



Hydrodynamic Model Integration

Supported by NSF through ITR

Institutions:

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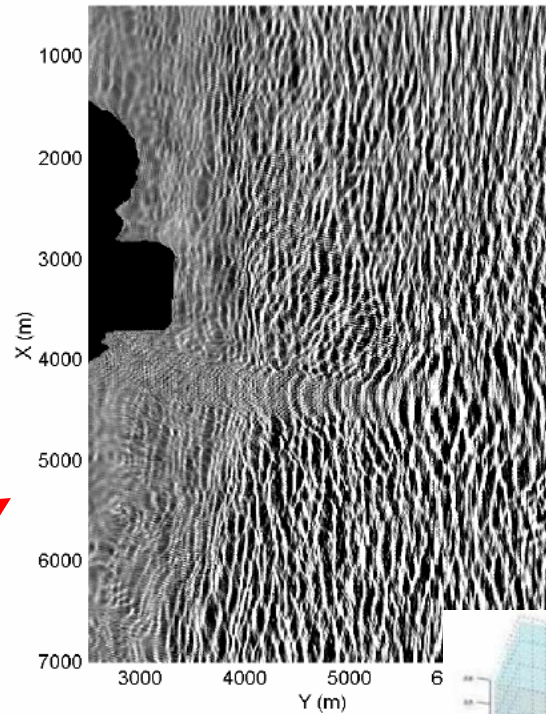
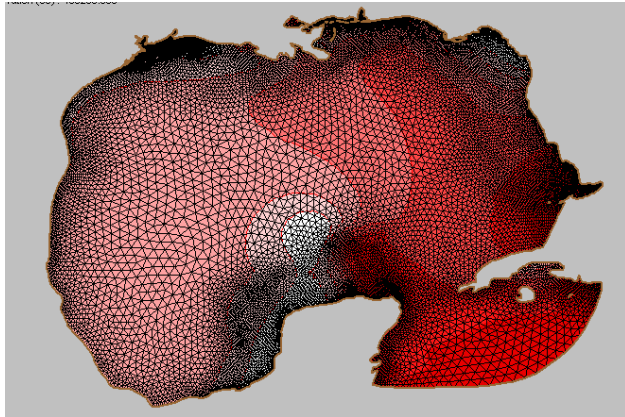
Woods Hole: B. Raubenheimer, T. Hsu



Goals

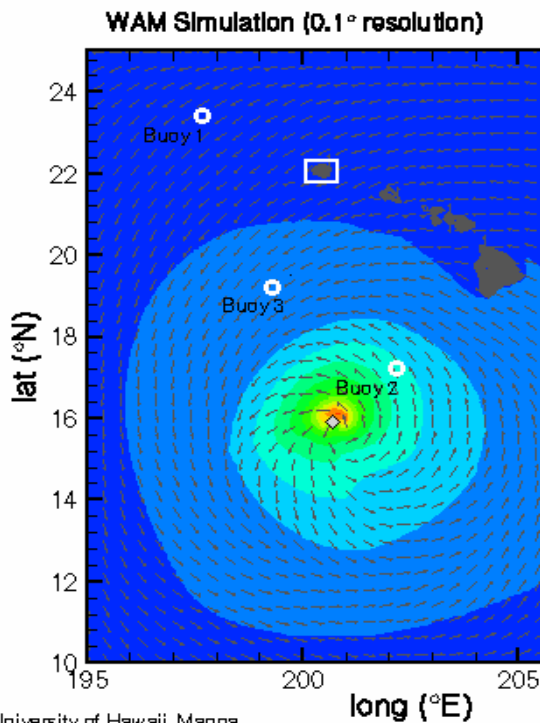
- Develop a coupled, hybrid hydrodynamic computational model for the simulation of wave processes from deep water to the beach
 - Spectral model offshore
 - Long wave model for tides/surges
 - Boussinesq model from offshore to breaking region
 - RANS in the surf and swash

Long wave model for tides and surges. $O(100\text{m}-10\text{ km})$



Boussinesq model: Depth-integrated and inviscid.

