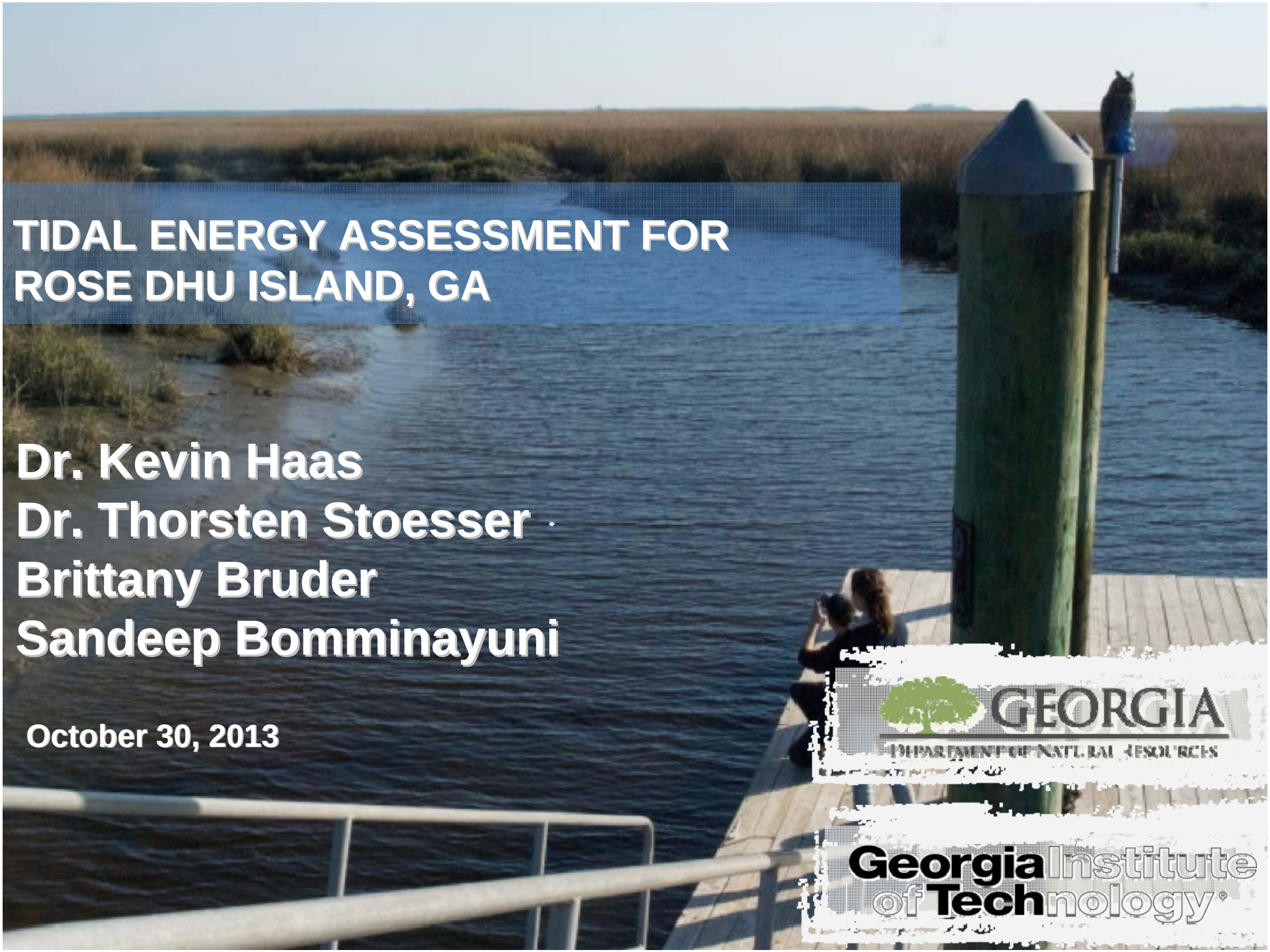

# TIDAL ENERGY ASSESSMENT FOR ROSE DHU ISLAND, GA


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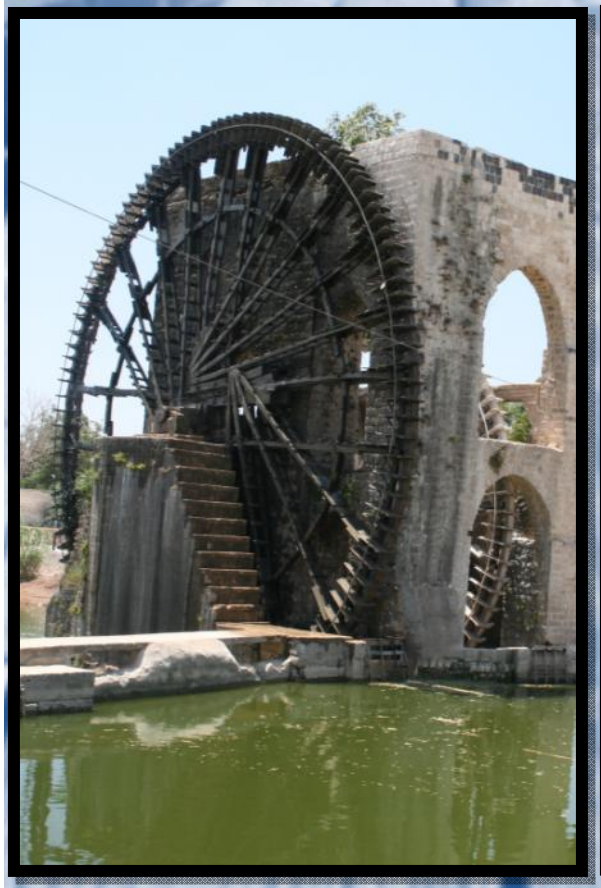
October 30, 2013

