Southeast O‘ahu (SEO) Regional Sediment Management (RSM) Workshop #2

June 1, 2005

Ko‘olau Golf Course

Agenda

- Welcome and Introductions — Mr. Sam Lemmo
- Summary of Workshop #1 — Mr. Tom Smith
- Presentations – Workshop #1 to Today
  - Numerical Models — Ms. Jessica Hays
  - Field Investigations — Mr. Stan Boc
  - GIS Web Application — Mr. Justin Pummell
- Break
- Breakout Sessions - Potential Demonstration Projects
- Summary and Conclusions

Summary of SEO/RSM Workshop #1

Mr. Thomas D. Smith

U.S. Army Corps of Engineers

Honolulu District

What is Regional Sediment Management?

- **Purpose: Coordinate activities in the Coastal Zone to enhance regional sediment budgets, reduce project costs and restore essential environmental habitat.**
- **Benefits: Allows use of natural processes to solve engineering problems, enhances the environment and saves money.**
- **Region: Mountain to the Sea - accounts for human effects on natural processes, optimizes sediment transport in streams, lakes, bays, and oceans.**

Southeast Oahu RSM Demonstration Project Area

Southeast Oahu RSM

- Location: Mokapu Point to the north through Makapu'u Point to the south.
- Purpose: Optimize use of sediment resources.
- Issues:
  - Complex sediment transport pathways.
  - Large percentage of critically eroded shorelines.
  - RSM solutions are not readily apparent.
  - Economical sand sources yet to be identified.
- Goal: Increase understanding of littoral processes with the goal of preserving and restoring beaches in the region with potential application elsewhere.

Workshop #1

- **Date: June 2004 at Waimanalo Library**
- **Attendees: 25 attendees representing federal, state and local agencies, academia, consultants and local community.**
- **Breakout Session Identified:**
  - **data needs**
  - **environmental concerns**
  - **environmental permits**
  - **potential funding sources**
  - **potential demonstration projects.**

Data Needs

- Directional Wave Data
- Long-term Wind and Wave Data
- General Circulation Data
- Site-specific Current Data
- Standard Datum (Horizontal & Vertical)
- Sand Source Inventory

Environmental Concerns

- **Environmental Assessment or Environmental Impact Statement**
- **Public Input (public meetings, workshops)**
- **Baseline Studies (biological, cultural, etc.)**
- **Environmental Monitoring**

Permitting Concerns

- Include time for obtaining permits in schedule
- Assessing Cumulative Impacts
- Effectively Describing Alternatives and Options
- Permits – CDUA, §404 CWA, §401 CWA, SMA, FWCA 2(b), State SPGP, NPDES, etc.

Potential Funding Sources

- **Federal**
  - Funding (CAP §103 & §1135, GI Studies, DOD)
  - Design (in-house, A/E contract)
  - Permit
  - Sand Source
  - Construction (RFP, IFB)
- **Non-Federal**
  - Funding (DOT, DLNR, DPW)
  - Design (A/E Contract)
  - Construction (RFP, IFB)

Potential Demonstration Projects

- **Kaupo & Kaiona Beaches**
- **Bellows Air Force Station**
- **Lanikai Beach**
- **Ka’elepulu Stream**

Kaupo & Kaiona Beaches

Problem Statement:

- **Erosion is threatening Kalanianaole Highway along Kaupo and Kaiona beaches.**
- **The beaches are narrow with unstable backshore slopes.**
- **Erosion is undermining the highway in a number of locations.**

Kaiona Beach

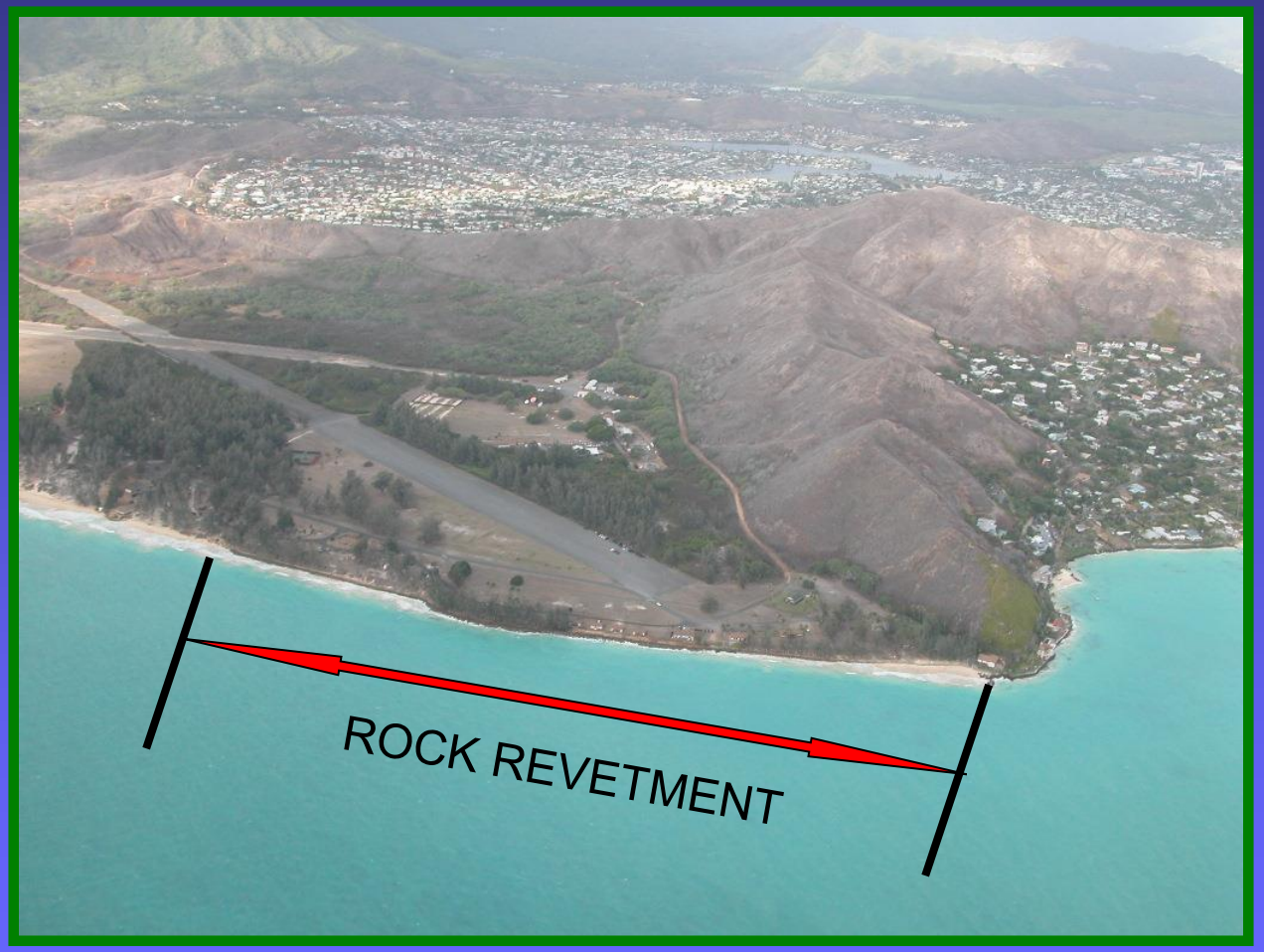
Kaupo Beach

Bellows Air Force Station

Problem Statement:

- **Erosion is threatening the vacation cottages.**
- **The existing coastal armoring is tying up the sand supply for the littoral zone.**

Bellows AFS



Lanikai Beach

Problem Statement:

- **There is no dry beach along the southern portion of the Lanikai shoreline.**

- **The majority of the Lanikai shoreline has been hardened.**

Lanikai Beach looking north

Lanikai Beach looking south

Ka'elepulu Stream

Problem Statement:

- **Sand is being removed from littoral system through maintenance of the stream mouth.**
- **Sand is being stockpiled along the stream banks.**
- **A portion of the sand is blown inland by the trade winds & lost to littoral system.**

Ka’elepulu stream looking makai

Ka’elepulu stream looking mauka

Numerical Models

Ms. Jessica Hays
U.S. Army Corps of Engineers
Honolulu District

Why?

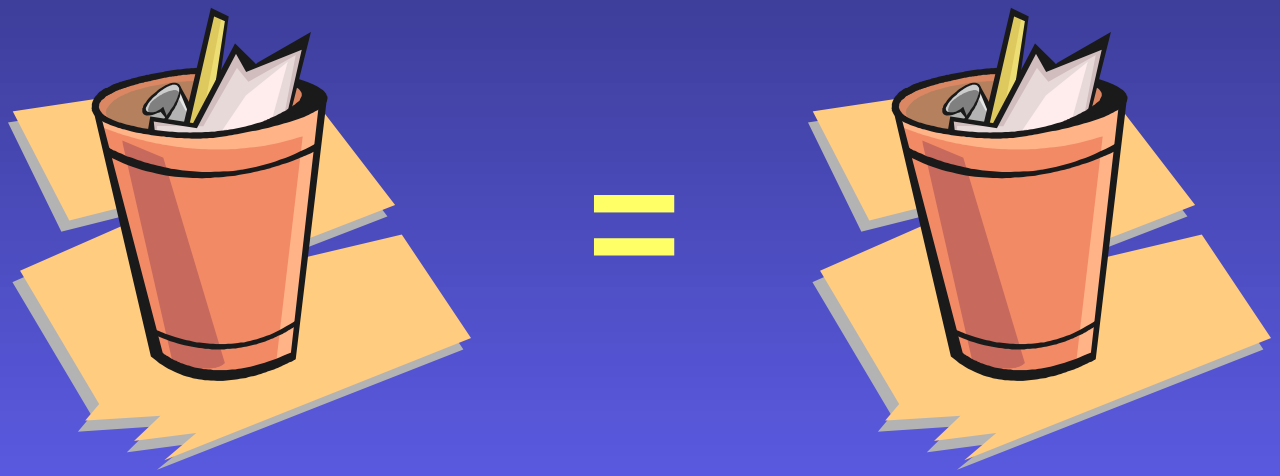
Numerical modeling, when properly applied and verified with field data, can provide valuable information on the processes affecting a region and can be used as a tool to evaluate alternative courses of action

Model Definitions

ADCIRC: A two-dimensional depth-averaged hydrodynamic model that simulates tidal circulation and storm surge over a large domain
=> "CIRCULATION MODEL"

STWAVE: A steady-state spectral wave transformation model that simulates wave shoaling and refraction, wave breaking and wave-wave interaction from deep to nearshore waters over a relatively small domain
=> "WAVE MODEL"

First Principle of Numerical Modeling



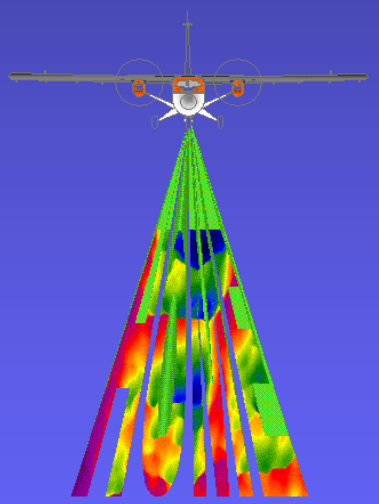
Garbage In = Garbage Out

Circulation Model Setup

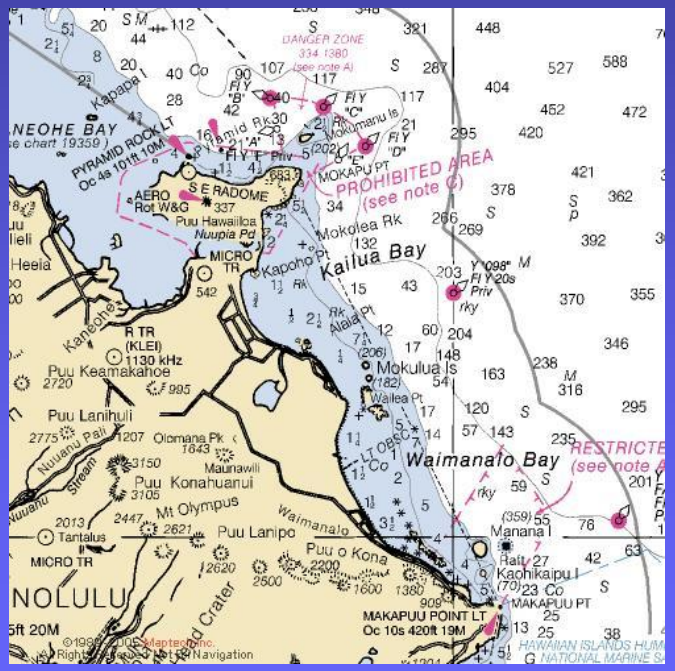
ADCIRC Grid Generation:

1. Bathymetric Data Sources

- National Geophysical Data Center (NGDC) - ETOPO2 and GEODAS



- USACE SHOALS surveys (2000)

