HEC-RAS

US Army Corps of Engineers' Hydraulic Engineering Center River Analysis System

Version 4.1

How to Get your Free Version

www.hec.usace.army.mil

HEC-RAS is software that allows the user to perform one dimensional

- Steady and unsteady flow river hydraulics calculations
- Sediment Transport
- Water Quality

Why do we need Models

- Direct Measurements are costly
- Sometimes it is hard
- Prediction

Hec-Ras Capabilities

- Steady flow water surface profiles single reach, dendritic, mixed flow regime.
- Unsteady flow simulation- full network of open channels, adapted from UNET
- Sediment transport/Movable boundary- long term trends of scour and deposition (not ready, only bridge scour)

Input Data

- Flows
- Geometry
 - Cross Section
 - Spacing
 - Structures
- Manning's n
- Calibration Data

Yasser Raslan

Other Applications and Capabilities

- Bridge Scour
- Culverts
- Drop Structures
- Hydraulic Jumps
- Split Flow
- Lateral Weirs
- In Channel Weirs
- Gated Spillways and Weirs
- Vertical Variation in Roughness
- GIS import and export features (HEC-GeoRAS 4.0 with ArcView)

HEC-RAS - Documentation

- User's Manual: provides an introduction and overview of the modeling system, installation instructions, how to get started, a simple example, detailed descriptions of each of the major modeling components, and how to view graphical and tabular output
- 2 Hydraulic Reference Manual: describes the theory and data requirements for hydraulic calculations
- 3 Applications Guide: contains a series of examples that demonstrate various aspects of HEC-RAS.

Geometric Data



Cross Section Data



Edit Station Elevation Data (m)

Steady Flow Data

| Nie Ito Add Multple secht: Reach 4 River Stat: 1420 Add A Flow Change Location Flow Change Location Profile Names and Flow Rates Profile Names and Flow Rates River Reach 4 1315 2146.991 Nike Reach 4 1310 2156.865 Nike Reach 4 1300 2164.352 Nike Reach 4 1290 2175.926 Nike Reach 4 1100 2193.027 Nike Reach 4 1120 2175.926 Nike Reach 4 1125 2175.926 Nike Reach 4 1125 2175.926 Nike Reach 4 1115 2164.352 Nike Reach 4 1115 2164.352 Nike <td< th=""><th></th><th>Lo</th><th>ocations of F</th><th>low Data Chanc</th><th>es</th><th></th></td<> | | Lo | ocations of F | low Data Chanc | es | |
|--|----------------|------------------------|---------------|----------------|------------------------------|------------------------------|
| Reach 4 River Sta: 1420 Add A Flow Change Location Flow Change Location Porifie Names and Flow Rates 1 Nie Reach 4 1420 2141.204 2 Nie Reach 4 1310 2145.931 3 Nie Reach 4 1305 2158.565 5 Nie Reach 4 1300 2164.352 6 Nie Reach 4 1295 2170.139 7 Nie Reach 4 1280 2187.578 8 Nie Reach 4 1280 2187.578 10 Nie Reach 4 1280 2187.578 11 Nie Reach 4 1280 2187.57 10 Nie Reach 4 1270 2193.074 11 Nie Reach 4 1120 2187.57 14 Nie Reach 4 1130 2187.75 14 Nie Reach 4 1130 2187.75 16 Nie Reach 4 1130 2187.75 18 Nie Reach 4 1130 2187.75 18 Nie Reach 4 1130 </th <th>River: Nile</th> <th>•</th> <th></th> <th></th> <th>Add Multiple</th> <th></th> | River: Nile | • | | | Add Multiple | |
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| Nile Reach 4 1420 2141.204 Nile Reach 4 1315 2146.991 Nile Reach 4 1300 2152.778 Nile Reach 4 1300 2158.565 Nile Reach 4 1300 2164.352 Nile Reach 4 1300 2164.352 Nile Reach 4 1290 2175.926 Nile Reach 4 1280 2187.5 Nile Reach 4 1280 2187.5 Nile Reach 4 1280 2187.5 Nile Reach 4 1270 2199.074 Nile Reach 4 1270 2199.074 Nile Reach 4 1100 2187.5 Nile Reach 4 1130 2187.73 Nile Reach 4 1130 2187.73 Nile Reach 4 1120 2170.139 Nile Reach 4 1120 2164.352 Nile Reach 4 1115 2164.352 | River | Reach | RS | PF 3 | | |
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| | 19 Nile | Reach 4 | 1105 | 2152.778 | | |
| 20 Nile Reach 4 1004 902.7778 | 20 Nile | Reach 4 | 1004 | 902.7778 | | |
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| | | Conference Fundamental | | | | |

