Appendix C

CALL FOR PHASE A MODEL EVALUATION

Contents

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The BAY-DELTA MODELING FORUM - GUIDELINES FOR A PEER-REVIEW PROCESS anticipates an Initial Review that includes written questions to model developers, test runs and workshop discussions to review initial results.

As anticipated, the model documentation has been provided in all possible shapes and forms. As a beginning phase (PHASE A) to this INITIAL REVIEW, we have defined a number of schematic applications to begin our familiarization with the candidate models. These applications will provide a data base of comparable detail on all five models. It will put us in a much more secure position to frame the written questions and provide suitable background information for workshop discussions.

Schematic applications (H1) through (H8) (hydrodynamics) and (M1) through (M4) (mass transport) have been defined.

C.1 1-D HYDRODYNAMIC and MASS TRANSPORT MODEL SYSTEMS

We begin with a restatement of the physical problem and a definition of terms.

1. PHYSICAL PROBLEM

   Unsteady flow and conservative contaminant (e.g. salinity) transport in a network of tidal channels.

2. FORCING

   Downstream tide stage or discharge and upstream river stage or discharge hydrographs at open boundaries. Contaminant concentration or contaminant flux at downstream and upstream open boundaries. Non-point lateral inflows (outflows) of water and/or contaminant along the channel. Point contaminant sources.

3. SPACE AND TIME RESOLUTION

   Adequate resolution of tide and flood hydrographs, and of point and non-point sources.

4. FIELD EQUATIONS

   Incompressible flow is assumed, in which the mass density ρ is constant.

Mass conservation for water.

$$b\frac{\partial \eta}{\partial t} + \frac{\partial Q}{\partial x} = q \tag{C.1.1}$$

in which x is local position, t is local time, $\eta(x,t)$ is the local water surface elevation to a fixed horizontal datum, $Q(x,t)$ is the local discharge or cross-section-integrated flow, $b(x,t)$ is the local surface width and $q(x,t)$ is the local lateral inflow per unit length. NOTE in particular that η is NOT the water depth (see Figure C.1).

Momentum conservation for water.

$$\frac{\partial Q}{\partial t} + \frac{\partial}{\partial x}(\frac{Q^2}{A}) = -gA\frac{\partial \eta}{\partial x} - \frac{\tau_0}{\rho}P \tag{C.1.2}$$

in which g is the gravitational acceleration, $A(x,t)$ is the local flow cross-section and $P(x,t)$ is the local wetted perimeter. The boundary shear $\tau_0(x,t)$ is estimated from a friction model, either

$$\tau_0 = \begin{cases} \frac{f}{8}\rho\frac{|Q|Q}{A^2} & \text{for Darcy-Weisbach model} \\ \frac{g}{\mathcal{C}^2}\rho\frac{|Q|Q}{A^2} & \text{for Chezy model} \\ \frac{g}{R^{1/3}}\left(\frac{n}{1.49}\right)^2\rho\frac{|Q|Q}{A^2} & \text{for Manning model [ft s units]} \end{cases} \tag{C.1.3}$$

in which f, $\mathcal{C}$ and n are the Darcy-Weisbach, Chezy and Manning friction factors respectively. $R = A/P$ is the local hydraulic radius.

Mass conservation for conservative contaminant.

$$\frac{\partial}{\partial t}(AC) + \frac{\partial}{\partial x}(QC) = \frac{\partial}{\partial x}\left(E_x A \frac{\partial C}{\partial x}\right) + S \tag{C.1.4}$$

where $C(x,t)$ is the local cross-section-averaged contaminant concentration, $E_x(x,t)$ is the local longitudinal dispersion coefficient and $S(x,t)$ is a local point or non-point contaminant source.

Assuming that the friction factor, the lateral inflow q and the contaminant sources S can be defined, the dependent variables are the local water surface elevation $\eta(x,t)$ and the local cross-section-integrated flow $Q(x,t)$ in the hydrodynamic Equations C.1.1 and C.1.2 and the local cross-section-averaged contaminant concentration $C(x,t)$ in the contaminant transport Equation C.1.4. In a natural channel, the surface width b, the flow area A and hydraulic radius R are dependent on η and x.

