Hydraulic bore interaction with a column - A comparison between the solution of the shallow equation and experimental results

Xinsheng Qin, Kaspar Müller

AM574 Conservation Laws and Finite Volume Methods
University of Washington, Seattle USA

March 13, 2015

Outline

Introduction

The Shallow Water Equations in 2D

$$
\begin{aligned}
h_t + (uh)_x + (vh)_y &= 0 \\
(hu)_t + (huv)_y + (hu^2 + \frac{1}{2}gh^2)_x &= -ghB_x - Du \\
(hv)_t + (huv)_x + (hv^2 + \frac{1}{2}gh^2)_y &= -ghB_y - Dv
\end{aligned}
$$

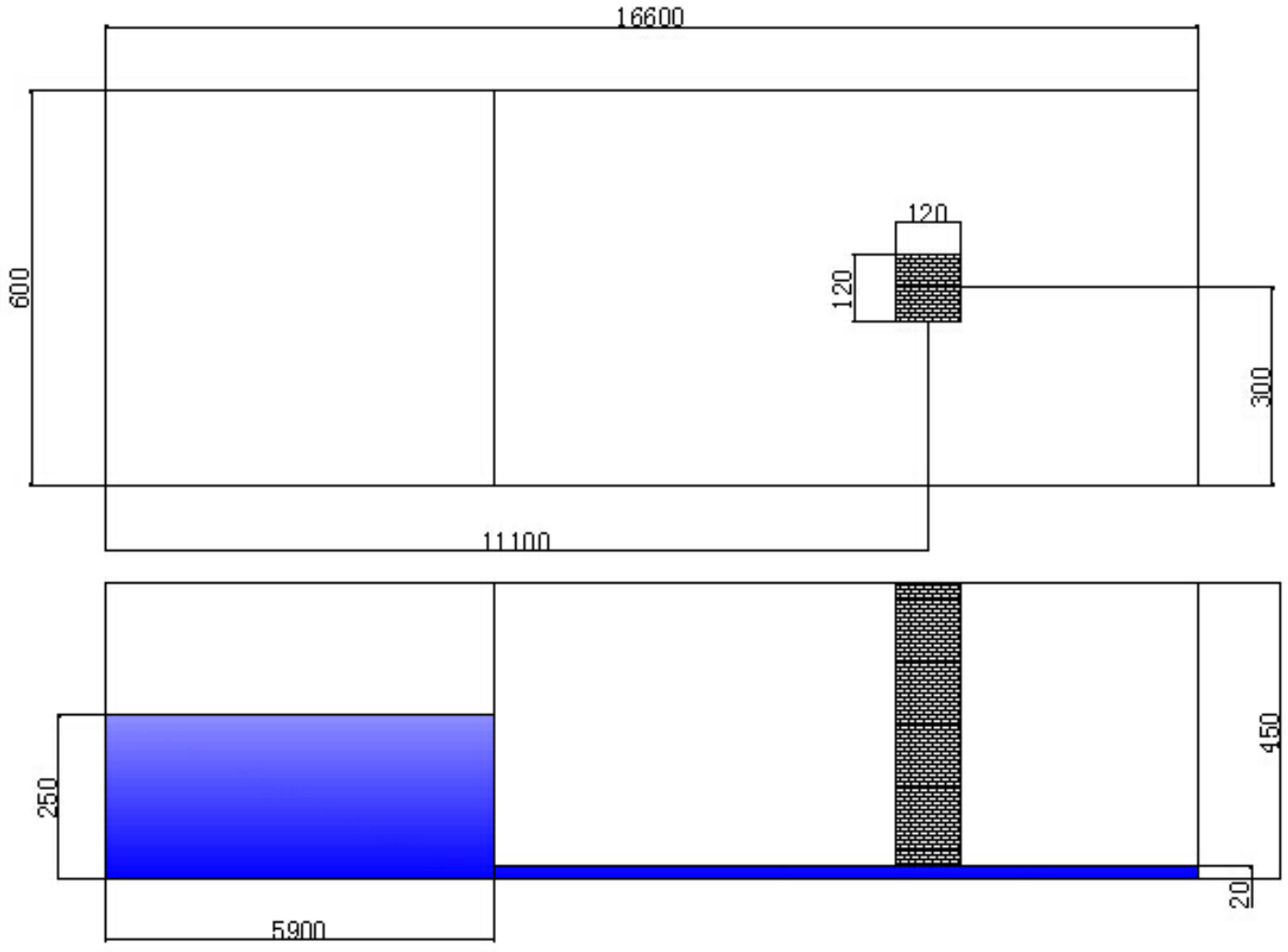
where B is the topography and D the drag coefficient. g stands for the gravitational acceleration.

