



Wave Overtopping in the City Scale Coupled Hydrodynamic/Hydraulic Numerical Inundation Model: C-FAST

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Australia's National Science Agency



Overview

- 1. C-FAST model
- 2. Inundation, overflow and overtopping.
- 3. Validation test case
- 4. Application





Section 1: C-FAST

City Scale Coupled Hydrodynamic/Hydraulic Numerical Inundation Model



• Cross platform



OpenCL

- Fast written to use modern GPU hardware
- Easy to navigate GUI



- Modular and expandable CSIRO Workspace framework enables collaborative improvement
- In built GIS map widget



• 3-in-1: Setup + Computation + Results Visualisation







A next-generation tool for modelling dynamic coastal inundation: modelling the duration of extreme water levels



Advantages of CFAST-CANUTE3 over the Bathtub approach;

- 1. Accounts for the time dependence of coastal flooding and hence the duration of flood events.
- 2. Resolves the potential inundation that can occur due to backwater effects and redistribution of storm water within underground drainage networks.
- 3. Includes short period wind-wave and surf driven processes such as wave overtopping.
- 4. Simulates adaptation methods such as retention ponds, backflow valves and raising local coastal defences.









0.1 m³/s Flow rate 0 m³/s



Section 2: Inundation, overflow and overtopping.

Overflow vs overtopping Overtopping turned off if SLW > height of seawall





Validation test case UKEA: Benchmarking the latest generation of 2D hydraulic modelling packages



Flooding a disconnected water body



Figure 4.1 Profile of digital elevation model (DEM) used in Test 1







Flooding a disconnected water body with short wave overtopping



t = 0.00 hours







Application Middle Park beach 24 June 2014



http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201406.pdf



- 22nd –24th : A cold front and associated low pressure system caused very strong winds across much of southeast Australia.
- In central Victoria, the low caused a storm surge and tidal flooding as well as large waves. Flooding in beachside suburbs and the Yarra River caused significant disruption to power and transport.
- The flood peak in the Yarra River (1.75 m) was notable because it was not associated with heavy rain, the first such event since spring 1994.







🖼 Wild scenes at Brighton Beach - photo by Nichola Clark



media.bom.gov.au/social/blog/1001/the-big-chill-what-is-a-cold-front/



Waves crash across Kerford Road Pier in Albert Park, Melbourne, 24 June 2014, driven by the passage of destructive cold fronts. Photograph: Liam Edleston.



C 🔒 https://www.abc.net.au/news/2014-06-26/waves-spill-over-the-sea-wall-at-middle-park/5551500 🍳 🛧 🌔







Without overtopping



Description Ensemble index 1 of 16: Grid = 489x284, Resolution = 2.0 m, Output period = 5 min, SLR = 0.0 m, initial fill = 0.63 AHD



With overtopping



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12/09/2019



+1m SLR



Description Ensemble index 14 of 16: Grid = 977x568, Resolution = 1.0 m, Output period = 10 min, SLR = 1.0 m, initial fill = 1.63 AHD, Sea wall added up to 2.5 m, Sea wall overtopping enabled



Why C-FAST with parametric EurOtop?

- Efficiently Simulate
 - Entire drainage network
 - Ensemble simulations
 - Probabilistic hazard maps.

Flow rate 0 m³/s

0.1 m³/s





Thank you

For further info see posters PP28 & PP29 on The Port Phillip Bay Coastal Hazard Assessment

CSIRO Oceans and Atmosphere with DATA61

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