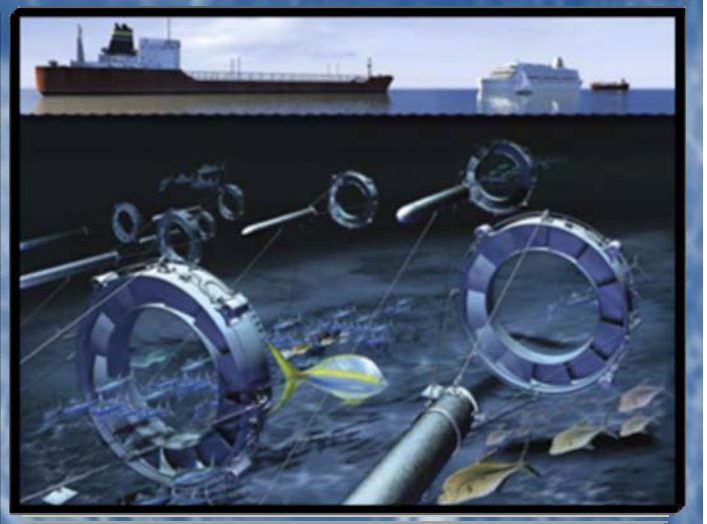
GEORGIA
DEPARTMENT OF NATURAL RESOURCES

Georgia Institute of Technology

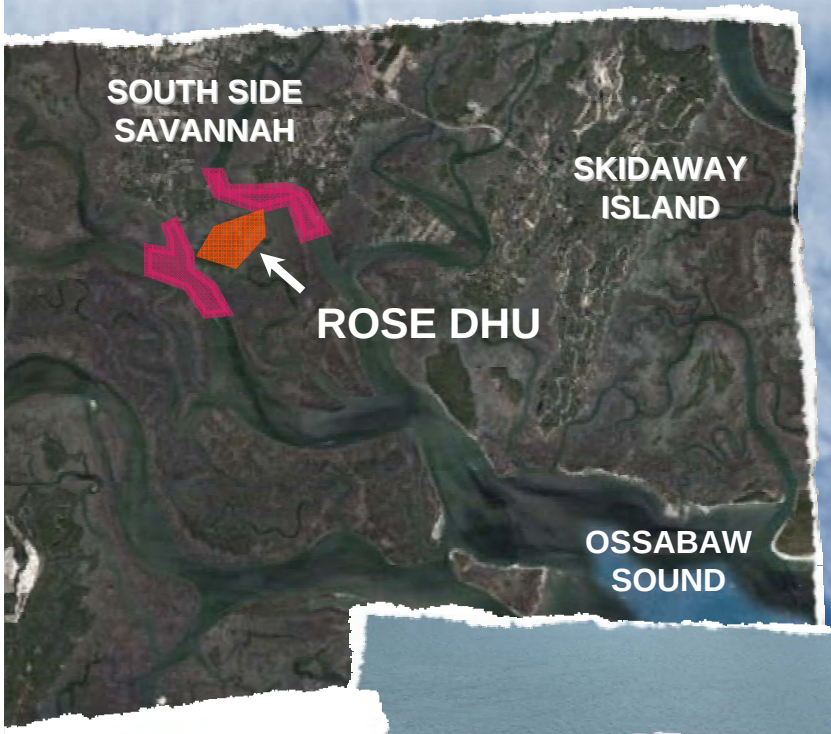
# Tidal Energy

**Converts the kinetic energy of tidal currents into a more useful form**



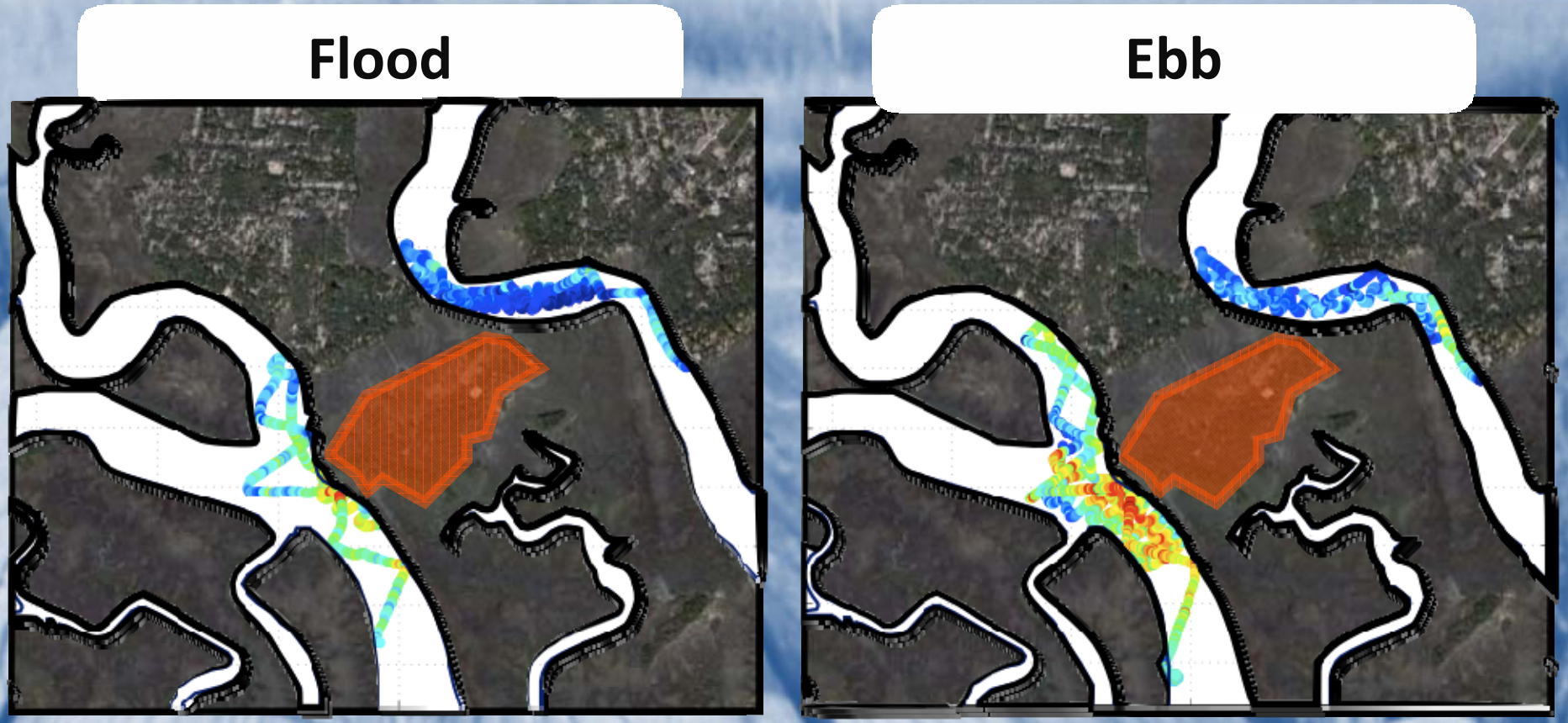


# Rose Dhu Island



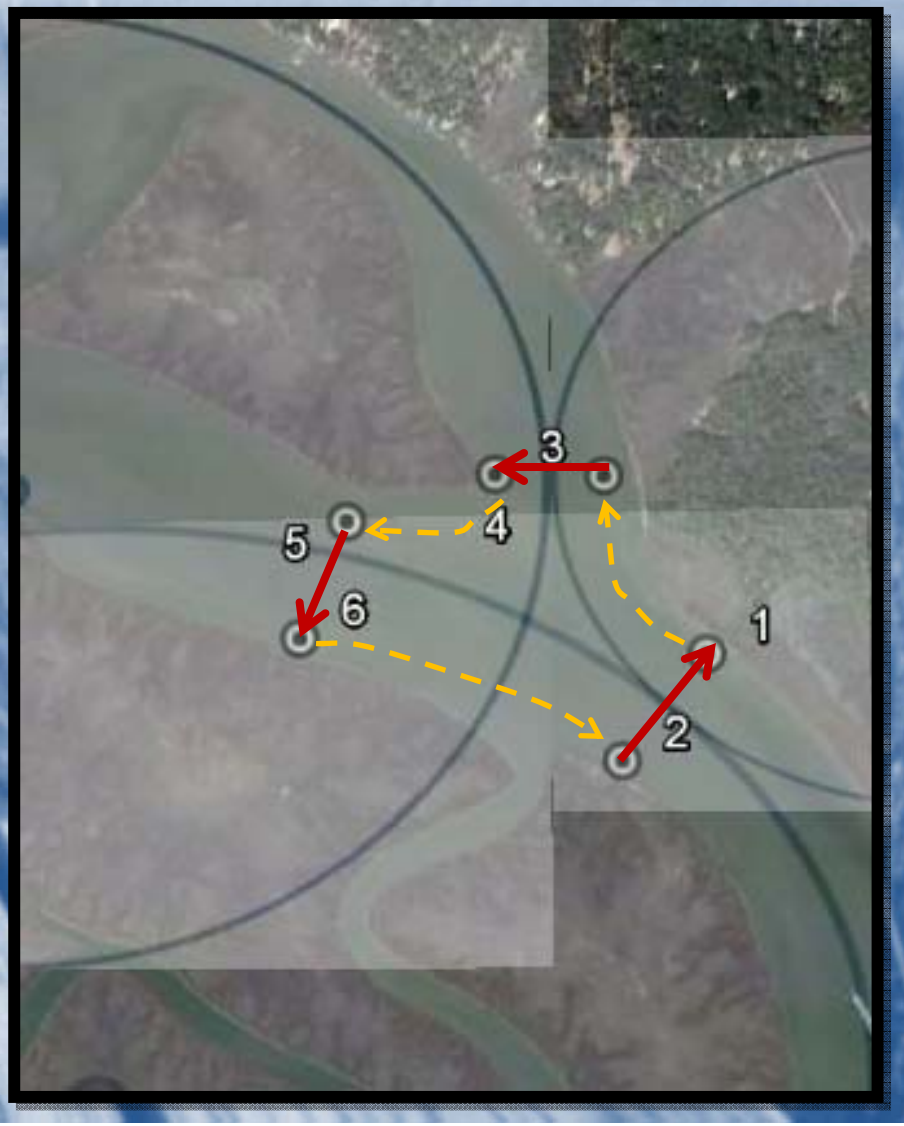

- Proposed site of Girl Scout "Eco-Village," powered by renewable resources
- Project was to assess available hydrokinetic energy
- Consisted of boat based tidal measurements of currents, water levels, and bathymetry
- Numerical model, validated by measurements, utilized to predict available power

