

AI-Assisted Analysis of Tsunami-HySEA



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1 Implemented improvements

- AI-assisted analysis performed using the Tsunami-HySEA standard multi-GPU version (one simulation on multiple GPUs).



- BUT the improvements have been implemented in Tsunami-HySEA MC version (multiple simulations in parallel, each one on one GPU).



1 Implemented improvements

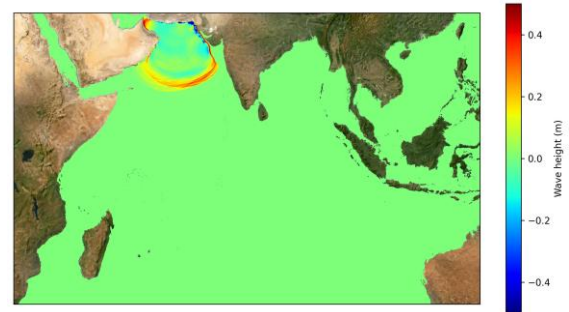
Proposed improvement	Description	Done
P1	Pointer swapping	No
P2	Fuse edge kernels	Yes
P3	const __restrict__	No
P4	Fuse metrics kernels	Yes
P5	New GPU reduction	Yes
P6	Direct GPU-GPU data transfers	N.A.
P7	CUDA Graphs	No



P8	Output GPU precomputing	Yes
P9	Modernize CMakeLists.txt	Yes
P10	Minor kernel-level items	Partially

2 Results

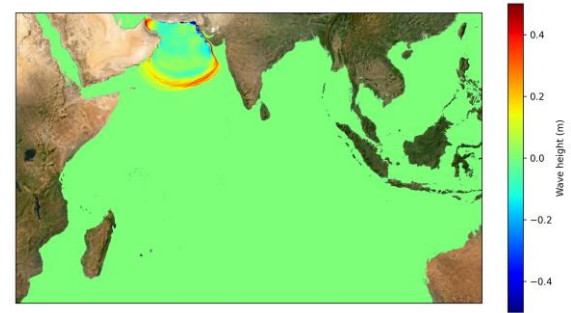
- Tsunami simulation in the Indian Ocean.
- Resolution: 30 arc-sec. 78.0 millions of cells.
- Initial sea floor deformation: 882 triangular segment faults with Kajiura filter. No file saving.





2 Results

- Tsunami simulation in the Indian Ocean.
- Resolution: 30 arc-sec. 78.0 millions of cells.
- Initial sea floor deformation: 882 triangular segment faults with Kajiura filter. No file saving.
- Runtime reduction w.r.t. previous code considering **only** the main simulation loop (without GPU initialization, sea floor deformation and filtering):
 - NVIDIA V100: **≈38 %**
 - NVIDIA A100: **≈34 %**





NVIDIA H100: **≈39 %**

- Global runtime reduction depends on the simulation time and the computational cost of deformations and filterings.