5. CHANNEL GEOMETRY

   b, A, P and R are space and time variable. Both the local water surface elevation $\eta(x,t)$ and the local bed elevation $Z(x)$ are measured from a fixed HORIZONTAL datum plane (MSL or NGVD or NAVD or ...)

C.2 PHASE A SCHEMATIC CHANNELS

In all of the Phase A schematic applications, the channels have a trapezoidal cross-section, as sketched in Figure C.1 The bed width B will be fixed for each schematic channel reach but may

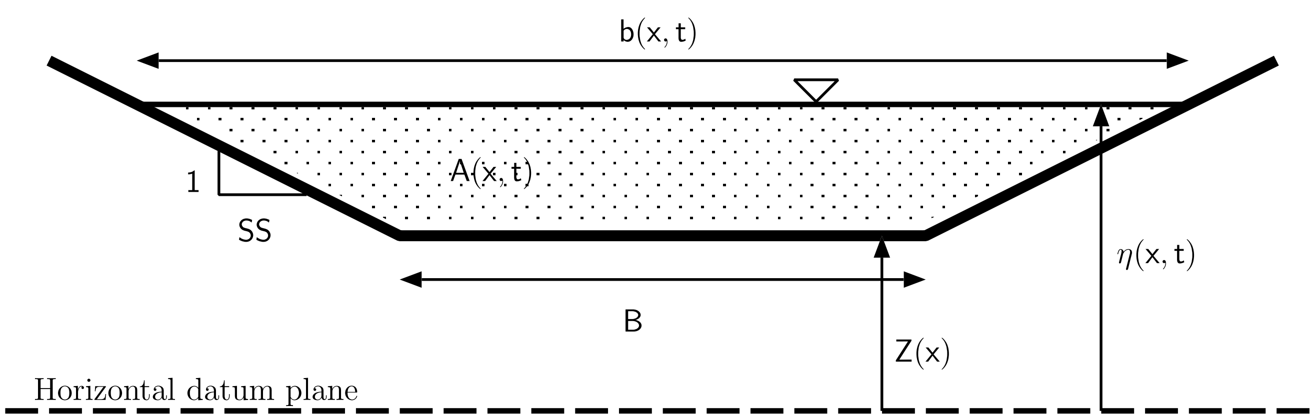

Figure C.1: Cross-Section of Schematic Channel.

vary from reach to reach. The bed elevation Z may change along the reach, at most in a linear manner with distance x along the channel. The side slopes of the schematic channels are 1 (vertical) to SS (horizontal). All trapezoidal channels have SS $= 2$. Rectangular channels have SS $= 0$.

In most the schematic problems outlined in the following, lateral inflows q and contaminant sources S are zero throughout. The exception is hydrodynamic problem H8, whose specific focus is lateral inflow.

C.3 SCHEMATIC HYDRODYNAMIC PROBLEMS

In all of these schematic hydrodynamic problems, the coupled mass transport is ignored. Zeros should be entered for local C and E_x.

(H1). Steady, uniform flow in an open-ended channel
Focus: dominant momentum balance, numerical precision.

Channel bed slopes linearly upwards from downstream point F to upstream point L. The x axis is directed upstream from F to L. The trapezoidal channel bed width B is 10 ft. At F, $x_F = 0$ ft, $Z_F = +1.00$ ft and $Q_F = -200$ ft^3/s. At L, $x_L = 10,000$ ft, $Z_L = +3.00$ ft and $Q_L = -200$ ft^3/s. Channel friction factor is constant at Darcy-Weisbach $f = 0.03$ or Manning $n = 0.02$.

Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

Choose *near* uniform flow initial conditions. Compute and write to file in the STANDARD FORMAT[1] the initial conditions at $t = 0$ and the model predictions for every time step to $t = 20\Delta t$.

If necessary, continue this computation for sufficient additional time steps as is necessary to reach the STEADY STATE. Append this solution to the end of the output file.

(H2). Transient response to an initial mound in an open-ended channel on a horizontal bed
Focus: propagation of wave, open boundary conditions.