# Preliminary Results

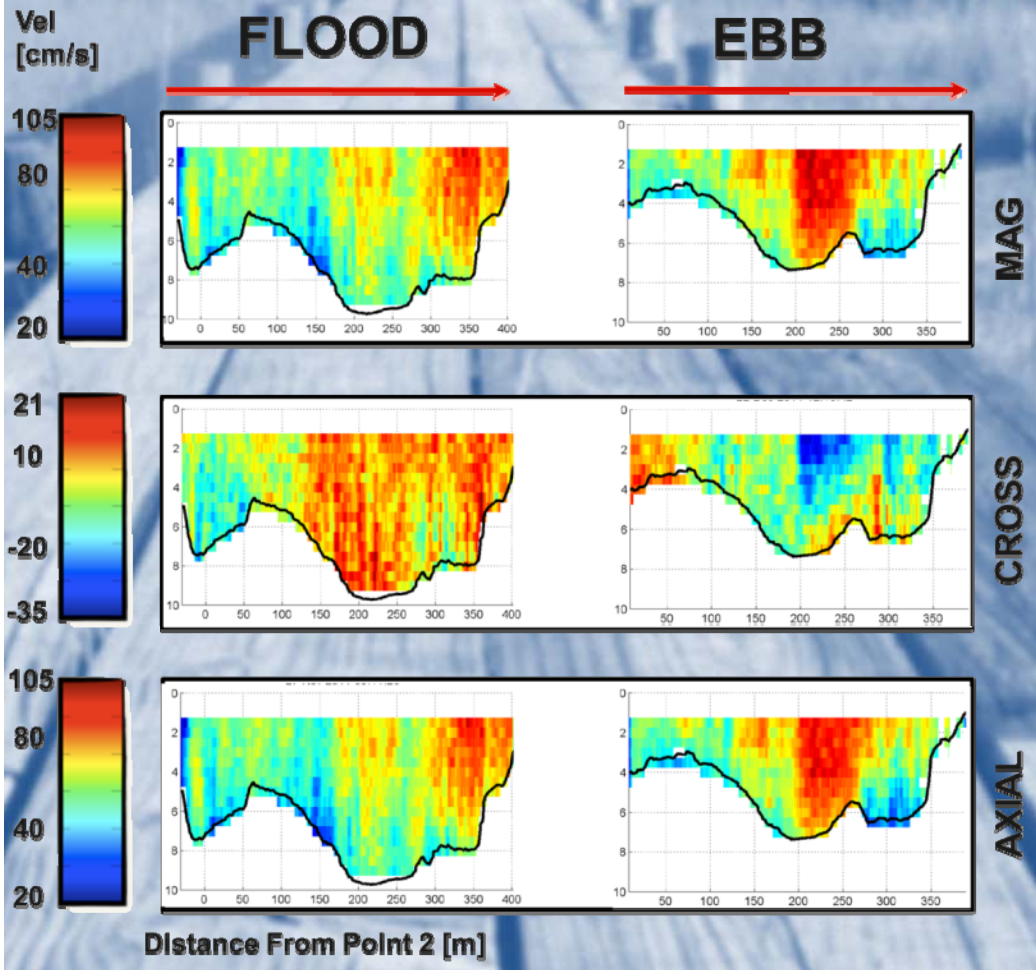


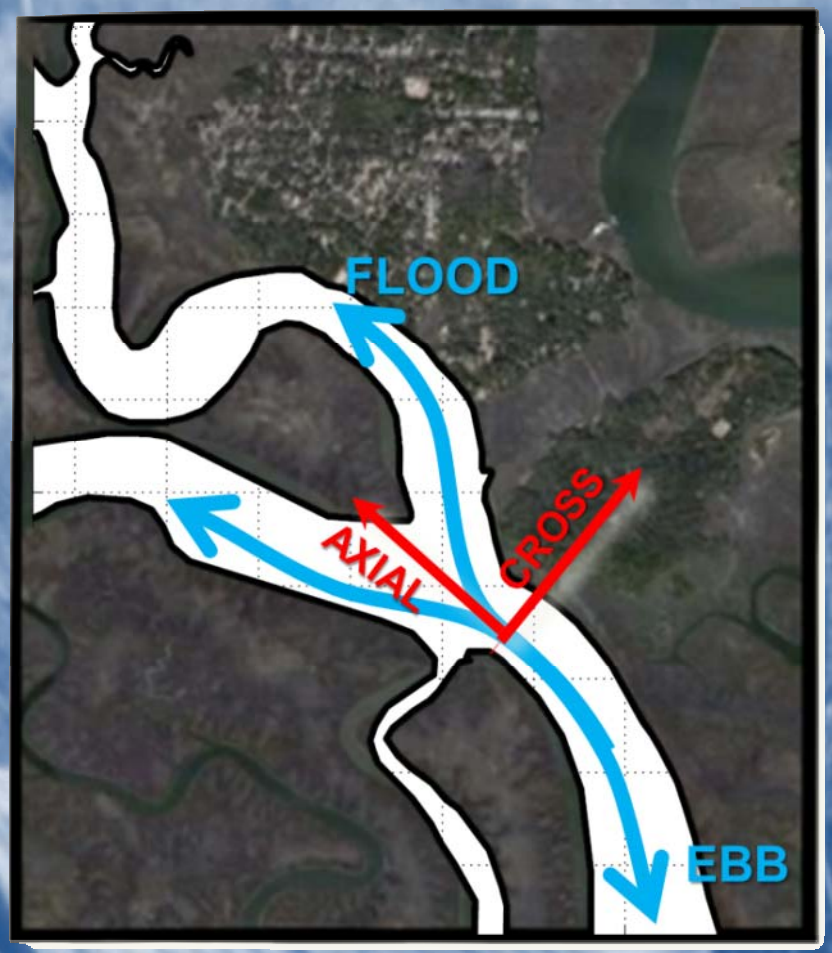
# 2nd Field Campaign

- Preliminary results adequate for a general assessment of viability but inadequate for model validation and hydrodynamic characterization
- Second campaign did transects in November and December 2011
- Designed to gain timeseries at points of interest
- Obtain volume flux estimates to observe aggregate hydrodynamics