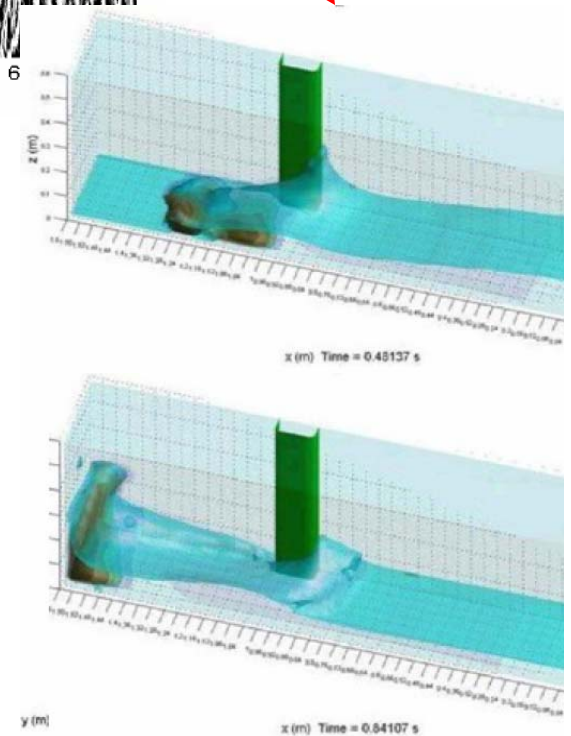
$O(1-100\text{m})$



Spectral model for offshore wave generation and propagation.

$O(1-100\text{ km})$

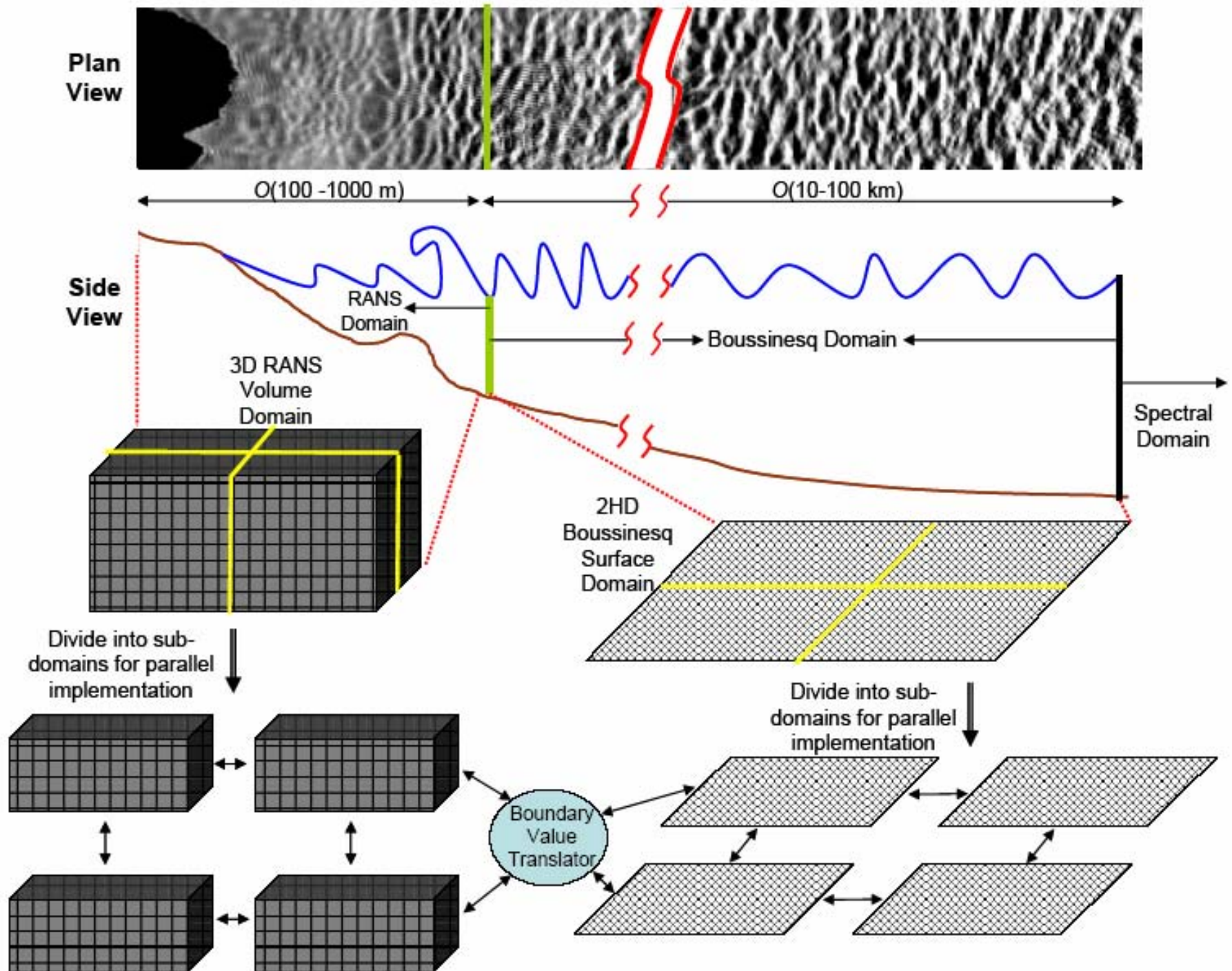
3D RANS model with turbulence closure $O(<1\text{m})$