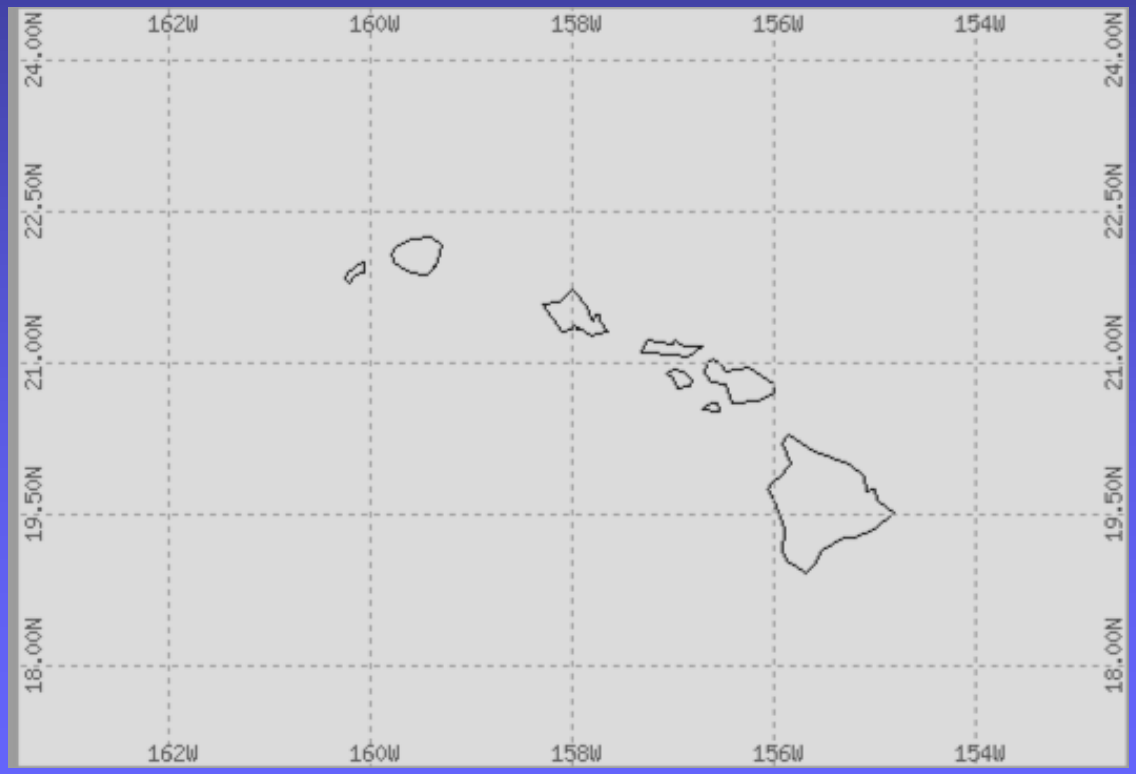


- NOAA Digital Nautical Charts

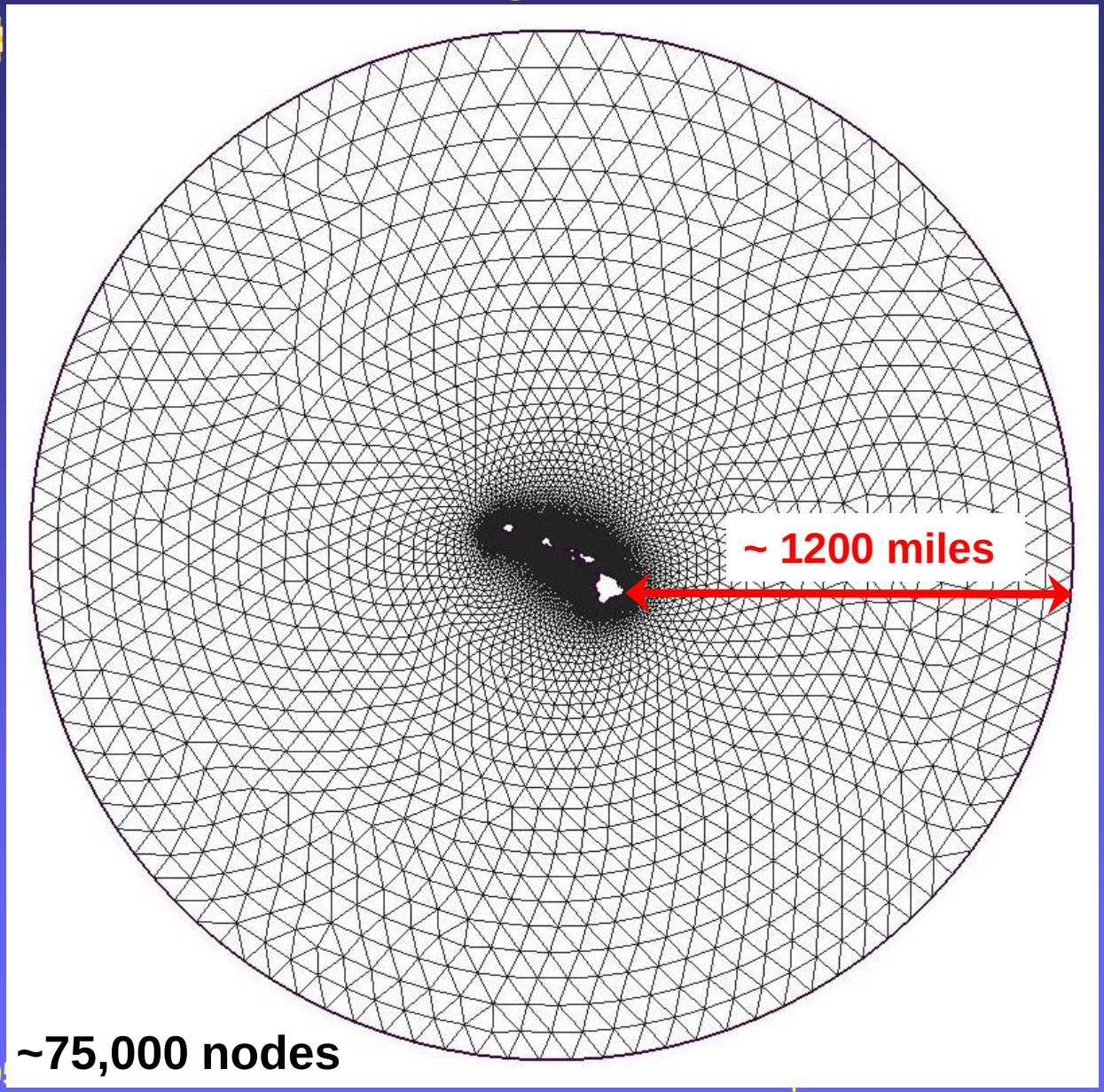
Circulation Model Setup

ADCIRC Grid Generation:

2. Shoreline coordinate data from NGDC



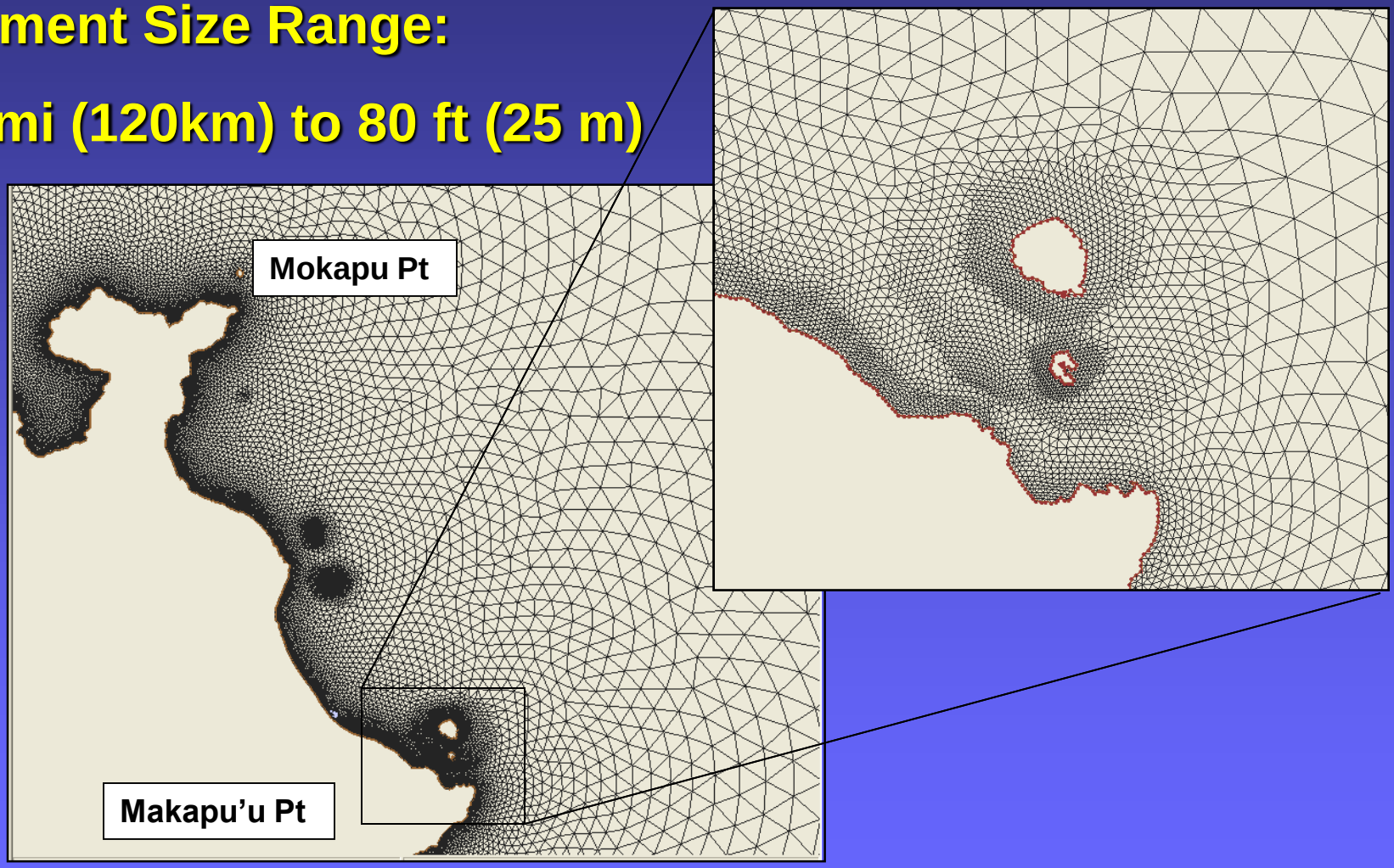
ADCIRC grid domain



~75,000 nodes

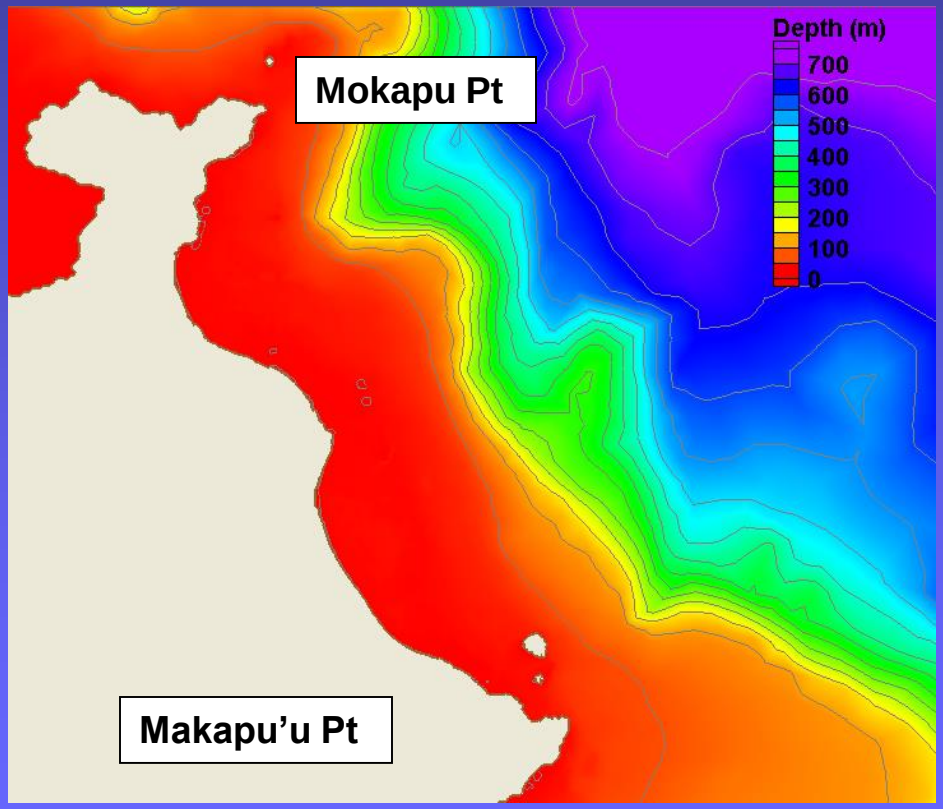
Element Size Range:

75 mi (120km) to 80 ft (25 m)



Circulation Model Setup

ADCIRC Grid Generation:

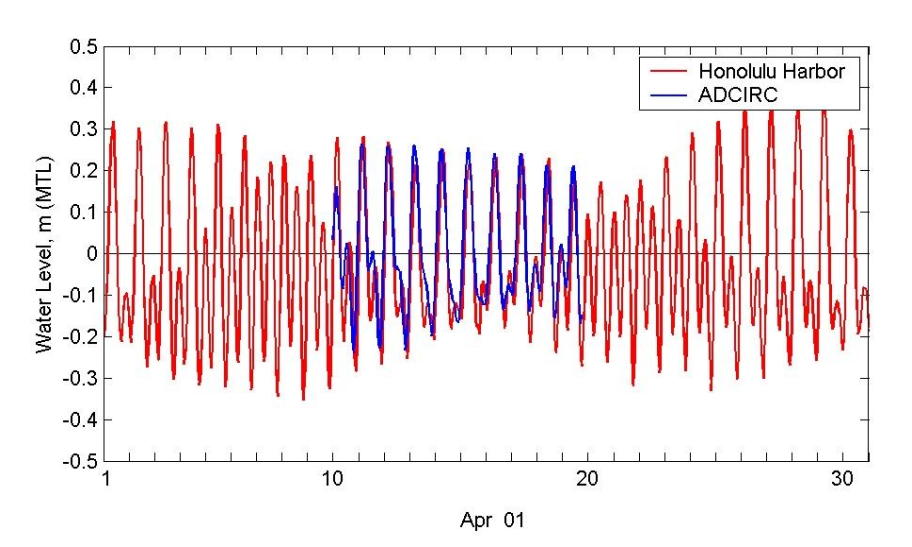


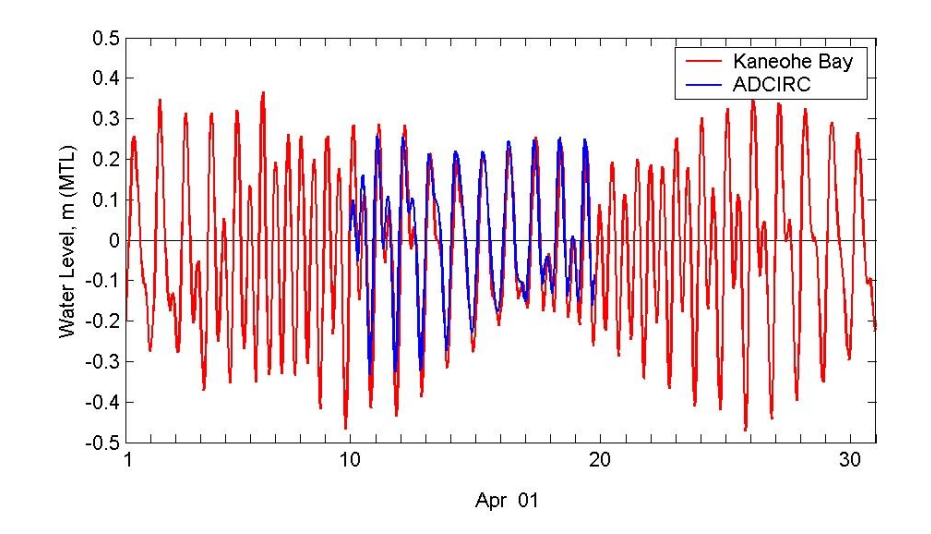
3. Bathymetry data is interpolated onto ADCIRC grid and hand-edited to ensure accuracy

Circulation Model Forcing

Atmospheric Forcing:

1. Tides = Tidal Constituents from established database used to run ADCIRC & resulting water level compared to NOAA tide stations at Kaneohe Bay and Honolulu Harbor

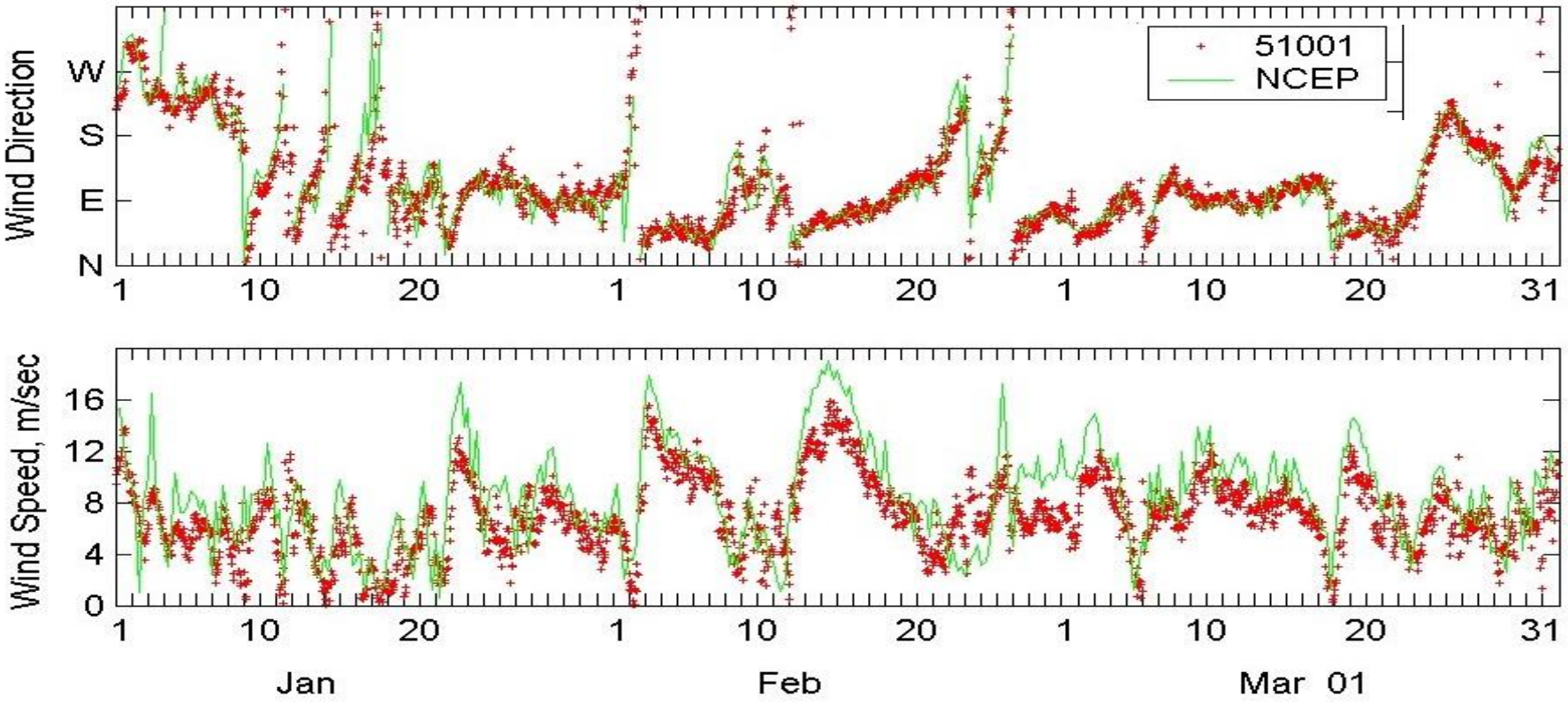




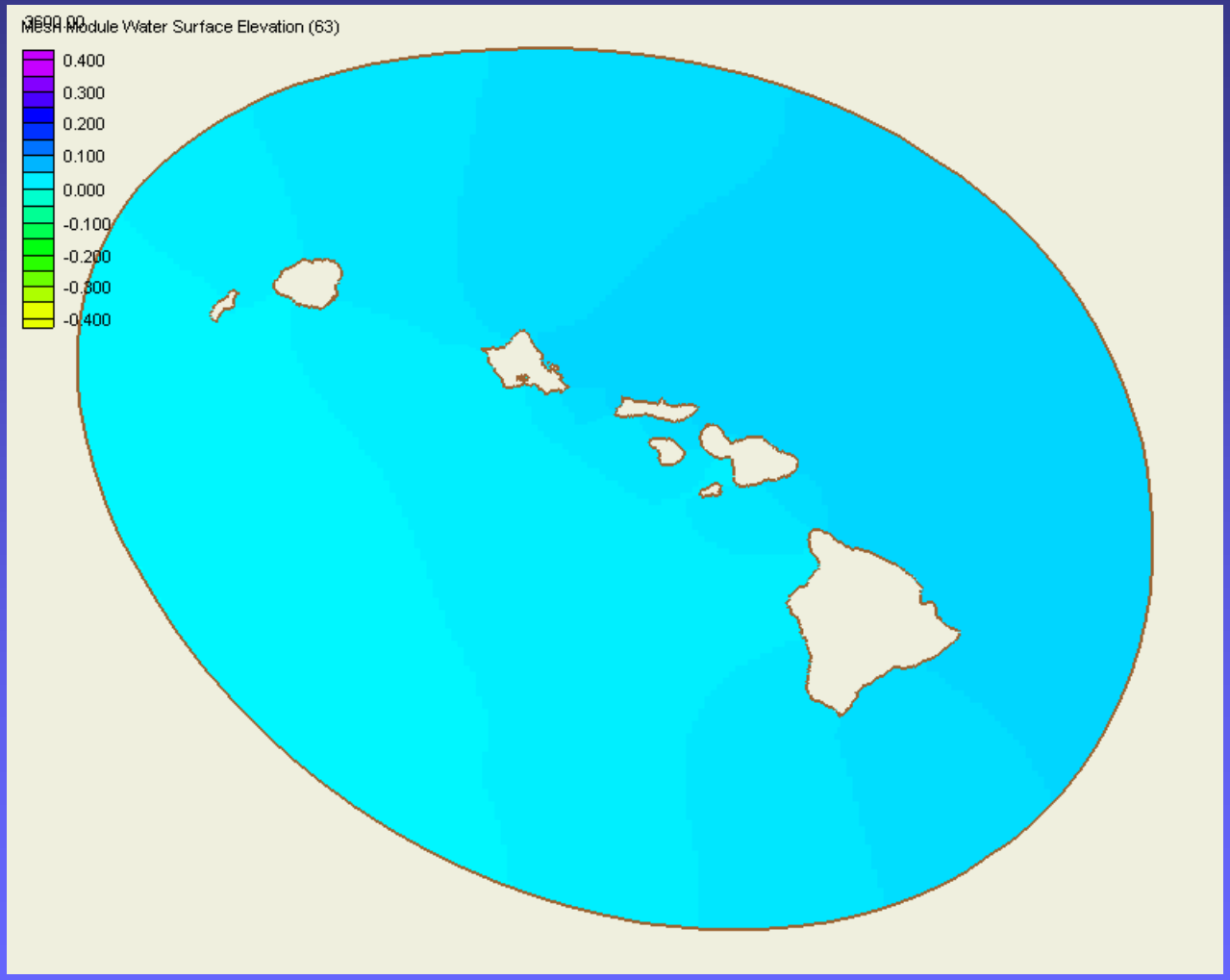
Circulation Model Forcing

Atmospheric Forcing:

2. Winds



Circulation Model Output



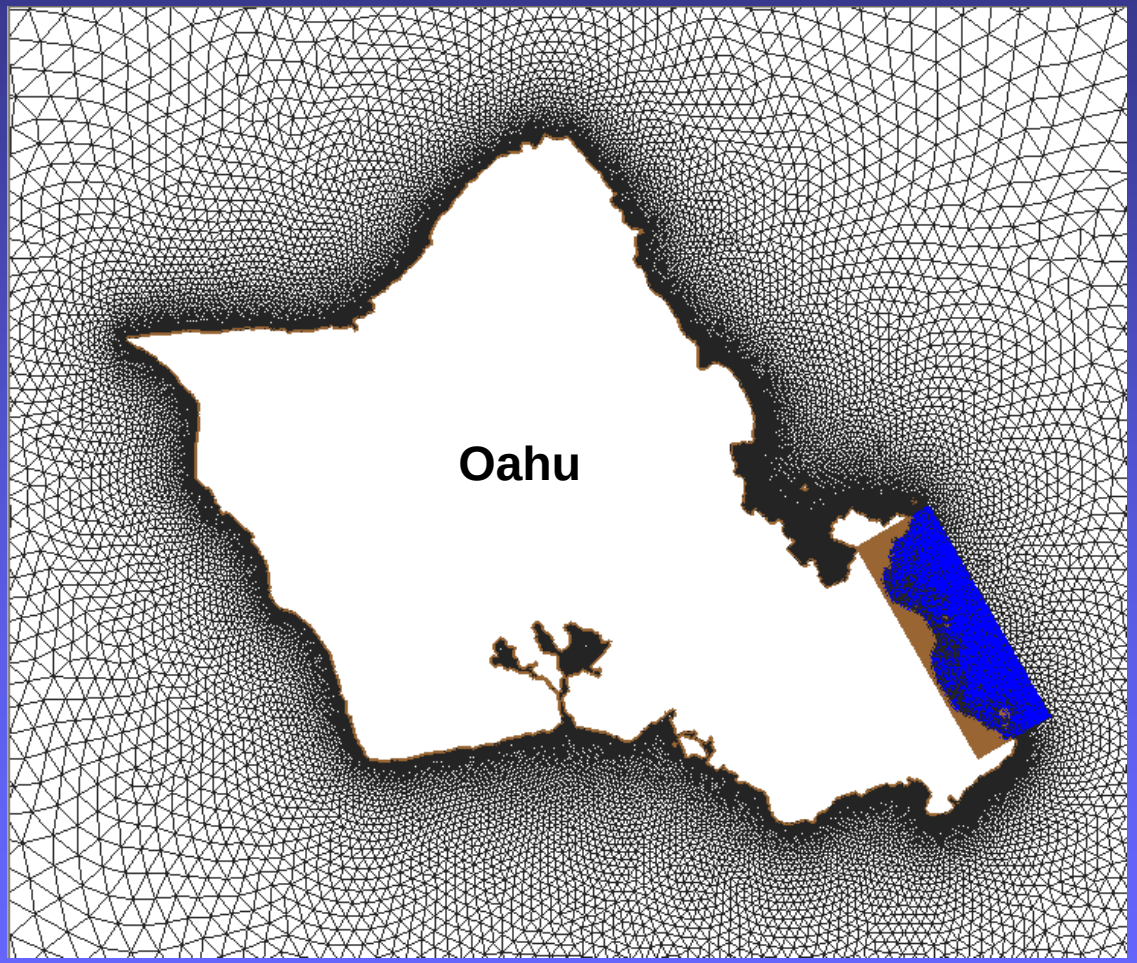
Circulation Model Output

Circulation Model Calibration

- Calibrate water level to existing tide gages
- Add winds
- Calibrate using all existing data and collect more current information to improve accuracy

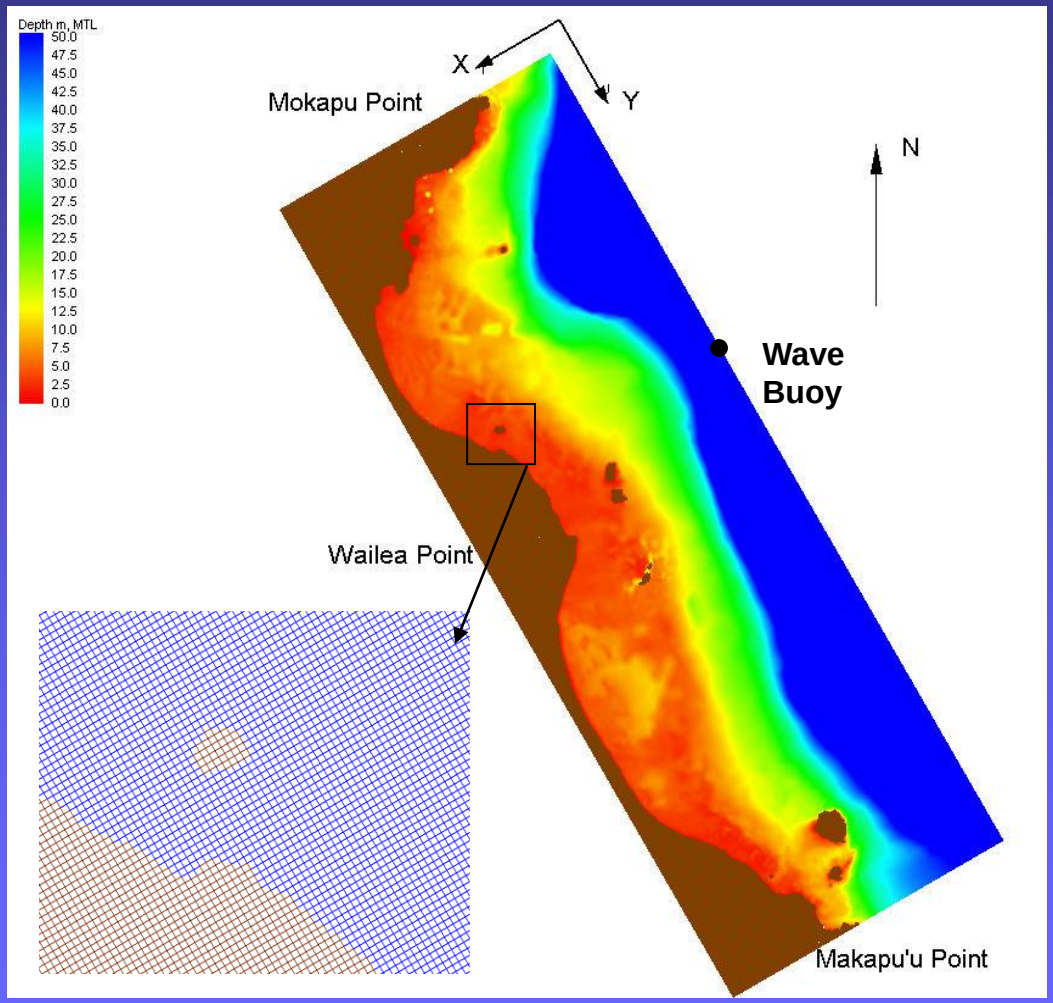
Wave Model Setup

STWAVE is a transformation scale model – much smaller domain than the circulation model



Wave Model Setup

- Domain chosen based on area of interest, buoy data location, and orientation of shoreline
- Bathymetry copied from ADCIRC mesh to develop STWAVE grid
- STWAVE grid resolution is 25 m x 25 m

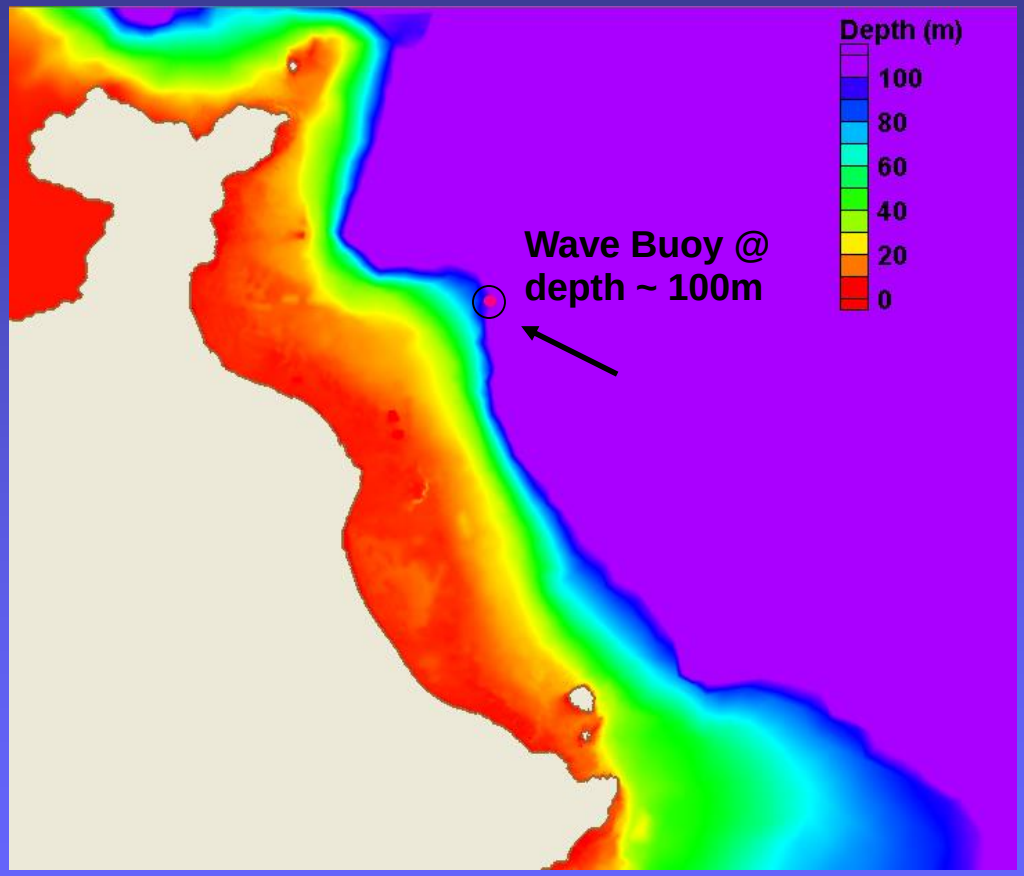


Wave Model Forcing

Directional Wave Data:

UH/CDIP Station 098 (Mokapu Point) :

- Measures wave energy and wave direction
- Available from August 2000 to present
- Directional spectra is used as input into the offshore boundary of the STWAVE grid
- Upcoming WIS Data



Wave Model Forcing

Directional Wave Data:

- **Waves are generally from the northeast quadrant and range in height from 0.5 to 6.0 meters**
- **Wave periods are generally 6-16 seconds**

Wave Rose for UH/CDIP Bouy in RSM Demo Area

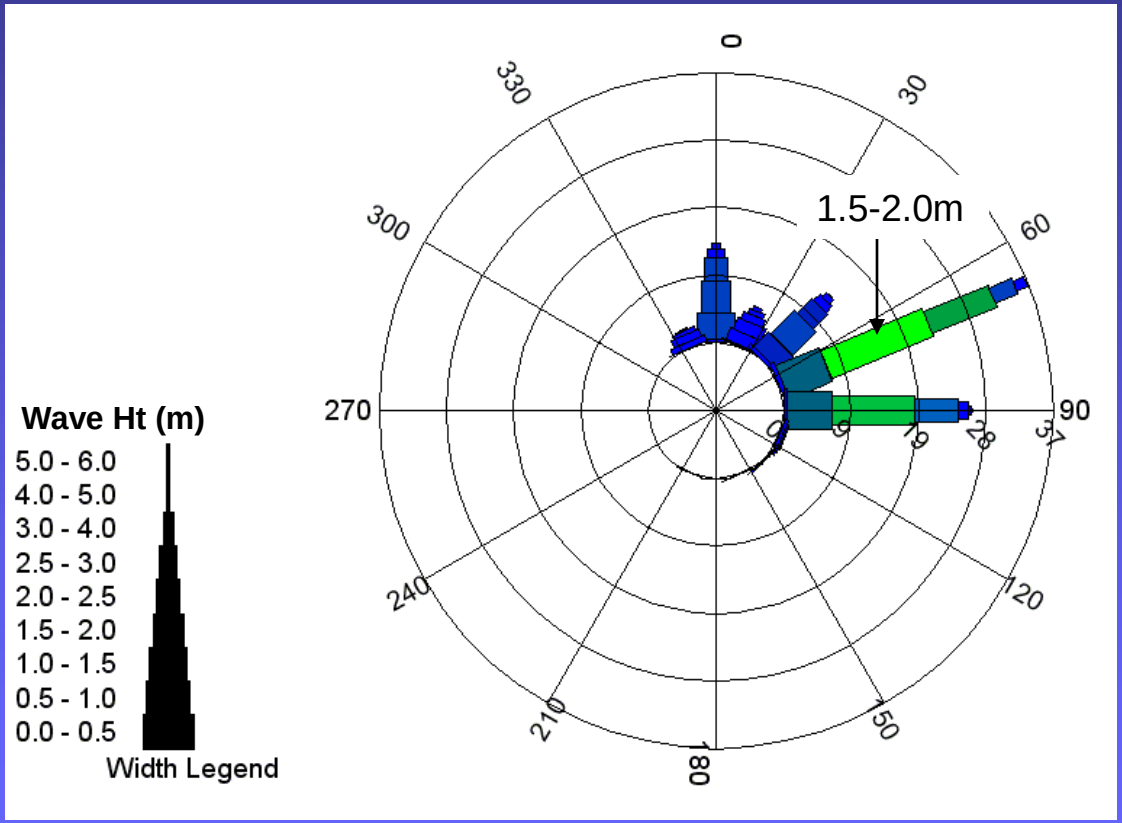
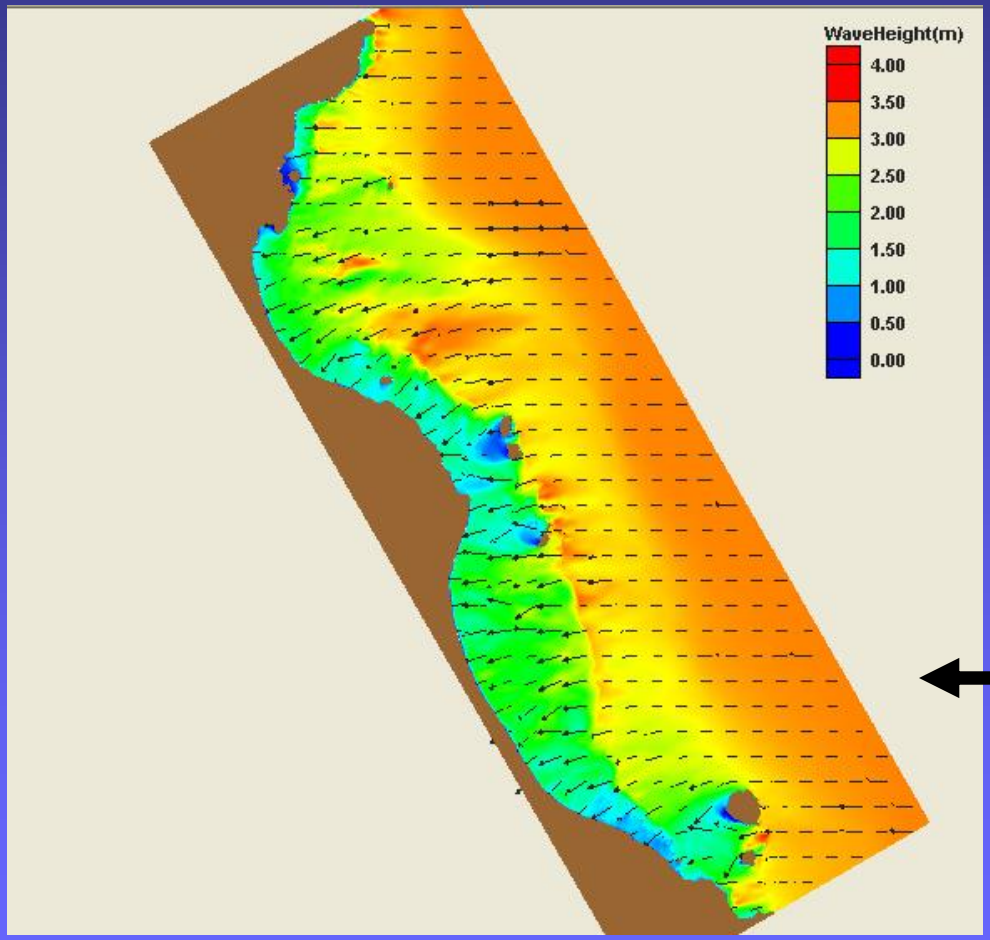