Summary Figure



Stal Balling

Summary Table

| Profile O | Output Ta | able - Star | ndard Tabl | e 1 | | | | | | | | |
|--------------|-----------|-------------|------------|-------------|-----------|-----------|-----------|------------|------------|-------------|------------|--------------|
| ile Optio | ons Sto | l. Tables | Locations | Help | | | | | | | | |
| | | | | | | | | HEC-RAS | Plan: Plan | 08 River: I | Nile Reach | : Reach 4 Pr |
| each F | River Sta | Profile | Q Total | Min Ch El 1 | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chi |
| | | | (m3/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m2) | (m) | |
| Reach 4 1 | 1420 | PF 3 | 2141.20 | 35.55 | 47.96 | 0.0 | 47.97 | 0.000018 | 0.47 | 4545.24 | 828.66 | 0.06 |
| Reach 4 1 | 1410 | PF 3 | 2141.20 | 41.99 | 47.65 | | 47.67 | 0.000043 | 0.60 | 3558.57 | 819.60 | 0.09 |
| Reach 4 1 | 1405 | PF 3 | 2141.20 | 39.83 | 47.49 | | 47.53 | 0.000076 | 0.85 | 2527.37 | 506.28 | 0.12 |
| Reach 4 1 | 1400 | PF 3 | 2141.20 | 39.48 | 47.18 | | 47.22 | 0.000089 | 0.83 | 2571.58 | 551.30 | 0.12 |
| Reach 4 1 | 1395 | PF 3 | 2141.20 | 40.02 | 46.80 | | 46.84 | 0.000064 | 0.79 | 2697.14 | 495.68 | 0.11 |
| Reach 4 1 | 1390 | PF 3 | 2141.20 | 39.90 | 46.53 | | 46.56 | 0.000102 | 0.78 | 2734.69 | 622.83 | 0.12 |
| Reach 4 1 | 1385 | PF 3 | 2141.20 | 38.62 | 45.94 | | 45.98 | 0.000117 | 0.95 | 2260.69 | 401.87 | 0.13 |
| Reach 4 1 | 1380 | PF 3 | 2141.20 | 36.13 | 45.14 | | 45.20 | 0.000155 | 1.05 | 2031.59 | 379.98 | 0.15 |
| Reach 4 1 | 1375 | PF 3 | 2141.20 | 32.84 | 44.74 | | 44.76 | 0.000073 | 0.66 | 3222.66 | 688.36 | 0.10 |
| Reach 4 1 | 1370 | PF 3 | 2141.20 | 29.50 | 44.33 | | 44.38 | 0.000060 | 0.99 | 2159.39 | 281.37 | 0.11 |
| Reach 4 1 | 1365 | PF 3 | 2141.20 | 37.04 | 44.02 | | 44.08 | 0.000100 | 1.07 | 1995.87 | 341.45 | 0.14 |
| Reach 4 1 | 1360 | PF 3 | 2141.20 | 30.77 | 43.37 | | 43.43 | 0.000113 | 1.10 | 1950.93 | 354.09 | 0.15 |
| Reach 4 1 | 1355 | PF 3 | 2141.20 | 35.41 | 42.64 | | 42.71 | 0.000199 | 1.16 | 1848.12 | 476.02 | 0.19 |
| Reach 4 1 | 1350 | PF 3 | 2141.20 | 29.07 | 42.37 | | 42.40 | 0.000025 | 0.73 | 2952.40 | 481.99 | 0.09 |
| Reach 4 1 | 1345 | PF 3 | 2141.20 | 35.41 | 42.13 | | 42.18 | 0.000104 | 0.98 | 2178.02 | 653.62 | 0.17 |
| Reach 4 1 | 1340 | PF 3 | 2141.20 | 34.40 | 41.40 | | 41.48 | 0.000166 | 1.24 | 1727.25 | 523.80 | 0.22 |
| Reach 4 1 | 1335 | PF 3 | 2141.20 | 34.35 | 40.87 | | 40.92 | 0.000088 | 0.96 | 2234.18 | 619.37 | 0.16 |