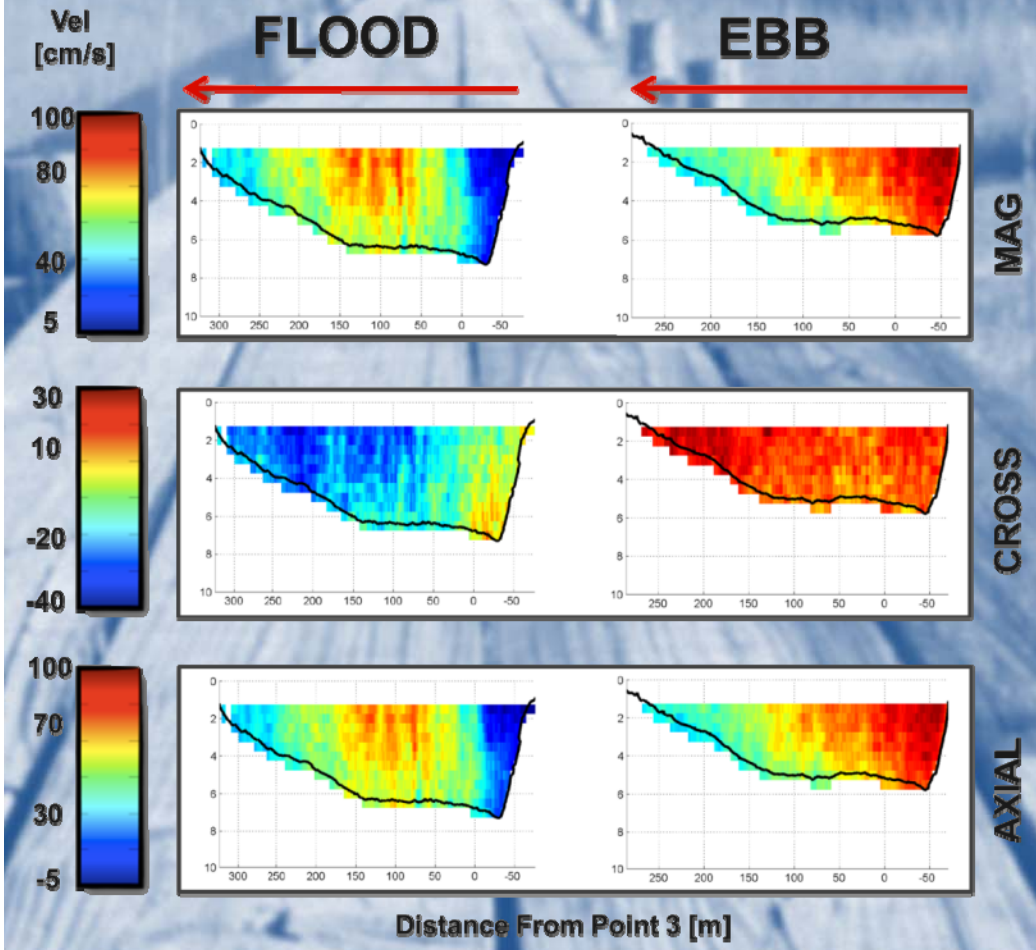


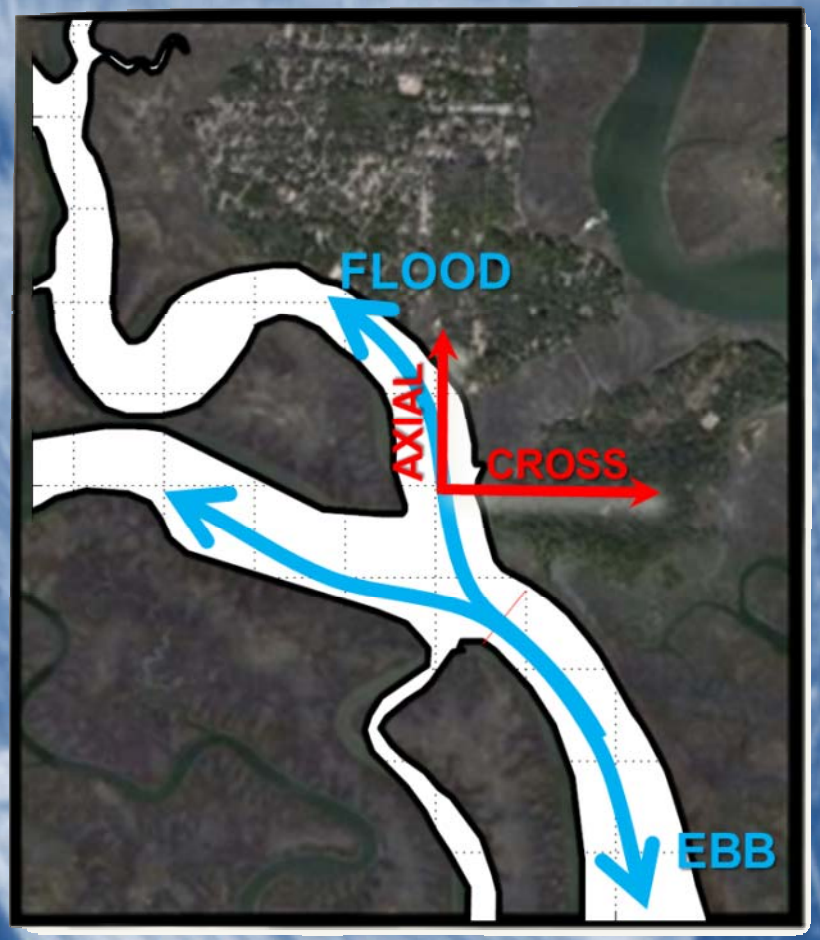
# Transect 2-1


Vel
[cm/s]
FLOOD
EBB
105
80
40
20
21
10
-20
-35
MAG
CROSS
AXIAL
Distance From Point 2 [m]


FLOOD
AXIAL
CROSS
EBB

# Transect 3-4


Vel
[cm/s]
FLOOD