CLAWPACK/GeoClaw

Software framework

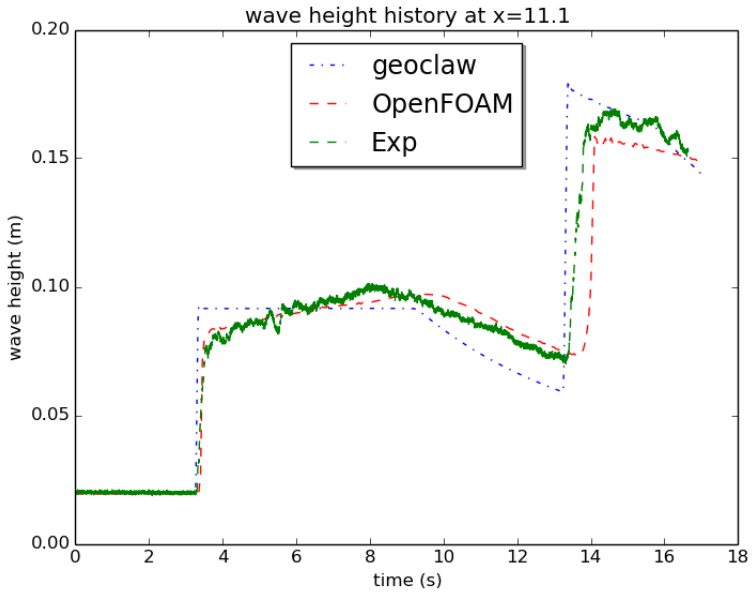
Method

Setup of the test case



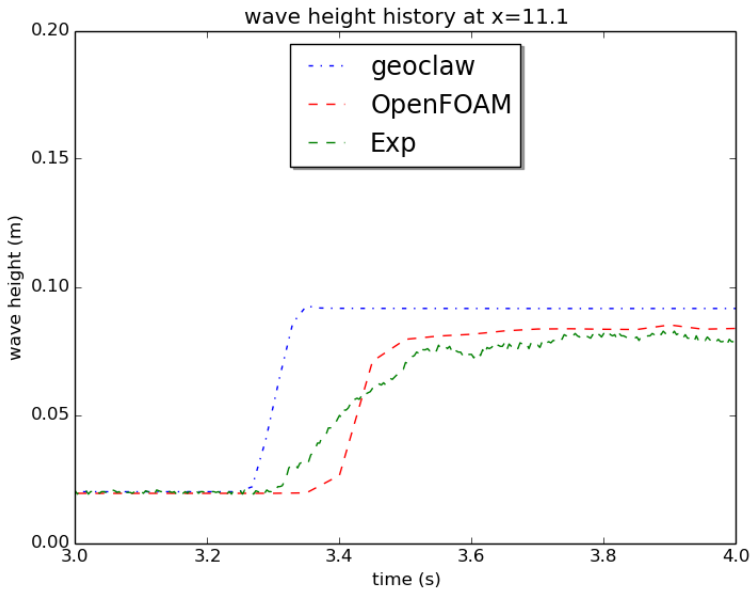
Case01 - Dam Break

$0 \leq t \leq 18$



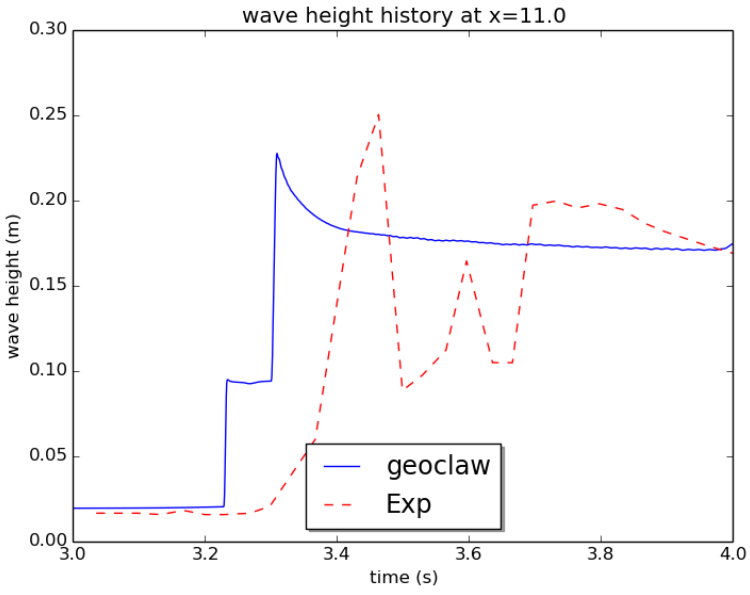
- Wave arrives at t=3.8s
- Second jump from reflection from right wall

