1 Constant, time-varying, and interdependent (Q-h) boundary conditions.

Quality Assurance

Date	: January 28 2020		
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Version information

Executable : Deltares, D-Flow FM Version 1.2.93.65833M, Jan 22 2020, 12:52:11

Location input : https://repos.deltares.nl/repos/DSCTestbench/trunk/cases/e02_dflowfm/f101_1D-boundaries/c01_steady-state-flow

Revision input :

Location output : https://repos.deltares.nl/repos/DSCTestbench/trunk/references/win64/e02_dflowfm/f101_1D-boundaries/c01_steady-state-flow/DFM_OUTPUT_Boundary

Revision output :

Purpose

This test originates from a D-Flow Flexible Mesh validation model and is used here to test import + export of a 1D channel flow model. The purpose of the original validation test is to verify the proper functioning of constant and time-varying boundary conditions for upstream discharge and downstream water level in 1D D-Flow Flexible Mesh simulations. Also the "Q-h relationship" to force the water level based on simulated discharge is tested.

Linked claims

N/A

Approach

Four straight channels, T1 to T4, (see Figure 1) are parametrized with different boundary condition types, namely constant in time, time-varying, and interdependent (Q-h). The latter is specified using a direct relationship between discharge and the local water level.

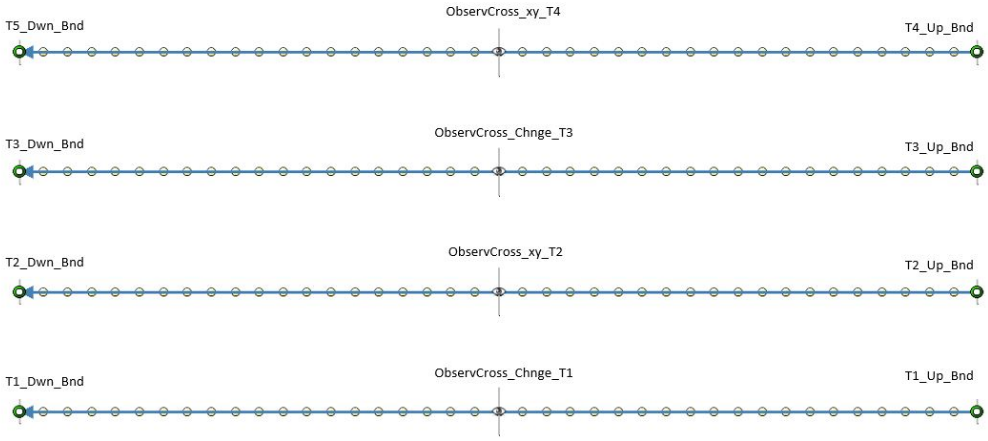


Figure 1: *Lay-out of the test model*

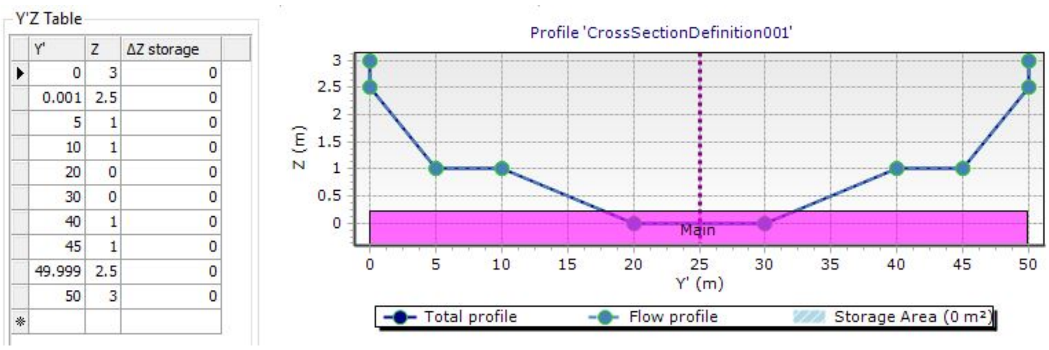
Conclusion

N/A

Model description

The test comprises of four separate sub-models T1 to T4 (see Figure 1). The models are 2 km in length and have an equidistant grid spacing of dx=50m. Roughness is constant at a Chézy roughness coefficient of 45 $m^{0.5}s^{-1}$ throughout the length and across the cross section of the sub-models as the lumped conveyance approach is used (see **??**). The same YZ cross sectional profile is applied uniformly throughout all sub-models (see Figure 2), but the bed levels decrease by 0.5 m from chainage=0 (east) to chainage=2000 (west) for a slope of 0.0025.

Note: The kernel of D-Flow FM does not allow vertical line segments in the YZ-profile. Hence, vertical line segments in this trapezoidal channel at 0 and 50 m are tilted slightly by 0.001 m.


Y'Z Table

Y'	Z	ΔZ storage
0	3	0
0.001	2.5	0
5	1	0
10	1	0
20	0	0
30	0	0
40	1	0
45	1	0
49.999	2.5	0
50	3	0

Figure 2: *YZ Cross-section definition*

The four sub-models are parametrized with different types of upstream and downstream boundary condition which ultimately converge to the same values (see Table 1).