EBB
100
80
40
5
30
10
-20
-40
100
70
30
-5
MAG
CROSS
AXIAL
Distance From Point 3 [m]


FLOOD
AXIAL
CROSS
EBB

# Numerical Model

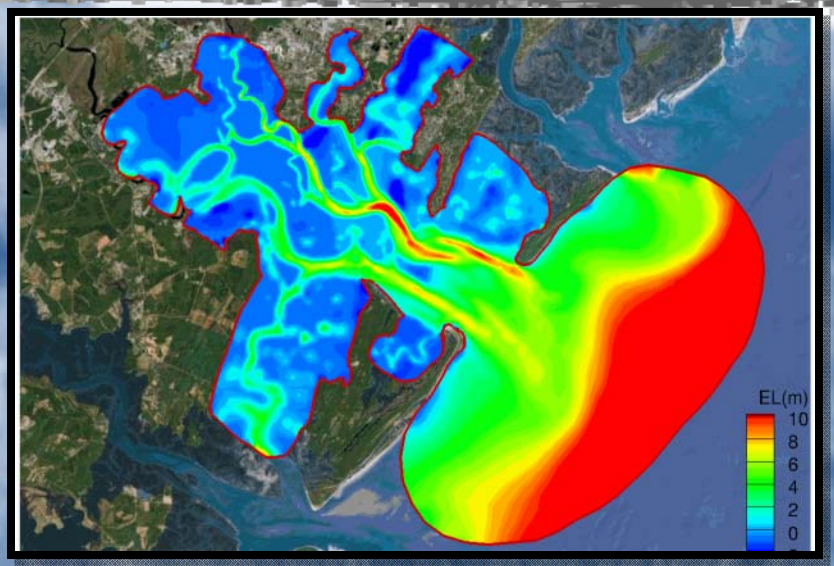
- Model used: Finite Volume Coastal Ocean Model (FVCOM) of Chen et al. (2003a)