| Reach 4 1 | 1330 | PF 3 | 2141.20 | 33.19 | 40.45 | | 40.50 | 0.000078 | 1.08 | 1985.15 | 418.51 | 0.16 |
| Reach 4 1 | 1325 | PF 3 | 2141.20 | 32.64 | 39.94 | | 40.02 | 0.000109 | 1.24 | 1729.63 | 357.54 | 0.18 |
| Reach 4 1 | 1320 | PF 3 | 2141.20 | 31.25 | 39.52 | | 39.57 | 0.000082 | 1.03 | 2079.44 | 488.93 | 0.16 |
| Reach 4 1 | 1315 | PF 3 | 2146.99 | 31.46 | 38.99 | | 39.06 | 0.000104 | 1.19 | 1802.92 | 406.23 | 0.18 |
| Reach 4 1 | 1310 | PF 3 | 2152.78 | 32.78 | 38.65 | | 38.68 | 0.000061 | 0.80 | 2690.53 | 745.34 | 0.13 |
| Reach 4 1 | 1305 | PF 3 | 2158.57 | 32.41 | 38.28 | | 38.33 | 0.000094 | 0.96 | 2253.97 | 656.99 | 0.17 |
| Reach 4 1 | 1300 | PF 3 | 2164.35 | 28.87 | 37.64 | | 37.72 | 0.000088 | 1.26 | 1719.73 | 314.81 | 0.17 |
| Reach 4 1 | 1295 | PF 3 | 2170.14 | 31.83 | 37.16 | | 37.22 | 0.000102 | 1.02 | 2132.44 | 601.83 | 0.17 |
| Reach 4 1 | 1290 | PF 3 | 2175.93 | 28.58 | 36.95 | | 36.97 | 0.000028 | 0.57 | 3830.74 | 979.71 | 0.09 |
| Reach 4 1 | 1285 | PF 3 | 2181.71 | 28.17 | 36.68 | | 36.75 | 0.000086 | 1.18 | 1850.24 | 366.42 | 0.17 |
| Reach 4 1 | 1280 | PF 3 | 2187.50 | 30.09 | 36.40 | | 36.43 | 0.000049 | 0.71 | 3083.10 | 859.42 | 0.12 |
| Reach 4 1 | 1275 | PF 3 | 2193.29 | 28.87 | 36.03 | | 36.10 | 0.000117 | 1.17 | 1872.27 | 443.90 | 0.18 |
| Reach 4 1 | 1270 | PF 3 | 2199.07 | 29.00 | 35.41 | | 35.47 | 0.000125 | 1.11 | 1984.87 | 540.18 | 0.18 |
| Reach 4 1 | 1265 | PF 3 | 2199.07 | 23.04 | 35.04 | | 35.07 | 0.000051 | 0.73 | 3011.86 | 830.32 | 0.12 |
| Reach 4 1 | 1260 | PF 3 | 2199.07 | 28.18 | 34.61 | | 34.67 | 0.000115 | 1.10 | 2004.07 | 553.63 | 0.18 |
| leach 4 1 | 1255 | PF 3 | 2199.07 | 26.32 | 34.14 | | 34.19 | U.000076 | 0.91 | 2422.54 | 694.17 | 0.16 |
| leach 4 1 | 1250 | PF 3 | 2199.07 | 25.42 | 33.72 | | 33.79 | U.000094 | 1.21 | 1815.67 | 395.14 | 0.18 |
| leach 4 1 | 1245 | PF 3 | 2199.07 | 27.82 | 33.35 | | 33.38 | 0.000069 | 0.79 | 2797.44 | 933.35 | 0.14 |
| leach 4 1 | 1240 | PF 3 | 2199.07 | 25.75 | 32.89 | | 32.94 | 0.000106 | 1.01 | 2168.78 | 678.67 | 0.18 |
| Reach 4 1 | 1235 | PF 3 | 2199.07 | 24.42 | 32.48 | | 32.52 | 0.000067 | 0.86 | 2554.44 | 720.92 | 0.15 |
| leach 4 1 | 1230 | PF 3 | 2199.07 | 24.77 | 32.01 | | 32.06 | 0.000097 | 1.04 | 2121.47 | 599.84 | 0.18 |
| each 4 1 | 1225 | PF 3 | 2199.07 | 25.00 | 31.50 | | 31.57 | 0.000121 | 1.22 | 1808.29 | 473.18 | 0.20 |
| Josoph I I 1 | 1000 | 1003 | 1 2100.07 | 24.27 | 21.00 | | 21.10 | n nnnn07 | n 01 | 2400 AE | 775 40 | 0.10 |