Table 1 – Conditions selected for simulation

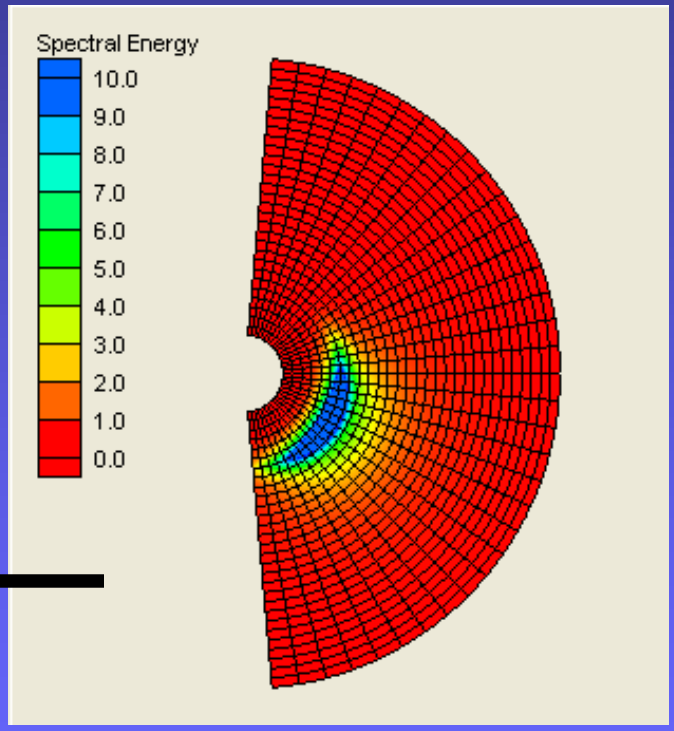
Significant Wave Height M	Wave Period sec	Wave Direction deg from North	Wave Direction deg from STWAVE axis
.75	6	-22.5	82.5
1.25	8	0	60
1.75	10	22.5	37.5
2.25	12	45	15
2.75	14	67.5	-7.5
3.5	16	90	-30

Wave Model Output

Wave Height and Direction



Spectral Wave Energy Input (m^2/Hz)



Next Steps

- Perform simulations with linked wave and circulation models
- Collect field data to measure wave height inside the reef and current velocity and direction under various conditions and use to better calibrate models
- Examine the resulting circulation patterns and wave transformation under various conditions to learn about possible sediment pathways and create “what if” scenarios

Questions

Field Investigations

Mr. Stan Boc

Engineer Research and Design Center

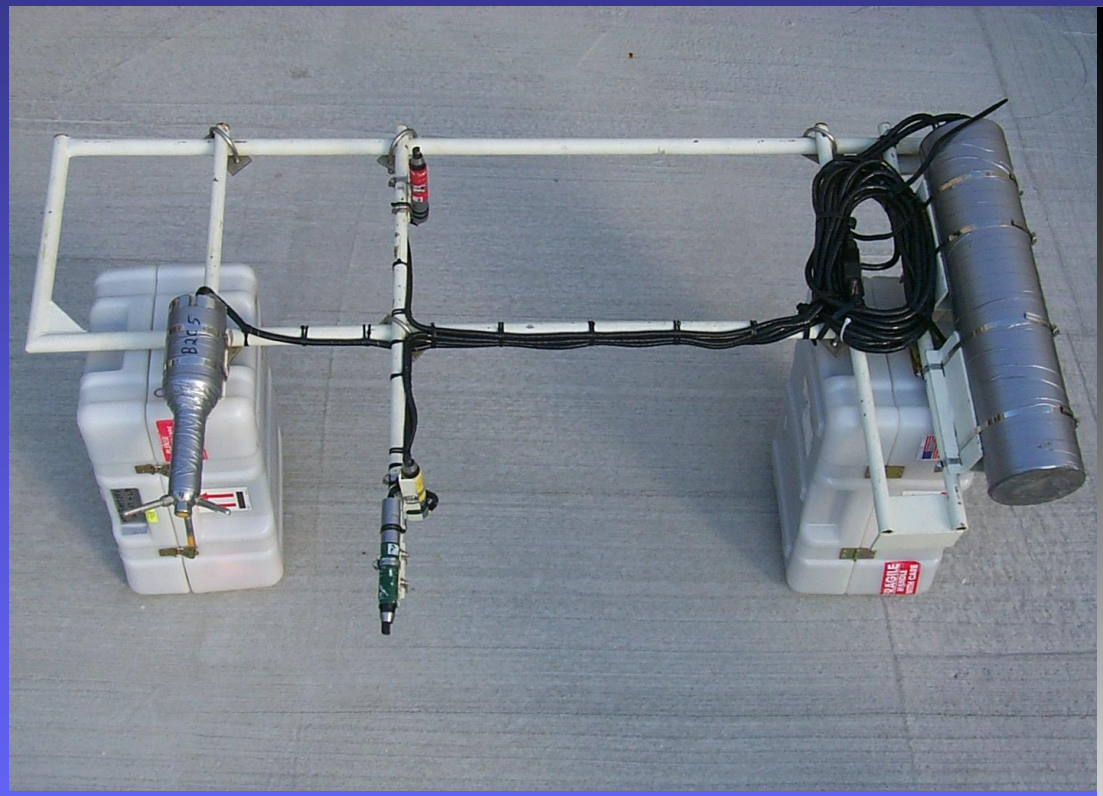
Why?

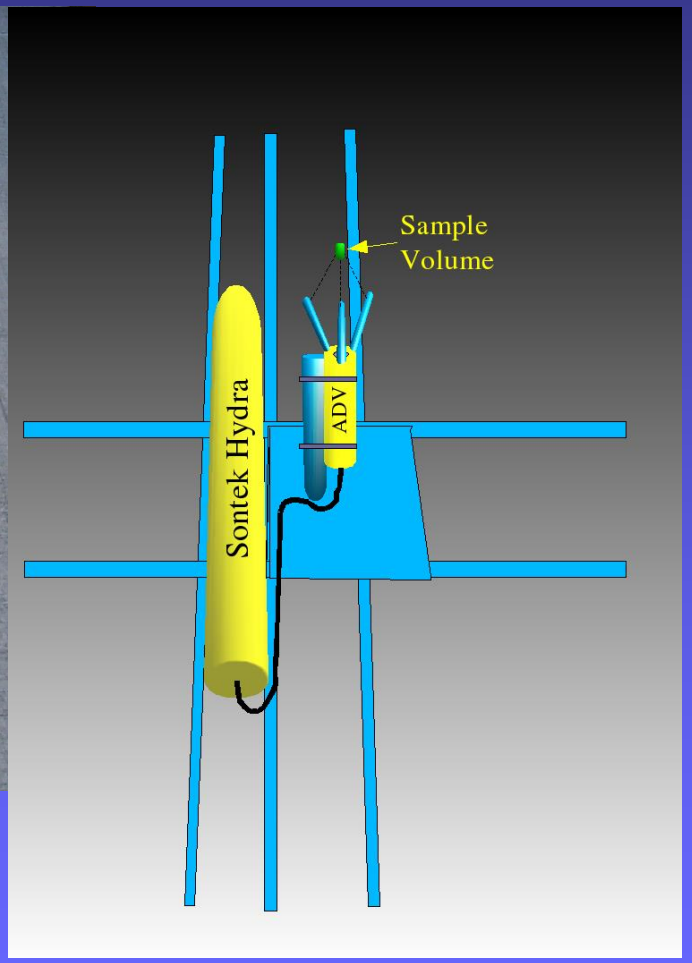
Numerical modeling, when properly applied and verified with field data, can provide valuable information on the processes affecting a region and can be used as a tool to evaluate alternative courses of action

What?

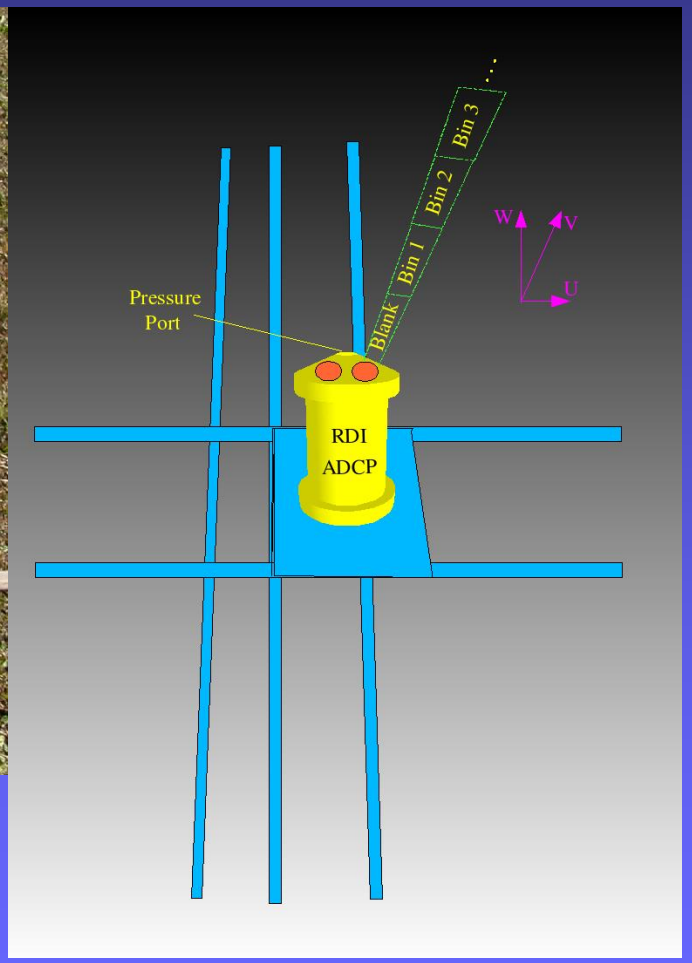
- **Currents**
  - **Acoustic Doppler Velocimeters (ADV)**
  - **Acoustic Doppler Current Profilers (ADCP)**
- **Waves**
  - **UH Datawell Directional Wave Buoy**
  - **Two ADCPs**
- **Bathymetry and Roving Current Profiles**