Channel bed is horizontal from downstream point F to upstream point L. The trapezoidal channel bed width B is 10 ft. At F, $x_F = 0$ ft and $Z_F = +1.00$ ft. At L, $x_L = 10{,}000$ ft and $Z_L = +1.00$ ft. Channel friction factor is constant at Darcy-Weisbach $f = 0.03$ or Manning $n = 0.02$.

The initial conditions at $t = 0$ are

$$\eta(x,0) = 5 + 0.5\exp\left[-c\left(\frac{x-5000}{1500}\right)^2\right] \quad \text{ft} \tag{C.3.1}$$

$$Q(x,0) = 0 \tag{C.3.2}$$

where $c = \ln 2 = 0.6931$.

Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

[1] See section STANDARD FORMAT for details of required output file format

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 50\Delta t$.

(H3). Transition from quiescent initial conditions to steady state circulation in uniform channel with upstream fresh water discharge and downstream tide.
Focus: initial transients, mixed boundary conditions.

Channel bed slopes linearly upwards from downstream point F to upstream point L. The trapezoidal channel bed width B is 50 ft. At F, $x_F = 0$ ft, $Z_F =$ -20.00 ft and

$$\eta(x_F, t) = 3 \sin \omega t \text{ for } t > 0 \tag{C.3.3}$$

where $\omega = 2\pi/T$, the tidal period T being 12.5 hours.

At L, $x_L =$ 250,000 ft, $Z_L =$ +10.00 ft and

$$Q(x_L, t) = -1,000 \text{ ft}^3/\text{s for } t > 0 \tag{C.3.4}$$

Channel friction factor is constant at Darcy-Weisbach $f = 0.03$ or Manning $n = 0.02$.

Initial conditions at $t = 0$ are quiescence.

$$\eta(x, 0) = +20 \quad \text{ft}, \qquad Q(x, 0) = 0 \tag{C.3.5}$$

Use a fixed computational space step $\Delta x =$ 500 ft and a fixed computational time step Δt = 30 s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 2T$.

(H4). Steady flow through a simple channel network
Focus: network connectivity, steady circulation.

Channel geometry for the Figure C.2 is listed in Table C.1.

Reach	#1/AB	#2/BC	#3/CD	#4/BF	#5/FE	#6/CF
B ft	400	300	300	200	200	100
L ft	25,000	10,000	10,000	10,000	10,000	10,000
f	0.02	0.025	0.025	0.03	0.03	0.04
n	0.016	0.018	0.018	0.02	0.02	0.03
Node	A	B	C	D	E	F
Z ft	-20	-15	-10	+0	-5	-10

L is reach length.