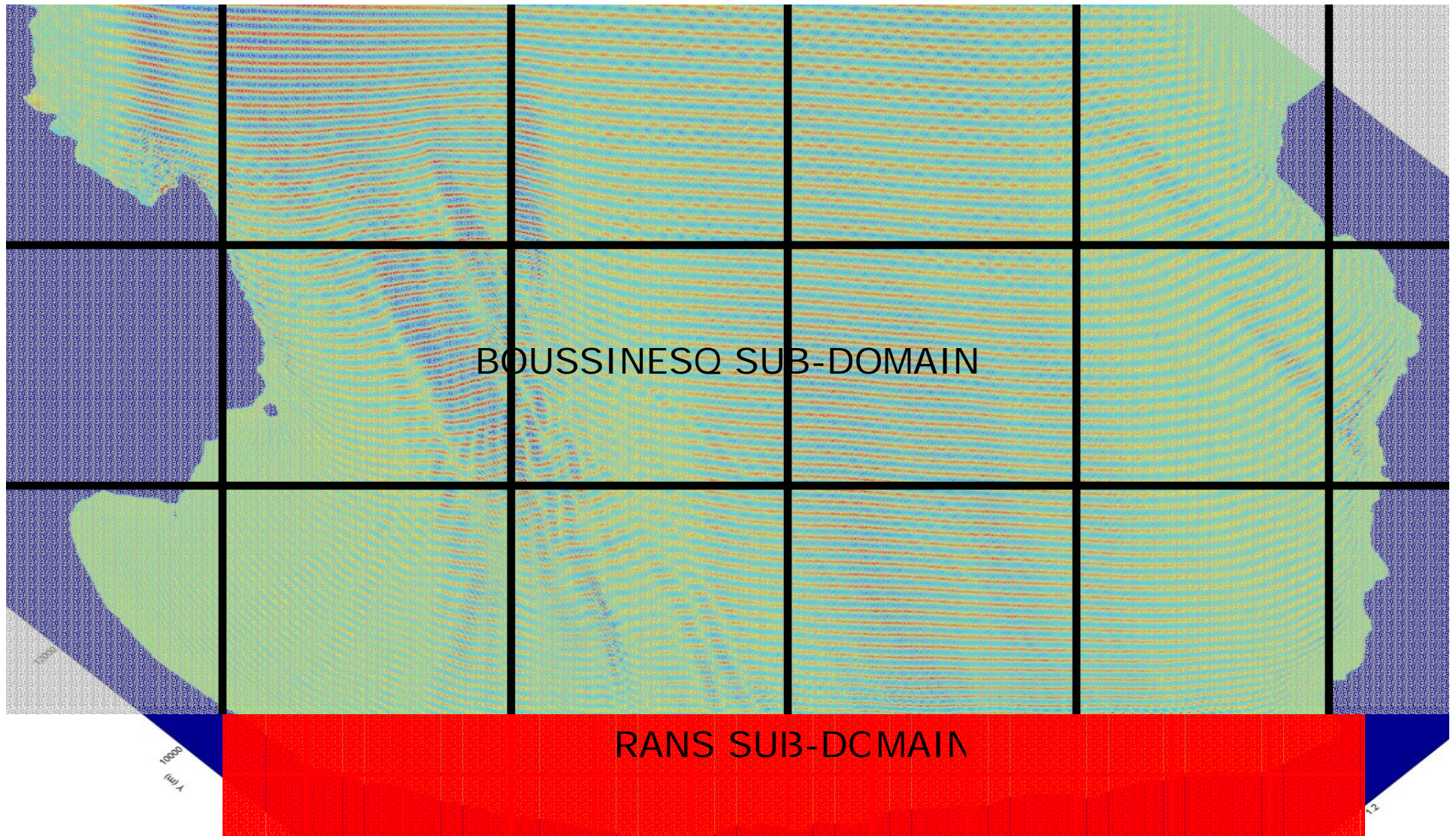




Goals

- Incorporate sediment transport formulations in the Boussinesq and RANS
- Match the various models at physically appropriate locations
- Each model component of the hybrid system will be parallelized
- Develop a load balancing algorithm to efficiently use resources





Computational expense:

To solve the entire domain with the Boussinesq model w/ 1.6 million grid points:

- ~ 5 days on a single 2 GHz desktop computer
- ~ 5 hours on a 32-CPU cluster (roughly 80% efficiency)



Tsunami Simulation?

- Current focus is on wind waves
- But, easily extendable to tsunami simulation
- Offshore model becomes tsunami long wave model
 - Currently integrating COMCOT
- Allows for detailed prediction of wave impacts, sediment movement, runup etc. in a “reasonable” amount of time