DU_Plan(g=1,u=1,
                           StartDateTime="2008-01-21 00:00",
                           EndDateTime="2008-02-21 00:00",
                           ProjectName="WabashAndTributarie")

>>> # Run HEC-RAS 1D unsteady flow analysis and get results (WSE, flow,
velocity)
>>> ARu.Py2HecRas_1DU_Run(ProjectName="WabashAndTributarie")
```

Issues of Current Version

- 1) Name the boundary data files (CSV): "BC_RiverID_ReachID".csv in the Folder "1D_Unsteady_BC".
- 2) Results named as "Variable of ProjectName".csv are stored in the Folder "1D_Unsteady_Results"

References