Table C.1: Channel geometry for Schematic Network

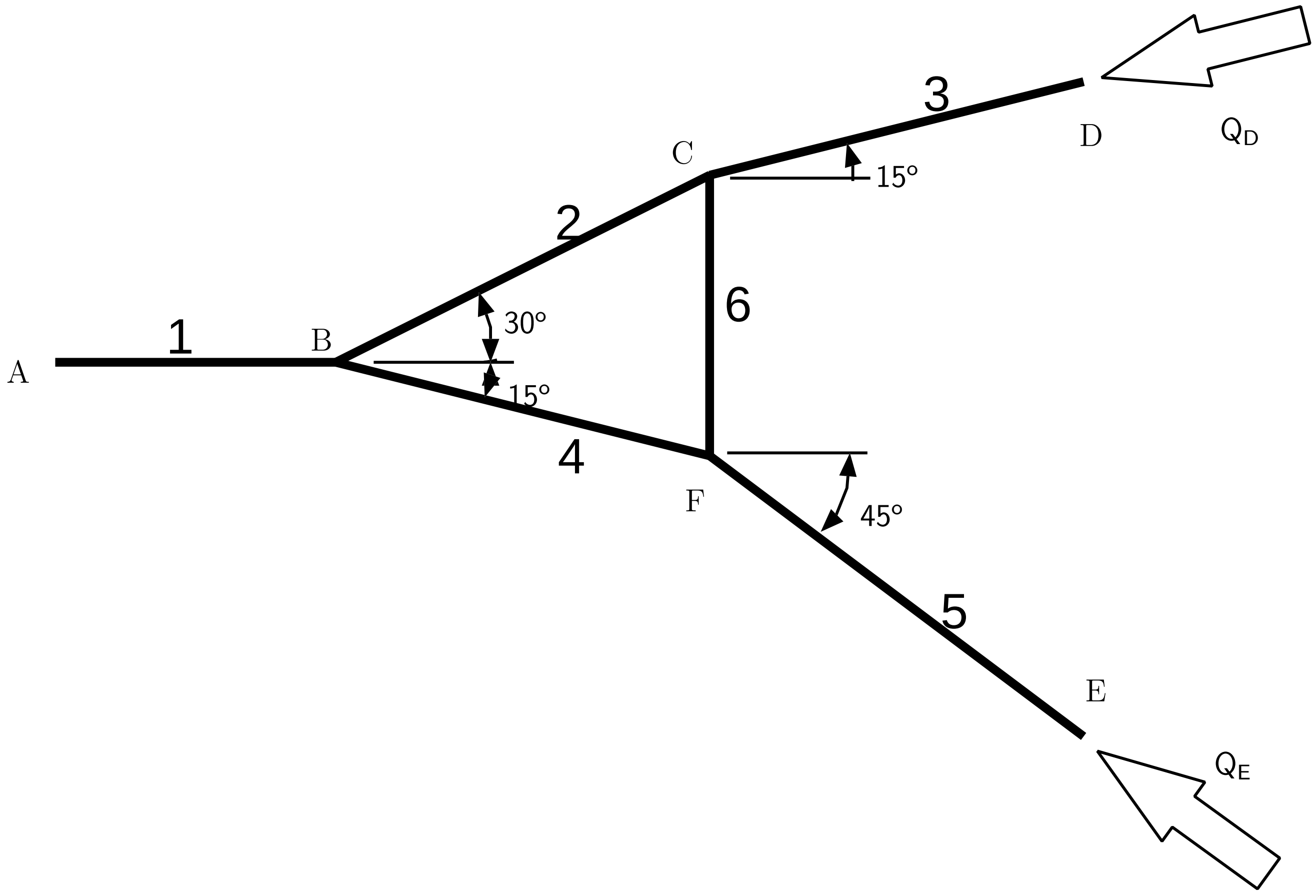

Figure C.2: Schematic Network.

Open boundary conditions are fixed at

$$\eta_A(t) = 0, \quad Q_D(t) = 4,000 \text{ ft}^3/\text{s}, \quad Q_E(t) = 2,000 \text{ ft}^3/\text{s} \qquad \text{for all } t > 0 \tag{C.3.6}$$

Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for EVERY time step to STEADY STATE.

(H5). Unsteady flow through a simple channel network
Focus: network connectivity, network circulation.

Channel network geometry is the same as schematic application (H4). Also, use the same fixed Δt and Δx as in (H4).

Open boundary conditions are

$$\eta_A(t) = \begin{cases} 0 & \text{for } t \le 0 \\ 3\sin\omega t & \text{for } t > 0 \end{cases}$$
$$Q_D(t) = 4,000 \text{ ft}^3/\text{s for all } t$$
$$Q_E(t) = 2,000 \text{ ft}^3/\text{s for all } t \tag{C.3.7}$$

where $\omega = 2\pi/T$, the tidal period T being 12.5 hours.

As initial conditions, use the STEADY STATE solution from application (H4). Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 2T$.

(H6). Steady flow through a channel gate
Focus: gate transients, network connectivity.

Channel bed is horizontal from upstream point A to downstream point D. The trapezoidal channel bed width B is 50 ft. At A, $x_A = 0$ ft and $Z_A = -20.0$ ft. At D, $x_D = 50,000$ ft and $Z_D = -20.00$ ft. Channel friction factor is constant at Darcy-Weisbach $f = 0.03$ or Manning $n = 0.02$.

