CE 5362 Surface Water Modeling
Project 8

Introduction and Purpose

SToRM is a component of the USGS Multi-Dimensional Surface Water Modeling System (McDonald and others, 2012) SToRM is one of a generation of recently available 2–D hydrodynamic models available without charge or for low cost. This project is to gain experience using the model to study the time-varying behavior of confluence of two streams

Problem Background

Figure 1 is a plan view map of a stream confluence, conceptualized in SToRM. The inflows are the leftmost boundaries, and the outflow is the rightmost boundary.

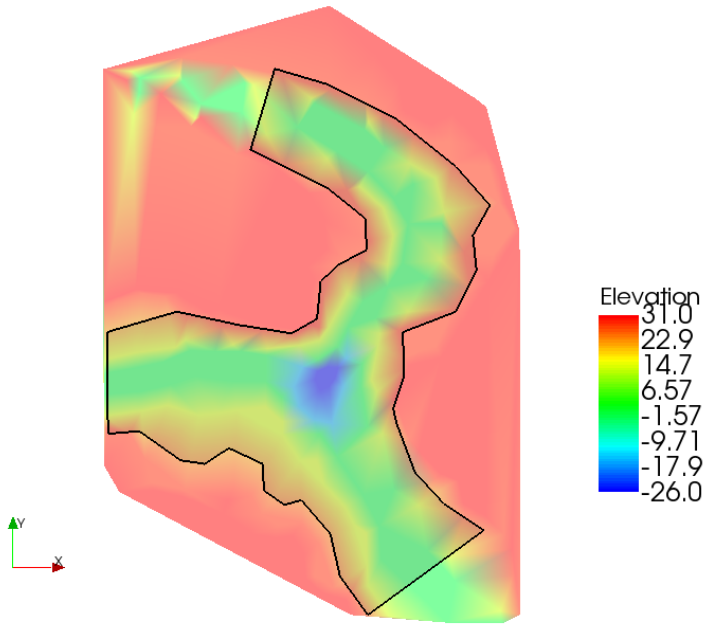

Figure 1: Aerial view of confluence with elevation scale shown. The portion outside area of interest is set to elevation 31 meters.

The dark blue "hole" is thought to confer advantage by reducing velocity of water in its vicinity, thus suspended constituents could conceivably be captured in this region, if indeed the velocity field is affected.

Topographic Model for the Confluence

STоRM uses a topographic database in XYZ format. Simple topographic files was built by digitizing a contour map of the study area using `G3DATA`, the file is named `bayou.jpg.txt.tpo`.

Boundary Conditions

The inflow boundary conditions were obtained by digitizing hydrographs from Wang, et. al. 1996 using `G3DATA`, and are listed herein, first the inflow hydrographs, then a stage hydrograph for the downstream end.

```
buffalo bayou upstream
time(s) q(cms)
874.0515933 12.64913151
9614.567527 12.64913151
20540.21244 28.46054591
33650.98634 69.57022333
42828.52807 120.1667494
52006.0698 177.0878412
56376.32777 284.6054591
59872.53414 382.6362283
64679.81791 480.6669975
70361.15326 572.373201
74731.41123 645.1057072
82160.84977 695.7022333
87842.18513 724.1627792
93960.54628 702.026799
104012.1396 660.9171216
110567.5266 622.969727
116248.8619 588.1846154
123241.2747 458.5310174
130233.6874 338.364268
138100.1517 243.4957816
146403.6419 151.7895782
159514.4158 104.355335
175684.3703 66.40794045
195350.5311 50.59652605
216327.7693 41.10967742
238616.085 31.62282878
```

```
266585.736 28.46054591
```

```
whiteoak upstream
time(s) q(cms)
0 6.324565757
12236.72231 25.29826303
26221.5478 60.08337469
37147.19272 148.6272953
41517.45068 202.3861042
48946.88923 265.6317618
56376.32777 471.1801489
60746.58574 800.0575682
63805.76631 1087.82531
65990.8953 1217.478908
67738.99848 1255.426303
69050.07587 1261.750868
72546.28225 1207.99206
80412.74659 961.333995
86531.10774 768.4347395
98330.80425 569.2109181
112752.6555 455.3687345
121930.1973 357.3379653
126300.4552 281.4431762
134166.9196 202.3861042
154270.1062 148.6272953
175684.3703 101.1930521
197972.6859 66.40794045
223320.1821 47.43424318
249978.7557 28.46054591
267022.7618 18.97369727
```

```
buffalo bayou downstream
time(s) stage(m)
0 0.855517268
3600 0.829221902
21600 0.847630963
43200 5.15802561
64800 6.236632103
66600 7.496430836
86400 2.774979436
108000 1.780747007
129600 1.394051388
```

```
151200 7.430356329
172800 4.580329805
194400 3.283308232
217800 2.437974098
241200 1.96207322
264600 1.628190963
286200 1.445657756
304200 1.346646963
324000 1.25942361
351000 1.164144829
378000 1.088578963
403200 1.049420732
432000 1.027644817
460800 0.997132927
496800 0.963971902
529200 0.939514927
558000 0.908042146
585000 0.905417988
603000 0.921159646
644400 0.913289805
684000 0.90279361
689400 0.898419159
```

Problem Statement

Build and run a SToRM model of the confluence, write a brief report (like a lab report) and include:

1. The velocity pattern in the confluence, at the peak White Oak discharge.
2. The velocity pattern in the confluence, at the peak Buffalo Bayou discharge.
3. The velocity pattern in the confluence, at the highest WSE in the confluence (as close as you can based on your output frequency).
4. Are the recirculation regions stable, or do they move about over the simulation time.

References

USGS Geomorphology Laboratory (2011). System for Transport and River Modeling.

`http://wwwbrr.cr.usgs.gov/projects/GEOMORPH_Lab/project-SToRM.html` Webpage last accessed, 12 Jan 2012.

McDonald, R.R., Nelson, J.M., and Bennett, J.P., (2012). *in press*. Multi-dimensional surface-water modeling system user's guide: U.S. Geological Survey Techniques and Methods, 6-B2, 136 p.