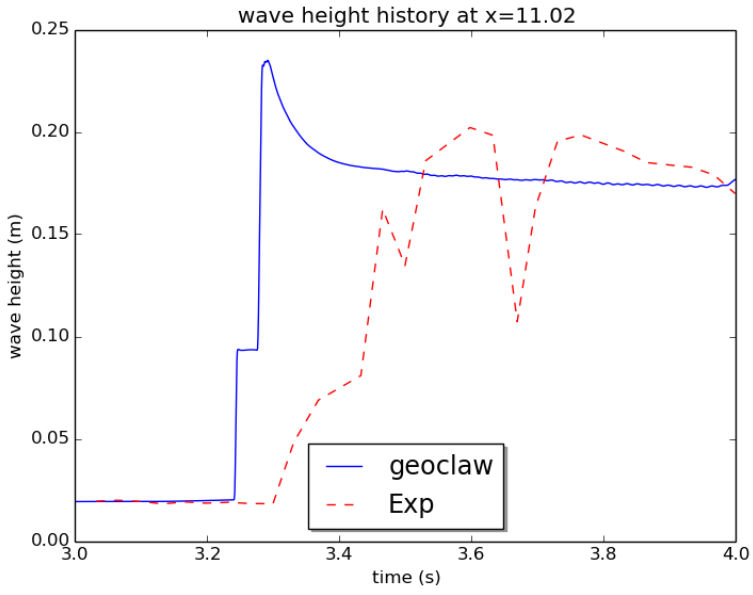
$3 \leq t \leq 4$



- Geoclaw 0.02s ahead
- Peak value overestimated

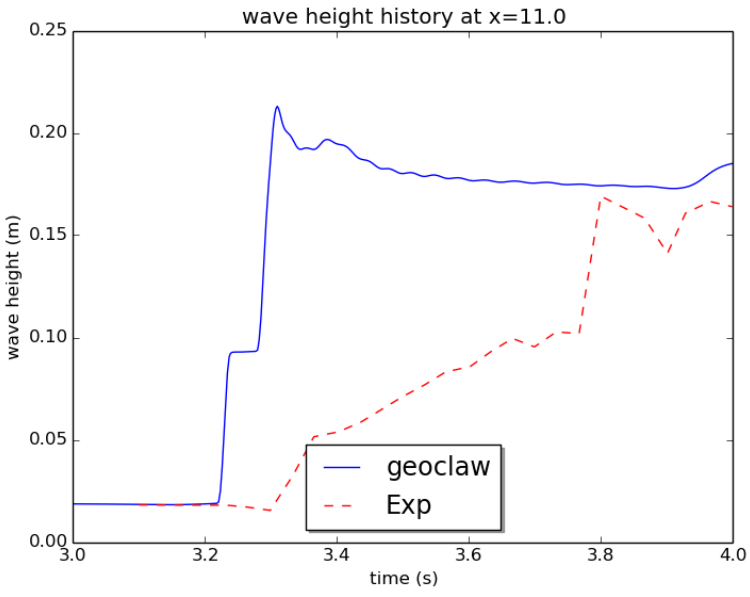
Case02 - Dam Break with Square Column

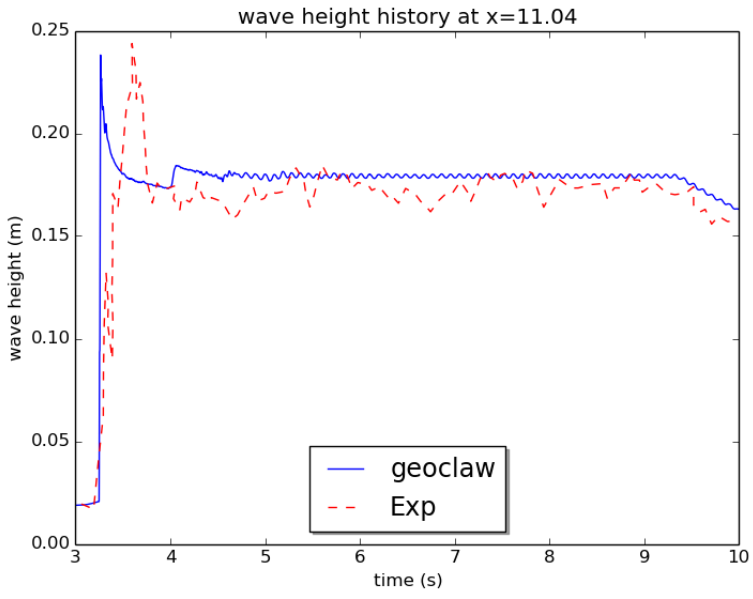




- Second jump reflection from the column
- Smooth increase in wave height in experiment

Case03 - Dam Break with Cylindrical Column





Conclusion and Outlook