Acoustic Doppler Velocimeter

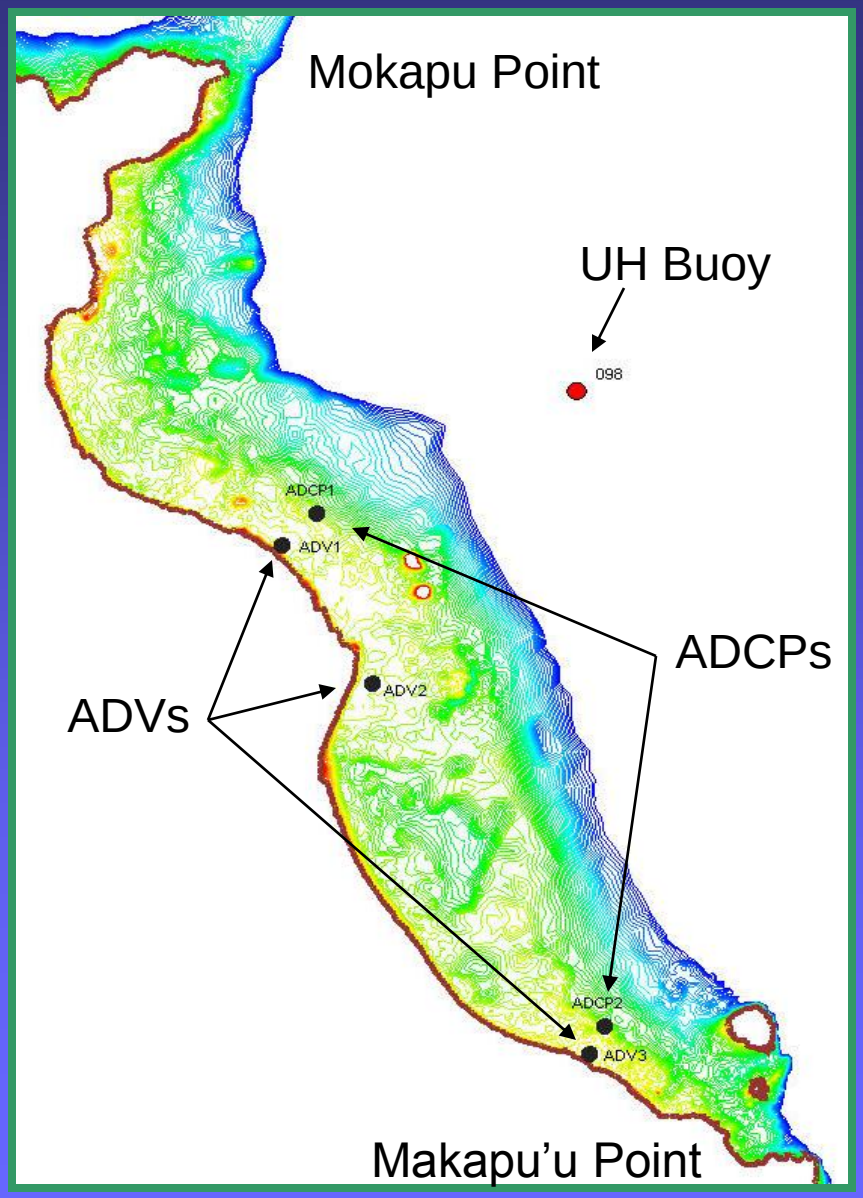




Acoustic Doppler Current Profiler



Where?


Mokapu Point
UH Buoy
098
ADCP1
ADV1
ADCPs
ADVs
ADV2
ADCP2
ADV3
Makapu'u Point

When?

Deployment: July 2005

Retrieval: September 2005

Next Steps

- Conduct Data Processing and Analysis
- Format Data for Input into Wave and Current Models
- Conduct Model Verification and Calibration

Questions

GIS Web Application

Mr. Justin Pummell
U.S. Army Corps of Engineers
Honolulu District

Objective

1)GIS Overview

2)

2)Regional Sediment Management GIS via the Internet

GIS Overview

What is GIS?

GIS = Geographic Information System

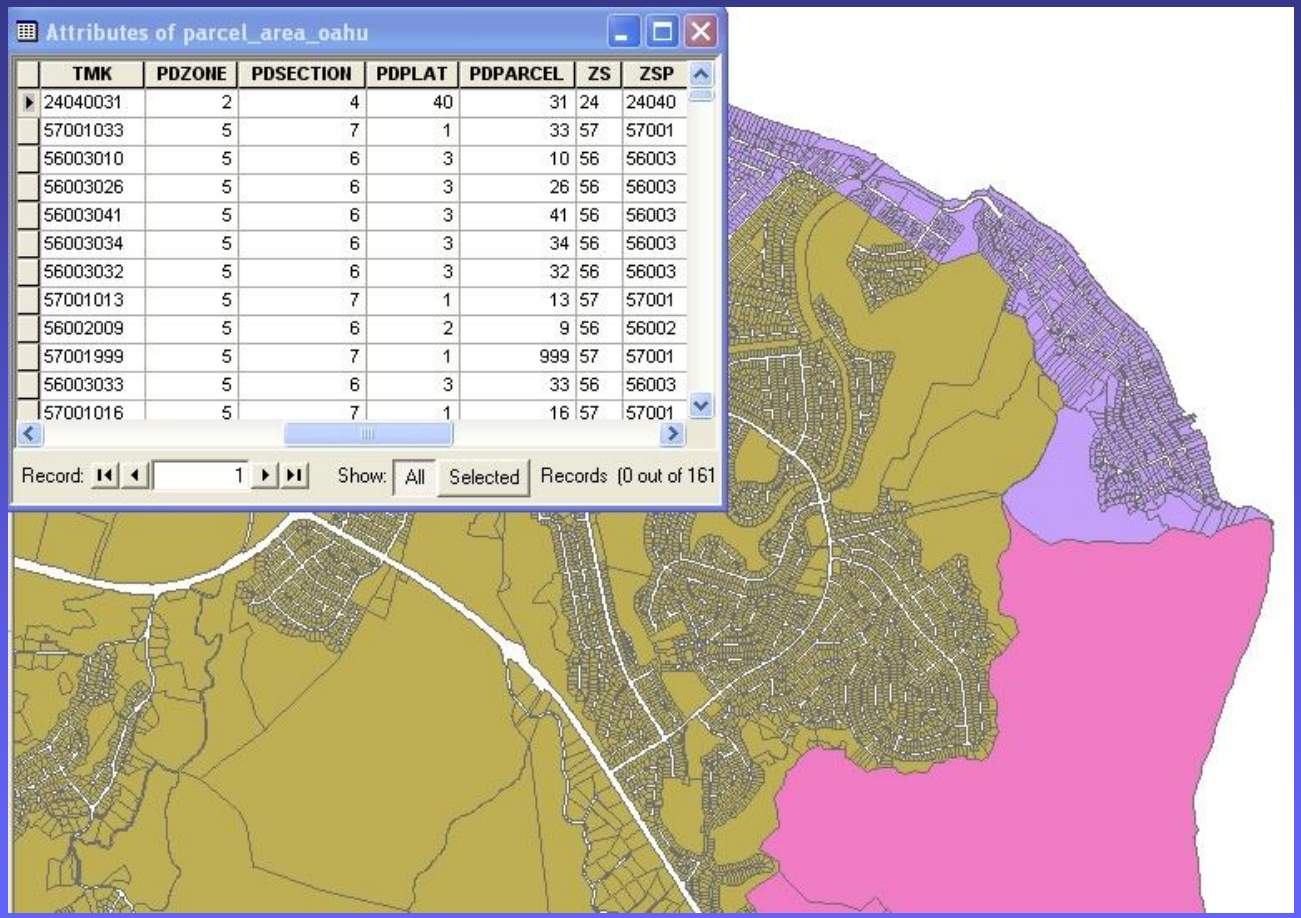
- A Geographic Information System (GIS) is a computer based information system used to digitally represent and analyze geographic features present on the Earth' surface and the events taking place on it.

- GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps.

What is GIS?

GIS allows you to:

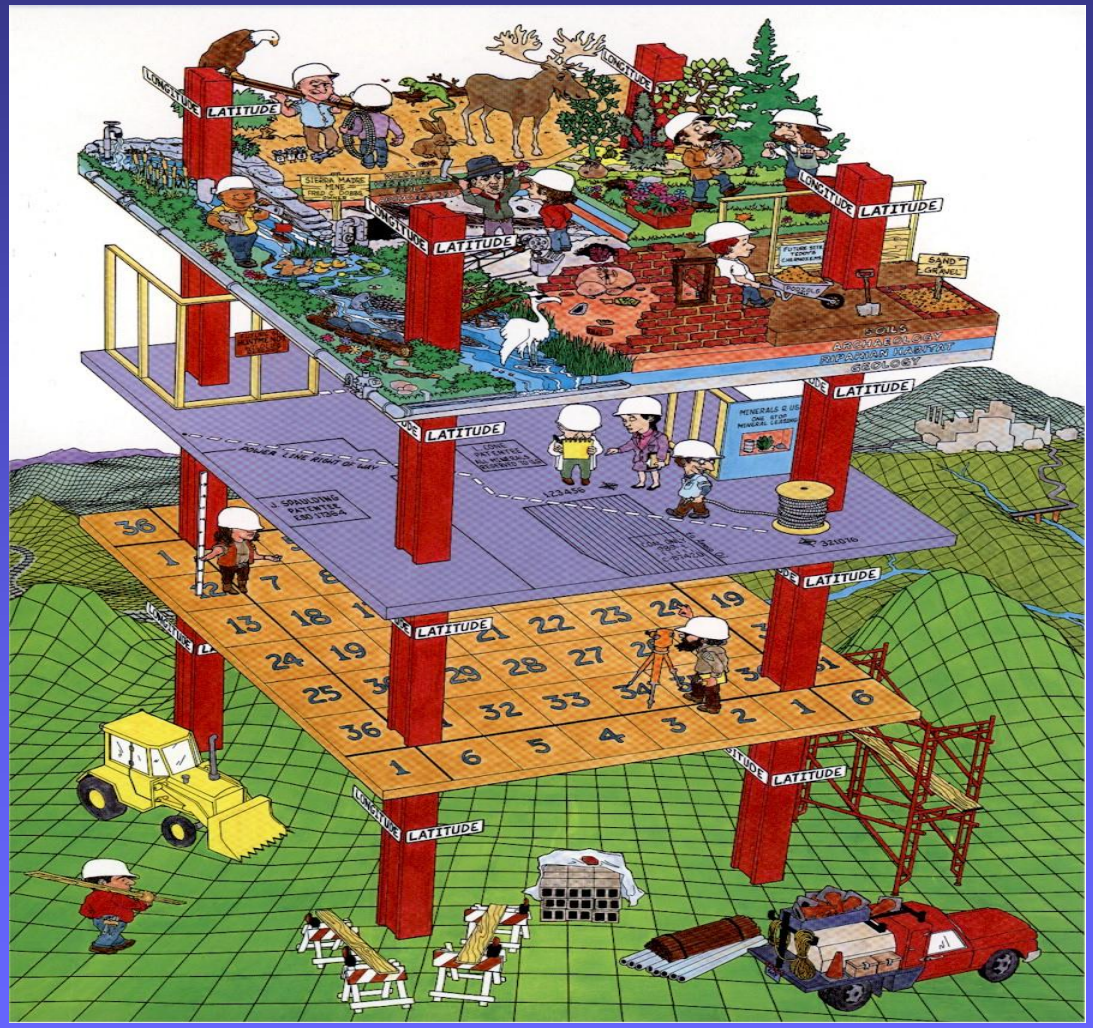
Store, access, and view information about your project



What is GIS?

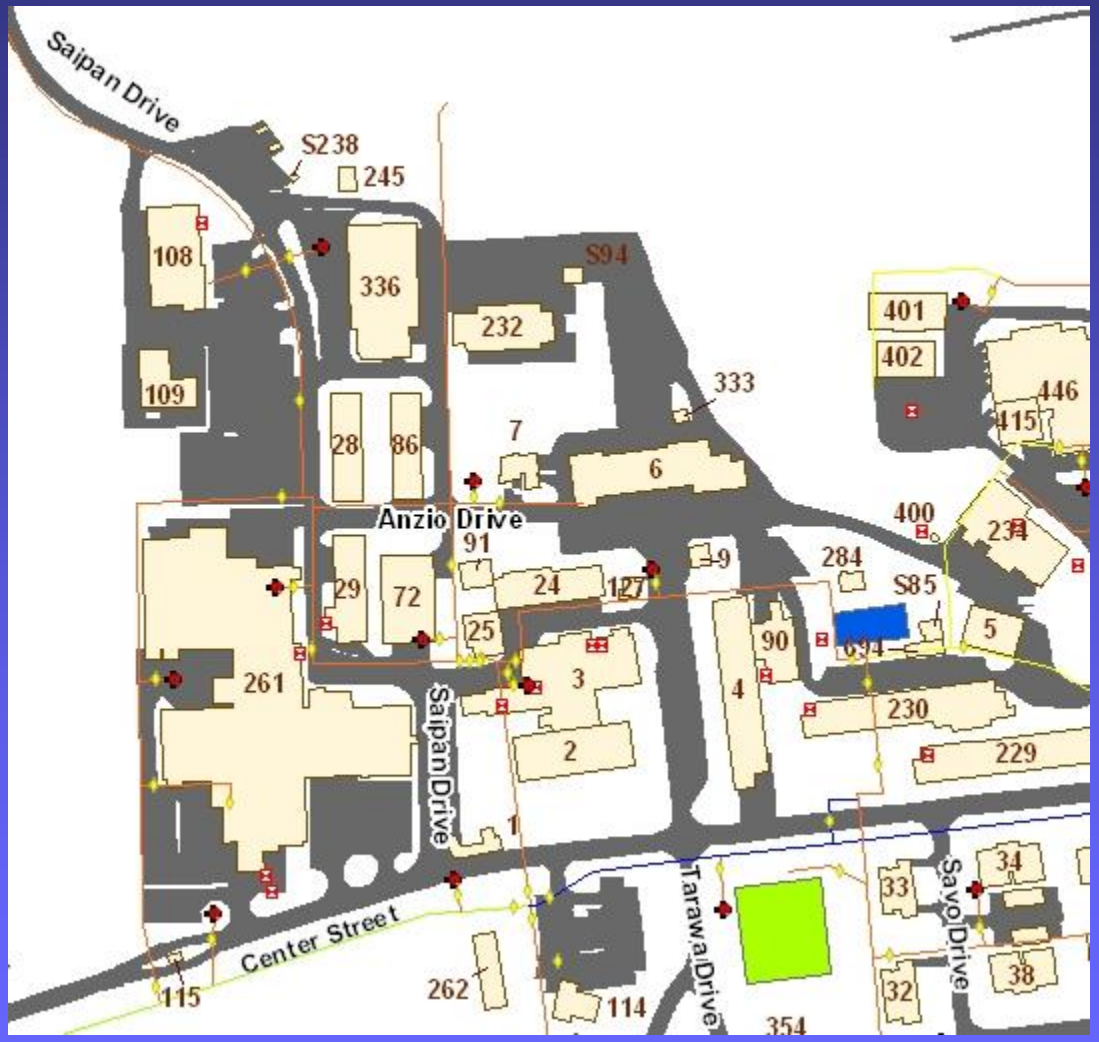
GIS allows you to:

Reference information spatially



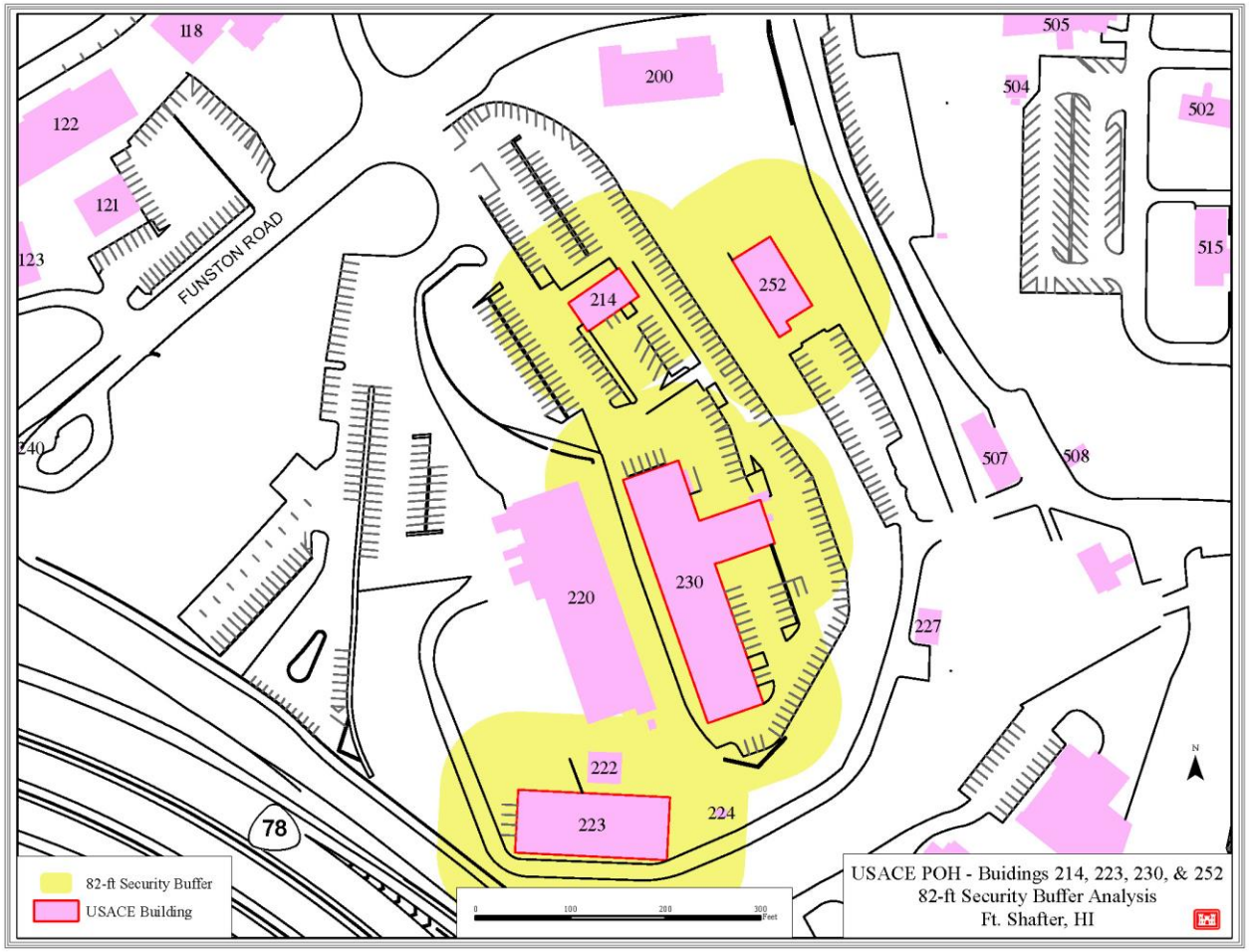
What is GIS?

GIS allows you to view information graphically



What is GIS?

GIS allows you to share information with others



GIS & Regional Sediment Management

GIS & RSM

- **RSM GIS will be a "decision" tool that uses geospatial information to analysis all regional sediment management processes from makua (mountains) to makai (ocean).**

- **It will be our primary platform to interactively participate with this project and learn about regional sediment management and change in Hawaii.**

Data Layers

Layers will include:

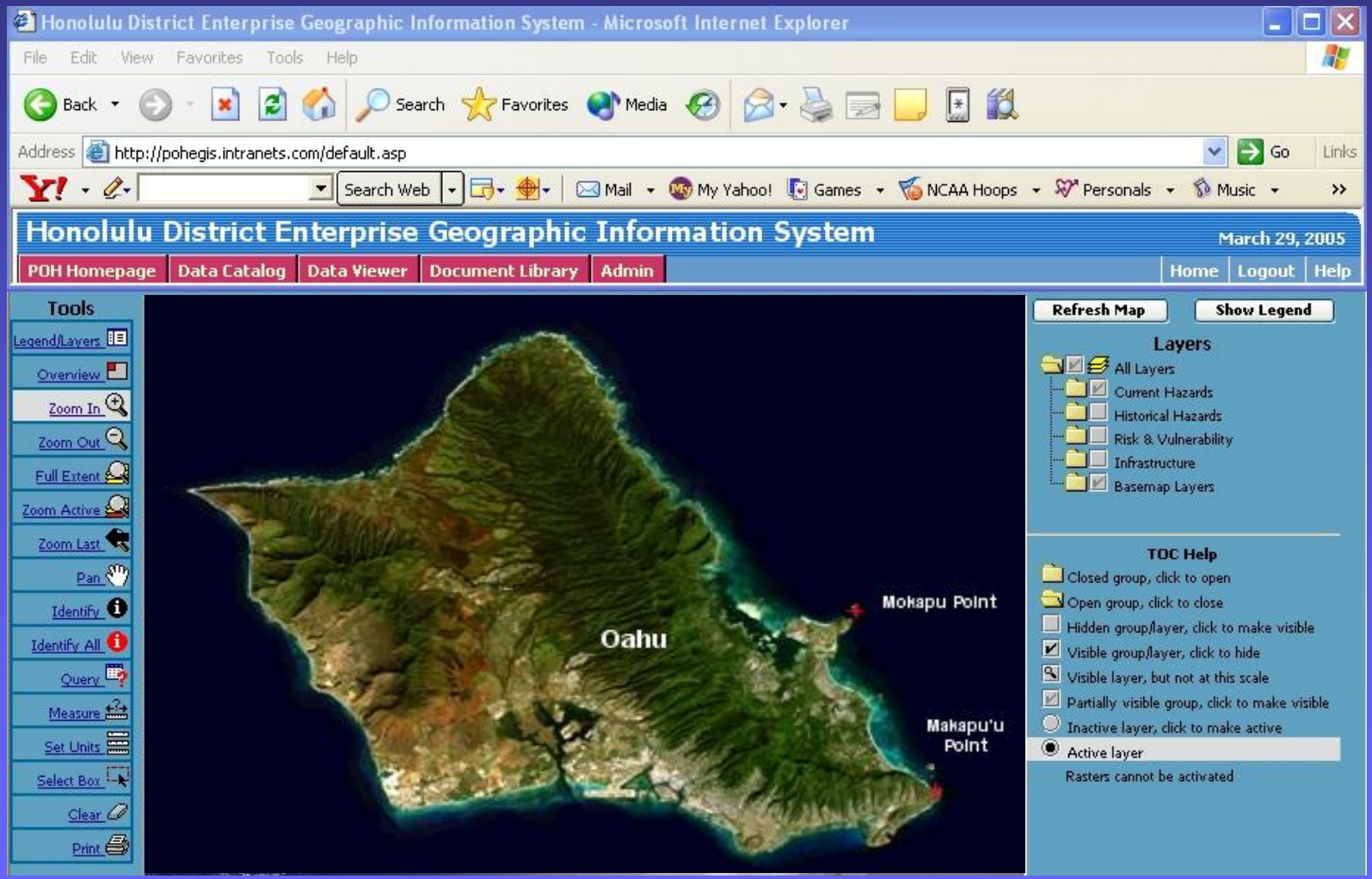
- satellite imagery
- watershed boundaries
- land parcels
- roads
- soil types
- wetlands
- hydrography
- shoreline profiles
- historical shoreline change
- shoreline structures
- coastal habitat & reefs
- sediment deposit information
- revetments
- bathymetry
- wave gages
- nautical charts
- and much more!

GIS and the Internet

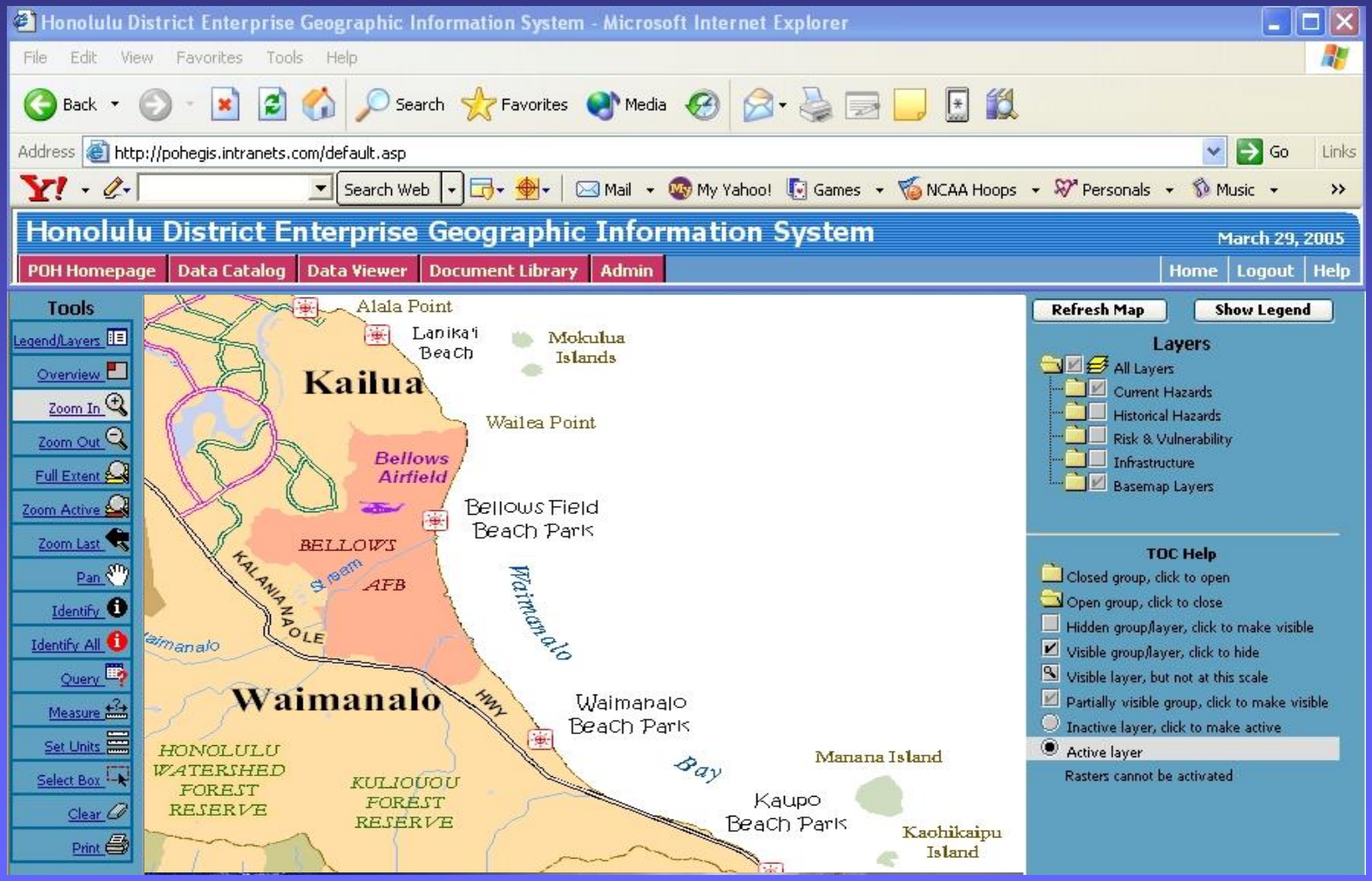
All of the RSM information gathered in a GIS will be deployed over the Internet for use.