Table 1: *Boundary conditions applied in sub-models T1 to T4.*

Sub-model	Chainage [m]	ID	Boundary condition
T1	0.00	T1_Up_Bnd	Constant discharge of 100 m^3s^{-1}
	2000.00	T1_Dwn_Bnd	Constant water level of 2.5 m
T2	0.00	T2_Up_Bnd	Time-varying Discharge (See Figure 3)
	2000.00	T2_Dwn_Bnd	Constant water level of 2.5 m
T3	0.00	T3_Up_Bnd	Constant discharge of 100 m^3s^{-1}
	2000.00	T3_Dwn_Bnd	Time-varying Water Level (See Figure 4)
T4	0.00	T4_Up_Bnd	Time-varying Discharge (See Figure 3)
	2000.00	T4_Dwn_Bnd	Q-h boundary condition (See Table 2)

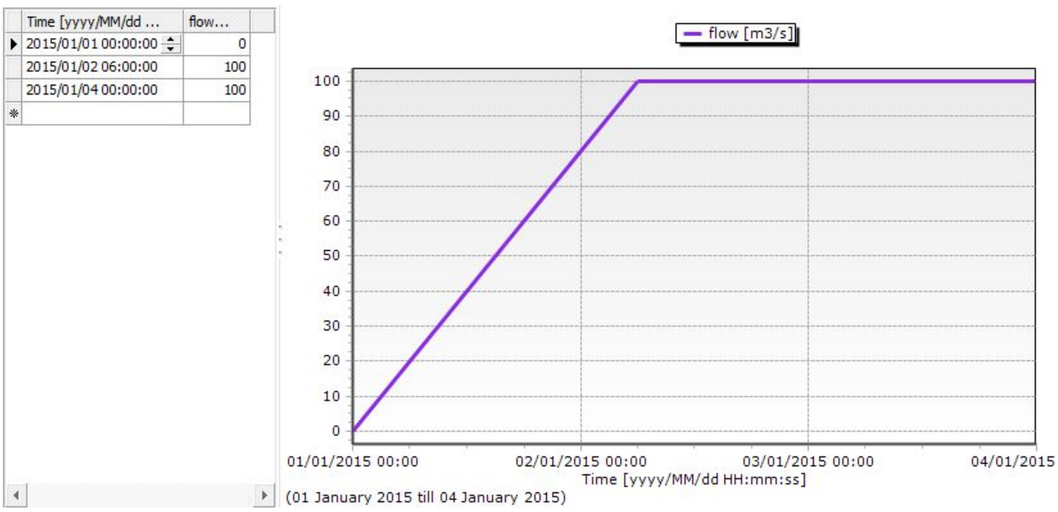


Figure 3: *Time-Varying Discharge Boundary Condition for T2 and T4*

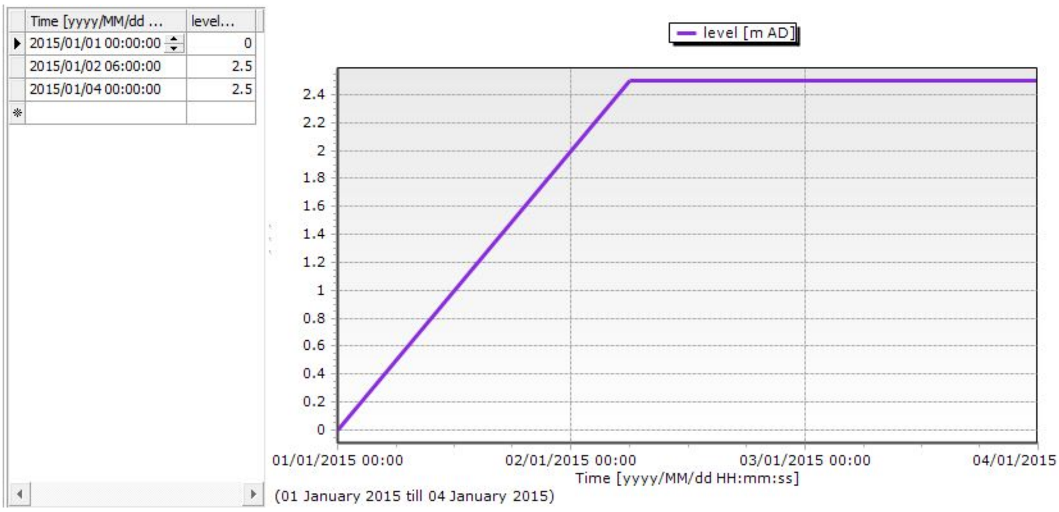


Figure 4: *Time-Varying Water Level Boundary Condition for T3*

Table 2: *Discharge-Water Level Interdependent Boundary Condition for T4*

Discharge [m^3s^{-1}]	Water Level [m]
50.00	1.25
100.00	2.50
150.00	3.75

Results

N/A

Analysis of results

N/A