An underflow gate is located at $x_B = x_C = +20,000$ ft, with point B on the upstream side, and point C on the downstream side. At $t = 0$ s, the gate is fully open, and remains fully open throughout.

The hydrodynamic initial conditions at $t = 0$ s are quiescence:

$$\eta(x,0) = 0 \qquad \text{and} \qquad Q(x,0) = 0 \tag{C.3.8}$$

The gate (see Figure C.3) operates with steady throughflow following

$$Q = C_G A_G \left(2g\Delta\eta\right)^{1/2} \tag{C.3.9}$$

The gate discharge coefficient C_G is 0.5. The gate flow area is

$$A_G = \begin{cases} W\left[\max(\eta_B, \eta_C) - Z_{sill}\right] & \text{for } \max(\eta_B, \eta_C) > Z_{sill} \\ 0 & \text{for } \max(\eta_B, \eta_C) \le Z_{sill} \end{cases} \tag{C.3.10}$$

where $W = 40$ ft is the uniform gate width, and $Z_{sill} = -15$ ft is the elevation of the sill. The water surface elevation difference across the gate is $\Delta\eta = |\eta_B - \eta_C|$, the flow being in the direction of falling elevation.

Open boundary conditions are fixed at

$$Q_A(t) = +20,000 \text{ ft}^3/\text{s} \quad \text{and} \quad \eta_D(t) = +0 \text{ ft} \qquad \text{for all } t > 0 \tag{C.3.11}$$

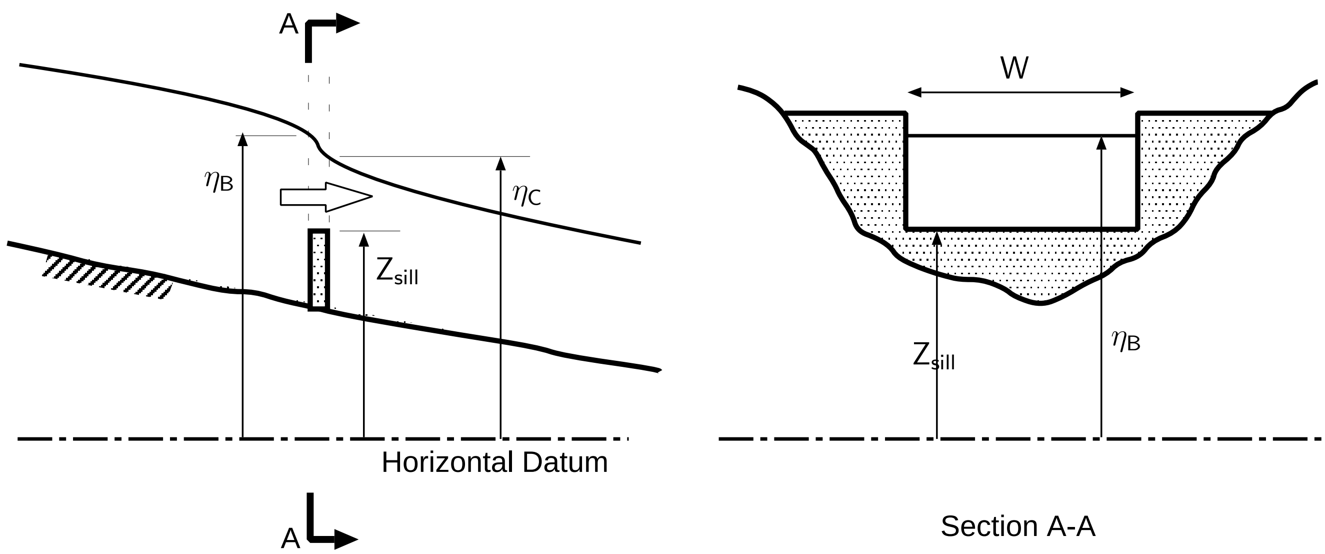

Figure C.3: Longitudinal Profile and Cross-Section at Gate

Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every 90 s (3 time steps) for 2.5 hours.

(H7). Reversing flow through a channel gate
Focus: reversing flow through gate.