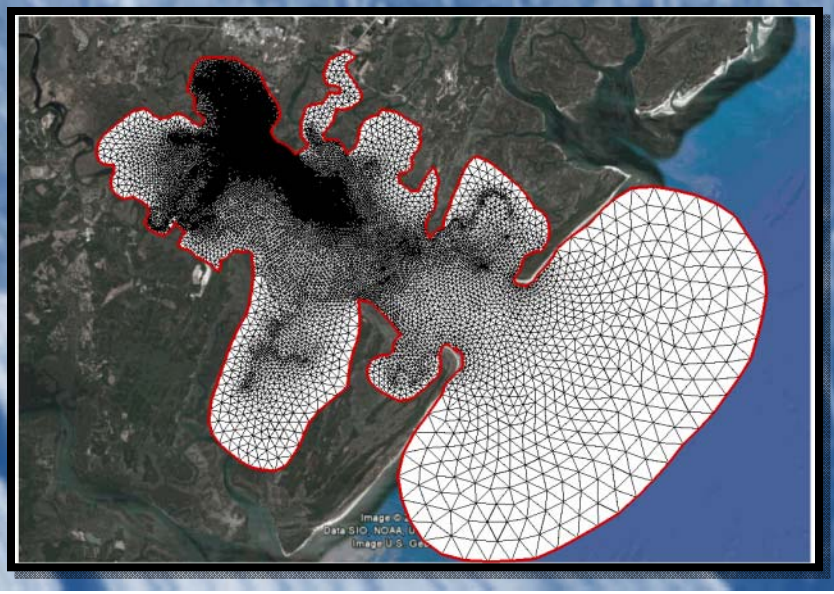
- Boundary Condition: water level forcing using ADCIRC constituents

- Initial Condition: Zero motion

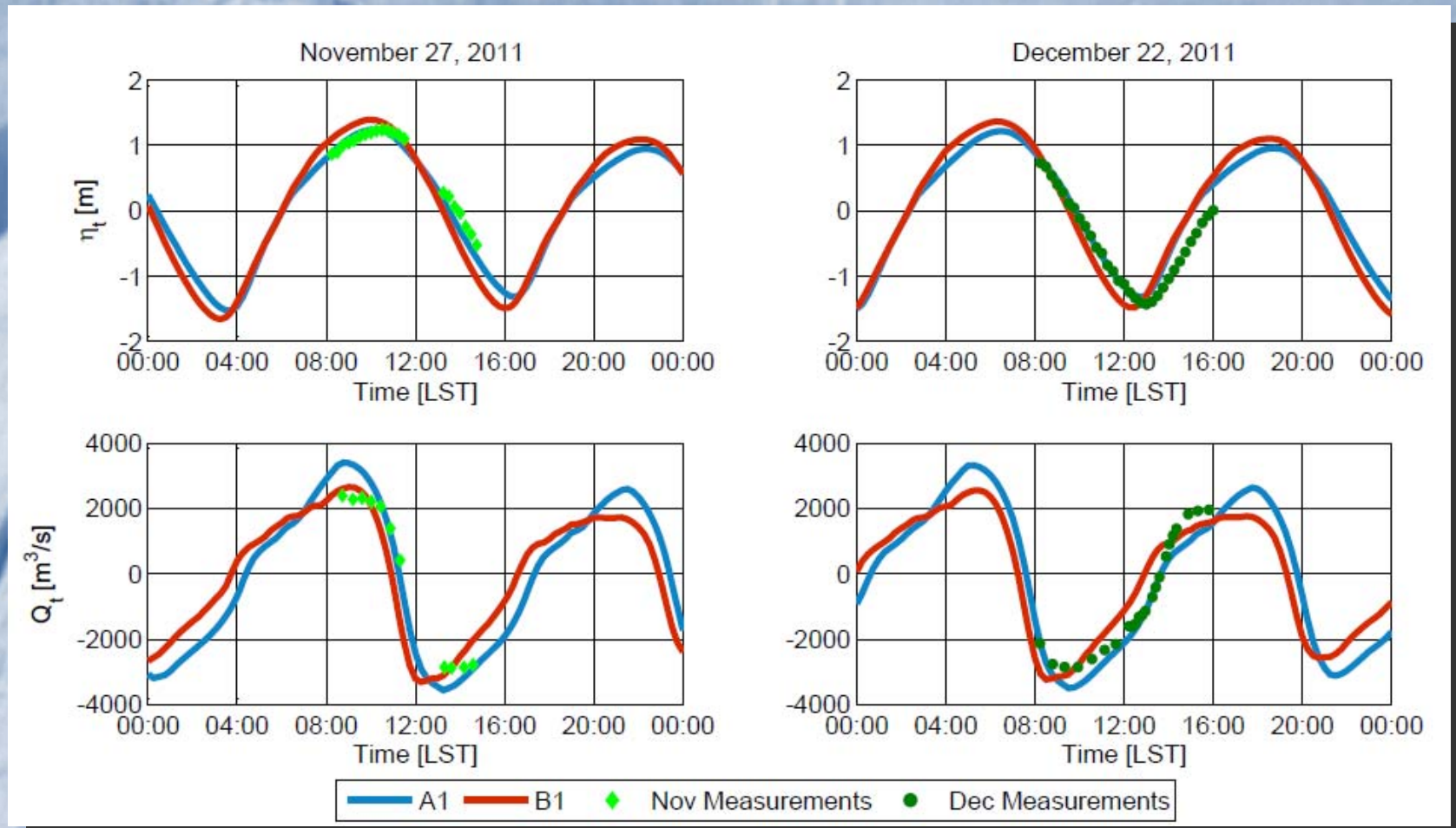
- Bathymetry and elevation data from measurements, NOAA, USGS, and LIDAR Data