GIS and the Internet

GIS and the Internet



GIS and the Internet



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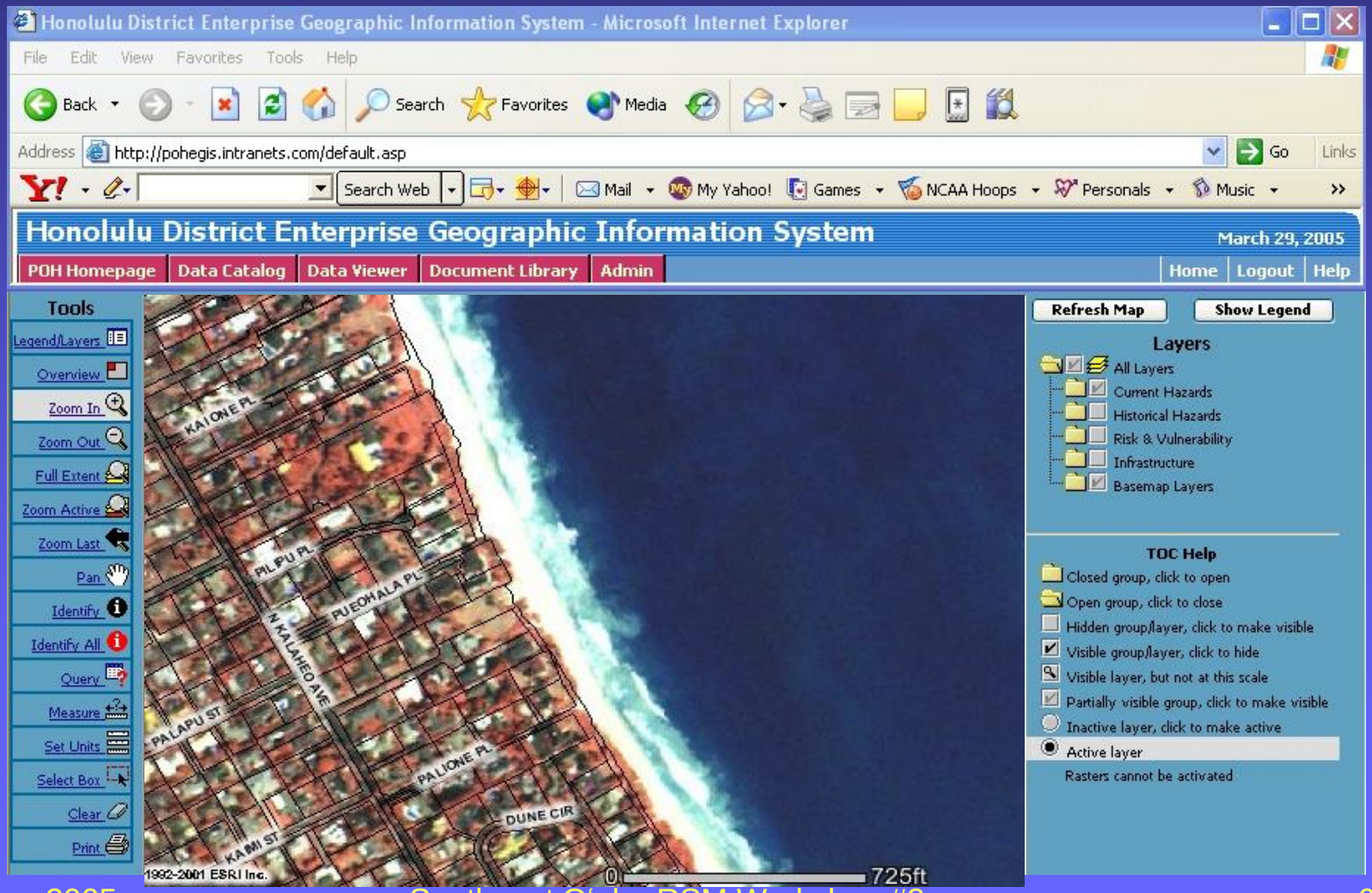

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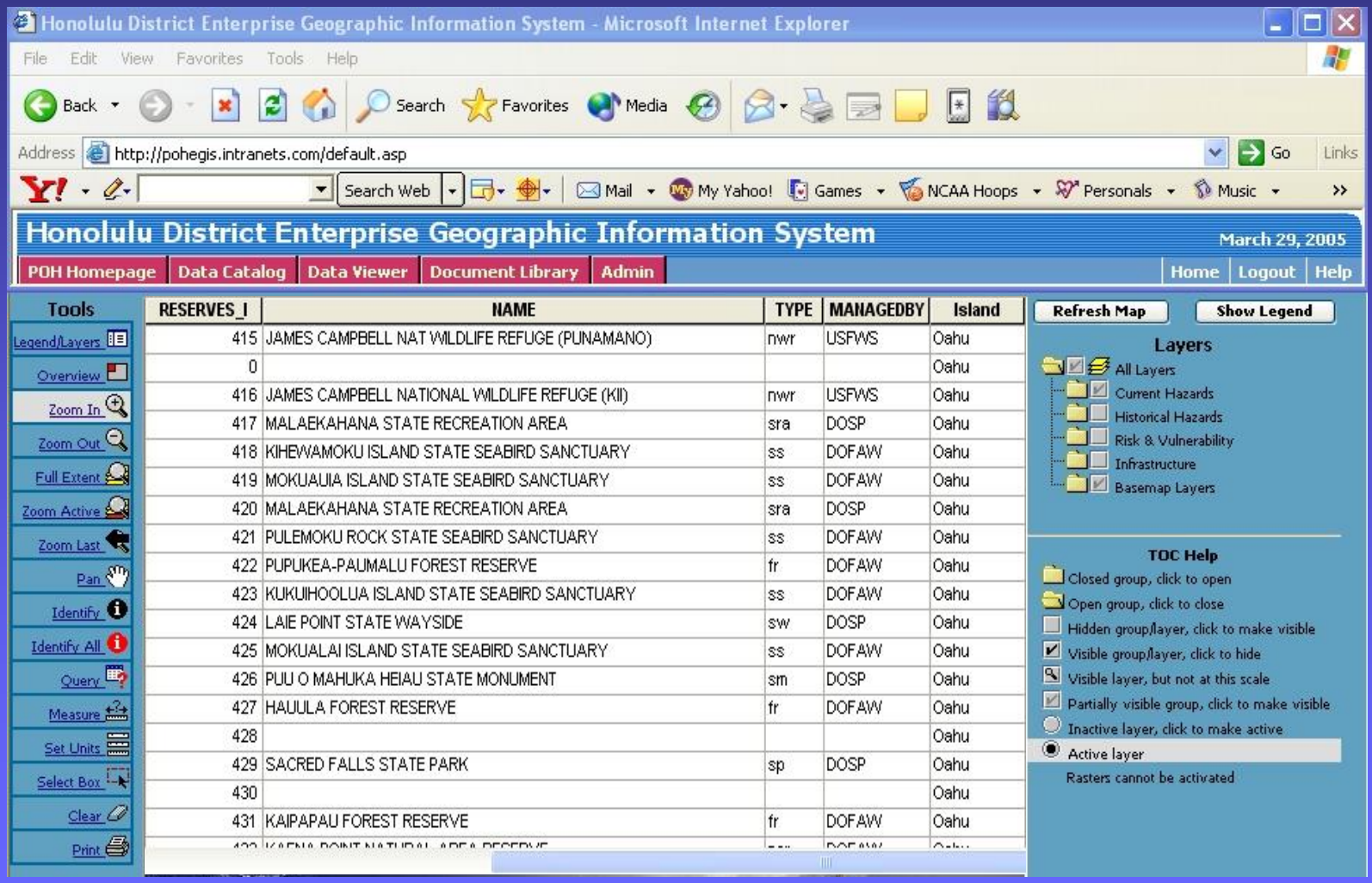
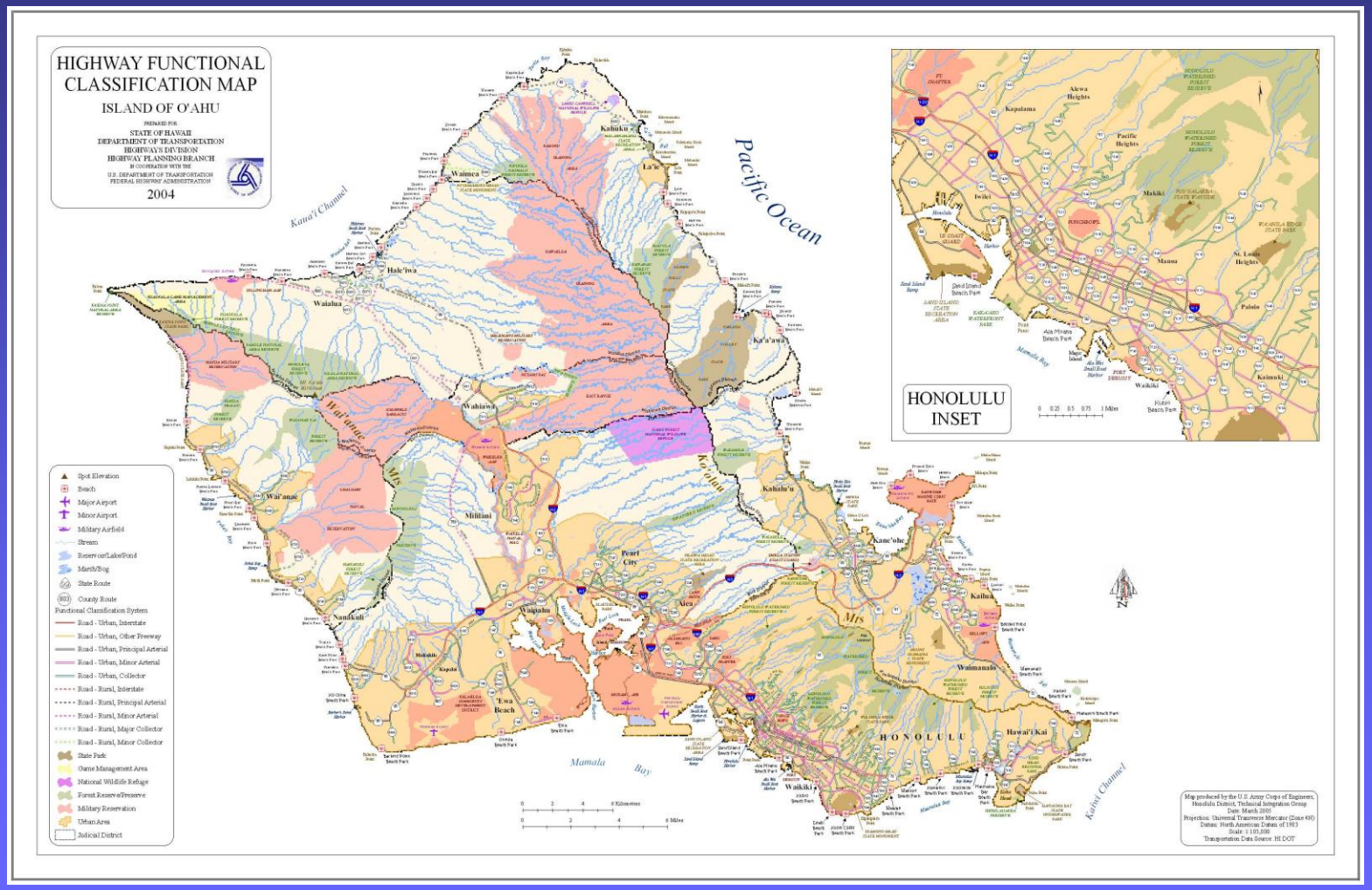


GIS and the Internet



Next Steps

- **Maintain & Update SEO/RSM Website:**
  http://www.poh.usace.army.mil/RSM/index.htm
- **Web-base GIS online by Fall 2005**

Questions

Breakout Sessions

Potential Demonstration Projects

- Kaupo Beach/Kaiona Beach
- Bellows Air Force Station
- Lanikai
- Ka‘elepulu Stream

- Breakout Session Objective:
  - Refine “Problem Statement”
  - Identify potential opportunities for project & region
  - Identify potential issues for project & region
  - Identify potential project design alternatives

MAHALO!