Channel geometry, channel friction, gate characteristics and the initial conditions are the same as schematic application (H6).

Open boundary conditions at the downstream end A are

$$\eta_A(t) = \begin{cases} 0 & \text{for } t \leq 0 \\ 1 \sin \omega t & \text{for } t > 0 \end{cases} \tag{C.3.12}$$

where $\omega = 2\pi/T$, the tidal period T being 12.5 hours.
Open boundary conditions at the upstream end D are

$$\eta_D(t) = \begin{cases} 0 & \text{for } t \leq 0 \\ 1 \sin(\omega t - \phi)) & \text{for } t > 0 \end{cases} \tag{C.3.13}$$

where the phase lag is 1 hour, i.e. $\phi = \omega\tau$, where τ is 1 hour.

Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every 900 s (30 time steps) for 25.0 hours.

(H8). Lateral inflows
Focus: agricultural diversions and drainage returns, network connectivity.

Channel geometry is the similar to schematic application (H6), but without the underflow gate.

Channel bed is horizontal from upstream point A to downstream point D. The trapezoidal channel bed width B is 50 ft. At A, $x_A = 0$ ft and $Z_A = -20.0$ ft. At D, $x_D = 50,000$ ft and $Z_D = -20.00$ ft. Channel friction factor is constant at Darcy-Weisbach $f = 0.03$ or Manning $n = 0.02$.

An agricultural diversion is located at $x_B = x_C = +20,000$ ft, with point B on the upstream side, and point C on the downstream side. The agricultural diversion withdraws flow Q_{BC} but negligible streamwise momentum from the channel. Its operational characteristics are

$$Q_{BC} = \begin{cases} 0 & \text{for } t < 0 \\ 500 \text{ ft}^3/\text{s} & \text{for } t \geq 0 \end{cases} \tag{C.3.14}$$

The hydrodynamic initial conditions in the channel at $t = 0$ s are quiescence:

$$\eta(x, 0) = 0 \qquad \text{and} \qquad Q(x, 0) = 0 \tag{C.3.15}$$

Open boundary conditions for the channel are fixed at

$$Q_A(t) = +10,000 \text{ ft}^3/\text{s} \quad \text{and} \quad \eta_D(t) = +0 \text{ ft} \qquad \text{for all } t > 0 \tag{C.3.16}$$

Use a fixed computational space step $\Delta x = 500$ ft and a fixed computational time step $\Delta t = 30$ s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every 90 s (3 time steps) for 2.5 hours.

If necessary, continue this computation for sufficient additional time steps as is necessary to reach the STEADY STATE. Append this solution to the end of the output file.

(H9). Revised Problem (H4): Steady flow through a simple channel network
Focus: network connectivity, steady circulation.

The revised channels are rectangular, $\mathsf{SS} = 0$, and reach AB has been shortened to 24,000 ft. The network schematic remains unchanged, Figure C.2. The complete channel geometry is listed in Table C.2.

Open boundary conditions[2] are fixed at

$$\eta_A(t) = +5 \text{ ft}, \quad Q_D(t) = 4,000 \text{ ft}^3/\text{s}, \quad Q_E(t) = 2,000 \text{ ft}^3/\text{s} \qquad \text{for all } t > 0 \tag{C.3.17}$$

[2]Note the change in η_A from Equation C.3.6.

Reach	#1/AB	#2/BC	#3/CD	#4/BF	#5/FE	#6/CF
B ft	400	300	300	200	200	100
L ft	24,000	10,000	10,000	10,000	10,000	10,000
n	0.016	0.018	0.018	0.02	0.02	0.03
Node	A	B	C	D	E	F
Z ft	-20	-15	-10	+0	-5	-10

L is reach length.

Table C.2: Channel geometry for Revised Schematic Network

Initial conditions at $t = 0$ are quiescence.

$$\eta(x, 0) = +5 \quad \text{ft}, \qquad Q(x, 0) = 0 \tag{C.3.18}$$

Use a fixed computational space step $\Delta x = 2,000$ ft and a fixed computational time step $\Delta t = 60$ s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for EVERY time step to ONE HOUR PAST STEADY STATE.

