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Bore Soliton Splash

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We review the experiment of a bore soliton splash [1]. In a long water filled channel, two solitons are generated by sudden opening of a sluice gate, which holds back a finite amount of water at a higher level. At the far end the channel linearly converges from both sides, forming a narrowing V-shape, when viewed from above. The first soliton quickly develops a jump/bore, and crashes in this contracting part of the channel. This first wave reflects from the convergence with a limited increase in the water level at the convergence, and then draws a trough in which the unbroken second soliton crashes. That results into a 3-4m high vertical jet, but only when initial water levels in the canal and sluice gate are finely tuned: 0.41m versus 0.9m. The jet is absent when the canal level is raised to 0.43m.

The combination of dispersion and nonlinearity in experiments such as the above one led to the development of a new water wave model [2], as well as conservative numerical techniques [3]. Both the model and its numerical counterpart are based on variational techniques. One key issue is the inclusion of dispersion as well as local wave breaking in jumps into one single model. Another issue is the modeling of the vertical splash. We also describe our preliminary (numerical) modeling attempts of the bore soliton splash to date.

References

[1] Google *Bore soliton splash YouTube*.

[2] C. Cotter and O. Bokhove 2010: Water wave model with accurate dispersion and vertical vorticity. Peregrine Commemorative Issue. *J. Eng. Maths.* **67**, 33–54.

[3] V.R. Ambati 2008: *Forecasting water waves and currents: a space-time approach.* Ph.D. Thesis, University of Twente, The Netherlands.