Total flow in cross section.

Sediment transport Module

| 🤘 Sediment Data - se | diment1 | | | | | | | | | | |
|---|------------------|----------------|---|--|--|--|--|--|--|--|--|
| File Options View | Help | | | | | | | | | | |
| Initial Conditions and Transport Parameters Boundary Conditions | | | | | | | | | | | |
| Select Location for Sediment Boundary Condition | | | | | | | | | | | |
| Add Sediment Bound | dary Location(s) | Delete Curre | rent Row | | | | | | | | |
| | | Sedime | ment Boundary Condition Types | | | | | | | | |
| Rating Curve | s Si | ediment Load (| d Series Equilibrium Load | | | | | | | | |
| Riv\SA | Reach | RS | | | | | | | | | |
| 1 Dammitta re | each5 | 394 | Sediment Time Series | | | | | | | | |
| Dammitta re |)ammitta reach5 | | Rating Curve | | | | | | | | |
| | | | Load Specification for Dammitta reach5 9 Number of flow-load points 2 sets | | | | | | | | |

| | and of now load points | | | |
|----|-------------------------|--------|-----------|---|
| | Flow (m3/s) | 350 | 1000 | |
| | Total Load (tonnes/day) | 150 | 500 | |
| 1 | Clay | | | |
| 2 | VFM | | | |
| 3 | FM | | | |
| 4 | MM | | | |
| 5 | CM | | | |
| 6 | VFS | | | |
| 7 | FS | 0.0351 | 0.0351 | |
| 8 | MS | 0.7778 | 0.7778 | |
| 9 | CS | 0.1772 | 0.1772 | |
| 10 | VCS | 0.0099 | 0.0099 | |
| 11 | VFG | | | |
| 12 | FG | | | |
| 13 | MG | | | |
| 14 | CG | | | |
| 15 | VCG | | | |
| 16 | SC | | | |
| 17 | LC | | | |
| 18 | SB | | | • |
| | Plot | | OK Cancel | |

Limitations

- Uncoupled
- Flow is constant with respect to time (unsteady is optional)
- Flow is gradually varied with distance
- Dominant flows in x direction (1-D)
- Channel slopes less than 1:10H