(H10). Revised Problem (H5): Unsteady flow through a simple channel network
Focus: network connectivity, network circulation.

Channel network geometry is the same as schematic application (H9). Also, use the same fixed Δt and Δx as in (H9).

Open boundary conditions[3] are

$$\begin{aligned} \eta_A(t) &= \begin{cases} 5 & \text{for } t \leq 0 \\ 5 + 3\sin\omega t & \text{for } t > 0 \end{cases} \\ Q_D(t) &= 4,000 \text{ ft}^3/\text{s for all } t \\ Q_E(t) &= 2,000 \text{ ft}^3/\text{s for all } t \end{aligned} \tag{C.3.19}$$

where $\omega = 2\pi/T$, the tidal period T being 12.0 hours.

As initial conditions, use the STEADY STATE solution from application (H9).

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to[4] $t = 6T$.

(H11). Hydrograph Routing
Focus: routing evolution, numerical precision.

[3]Note the change in mean elevation and tidal period from Equations C.3.7.
[4]Note the continuation beyond $2T$ to to $6T$.

Channel bed slopes linearly downwards from upstream point F to downstream point L. The rectangular channel bed width B is 100 ft. At F, $x_F = 0$ ft, $Z_F = +150.00$ ft, such that

$$Z(x) = 150 - S_0 x \text{ [ft]} \tag{C.3.20}$$

where the bed slope S_0 is 0.001.

The upstream boundary conditions are

$$Q(x_F, t)\left[\frac{\text{ft}^3}{s}\right] = \begin{cases} 250 + \dfrac{750}{\pi}\left(1 - \cos\dfrac{\pi t}{75}\right) & \text{for } 0 < t < 150 \text{ [minutes]} \\ 250 & \text{for } t \geq 150 \text{ [minutes]} \end{cases} \tag{C.3.21}$$

At L, $x_L = 150{,}000$ ft, $Z_L = +0.00$ ft and

$$\eta(x_L, t) = +1.7 \text{ [ft] for all } t \tag{C.3.22}$$

Channel friction factor is constant at Manning $n = 0.045$.

Initial conditions at $t = 0$ are

$$\begin{aligned} \eta(x,0) &= Z(x) + 1.7 \text{ [ft], i.e. constant flow depth} \\ Q(x,0) &= 250 \text{ [ft}^3\text{/s]} \end{aligned} \tag{C.3.23}$$

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 500$ minutes.

Use the fixed computational space step Δx ft and the fixed computational time step Δt s specified in the separate lines of Table C.3 to define three separate problems - a, b and c.

Problem	Δx ft	Δt s
H11a	1000	60
H11b	2000	120
H11c	5000	300

Table C.3: Space and Time Steps for Hydrograph Evolution

Report parts a, b and c as SEPARATE files.

C.4 SCHEMATIC MASS TRANSPORT PROBLEMS

(M1). Advection of salinity plume in uniform flow
Focus: advection algorithm, downstream boundary

Channel geometry and hydrodynamic boundary conditions are the same as schematic application (H1). As hydrodynamic initial conditions, use the computed STEADY STATE prediction from (H1). The longitudinal dispersion coefficient $E_x = 0$.

The contaminant initial conditions at $t = 0$ are

$$C(x, 0) = 1 \exp\left[-c\left(\frac{x - 5000}{1500}\right)^2\right] \quad \text{ft} \tag{C.4.1}$$

where $c = \ln 2 = 0.6931$.

The contaminant open boundary conditions are unconstrained outflow.

Use a fixed computational time step $\Delta t = 120$ s and a fixed computational space step of $\Delta x = 500$ ft.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 30\Delta t$ s.

(M2). Advection of sharp salinity plume in uniform flow
Focus: advection algorithm, numerical dispersion.

Channel geometry and hydrodynamic initial and boundary conditions are the same as schematic application (M1). Also, use same fixed computational time step $\Delta t = 120$ s and fixed computational space step of $\Delta x = 500$ ft. The longitudinal dispersion coefficient $E_x = 0$.

The contaminant initial conditions at $t = 0$ are

$$C(x, 0) = 1 \exp\left[-c\left(\frac{x - 5000}{250}\right)^2\right] \quad \text{ft} \tag{C.4.2}$$

where $c = \ln 2 = 0.6931$.

The contaminant open boundary conditions are no contaminant inflow and unconstrained contaminant outflow.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 30\Delta t$ s.

(M3). Salinity penetration into channel.
Focus: coupled models, initial transients.

Channel geometry, friction and hydrodynamic open boundary conditions as in schematic application (H3). Also, same fixed Δx and Δt as application (H3). Use final predicted solution at $t = 2T$ from (H3) as hydrodynamic initial conditions at $t = 0$ here.

Contaminant initial conditions are $C(x, 0) = 0$ throughout. The upstream contaminant open boundary condition at L is no contaminant inflow and unconstrained contaminant outflow. The downstream contaminant open boundary condition is

$$C(x_F, t) = \begin{cases} 0 & \text{for } Q(x_F, t) \leq 0 \\ 1 & \text{for } Q(x_F, t) > 0 \end{cases} \tag{C.4.3}$$

The longitudinal dispersion coefficient is $E_x = 10^3$ ft^2/s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 2T$.

(M4). Salinity penetration into simple network.
Focus: coupled models, network circulation.

Channel geometry, friction and hydrodynamic open boundary conditions as in schematic application (H5). Also, same fixed Δx and Δt as application (H5). Use final predicted solution at $t = 2T$ from (H5) as hydrodynamic initial conditions at $t = 0$ here.

Contaminant initial conditions are $C(x, 0) = 0$ throughout. The upstream contaminant open boundary conditions at D and E are no contaminant inflow and unconstrained contaminant outflow. The downstream contaminant open boundary condition at A is

$$C(x_A, t) = \begin{cases} 0 & \text{for } Q(x_A, t) \leq 0 \\ 1 & \text{for } Q(x_A, t) > 0 \end{cases} \tag{C.4.4}$$

The longitudinal dispersion coefficient is $E_x = 10^3$ ft^2/s.

Compute and write to file in the STANDARD FORMAT the initial conditions at $t = 0$ and the model predictions for every time step to $t = 2T$.

C.5 STANDARD OUTPUT FILE FORMAT

The ASCII file format defined in Table C.4 is required for all output.

Where there are several entries on the same line, space delimited data is required. Predictions at ALL NODES and at ALL TIMES should be written to file. Please list all scalar entries to FOUR significant figures. Do not exclude any spatial nodes or any time steps.

Please provide the data files on standard DOS 3.5 inch 1.4MB diskette as raw ASCII files.

Line	Contents	Format
1	Model identification	string
2	Schematic application	string
3	Prepaper, Date	string, string
4	Friction model	string
5	g	scalar
6	Reach	string
7	t	scalar
8	$x \quad \eta \quad Q \quad b \quad A \quad P \quad [f \text{ or } n] \quad C \quad E_x$	scalar scalar scalar …
9	…	
10	…	
⋮		
⋮		
j	Reach	string
j+1	t	
j+2	$x \quad \eta \quad Q \quad b \quad A \quad P \quad [f \text{ or } n] \quad C \quad E_x$	scalar scalar scalar …
j+3	…	
j+4	…	
⋮		
⋮		

Repeat sequence beginning at Line j for all reaches and for all t.
Lines 8,9,10,… and j+2,j+3,j+4,… and … are space delimited.

Table C.4: **Standard Output File Format**

The following is a segment of a sample output file:

```
Fischer Delta Model, Version 0
H9
Hugo B. Fischer, 4 July 1980
Darcy-Weisbach
32.2
1
000.0
000.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
200.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
400.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
600.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
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.
2
000.0
000.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
200.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
400.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
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3
000.0
000.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
200.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
400.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
.
.
1
060.0
000.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
200.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
400.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
.
.
2
060.0
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200.0 12.34 567.8 90.12 345.6 7.890 .01234 .5678 .9012
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C.6 ADDRESSES FOR DATA FILES

Please send separate copies of all data files to

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