- Grid Spacing: 25m at Rose Dhu; 250m at ocean boundary



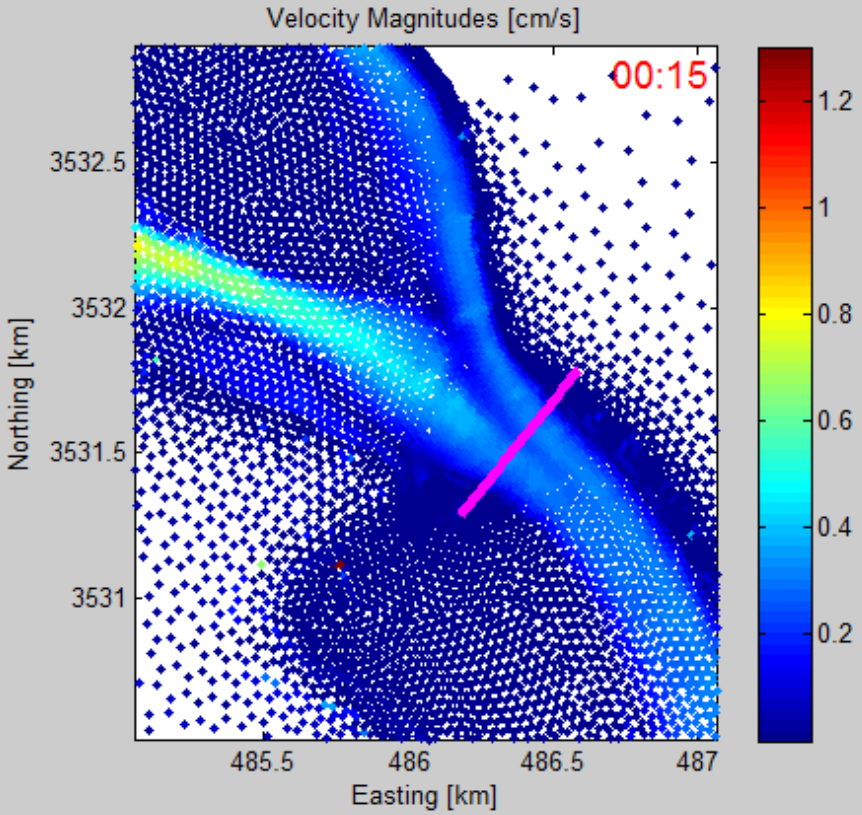



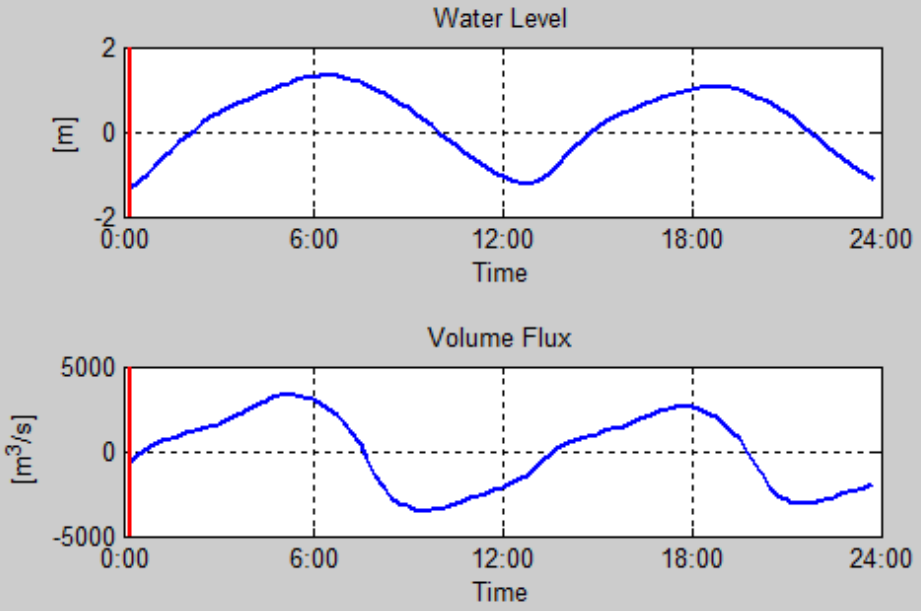
# Model Validation




**Utilized two different marsh elevations, LIDAR (A1) and USGS (B1)**

# Additional Results



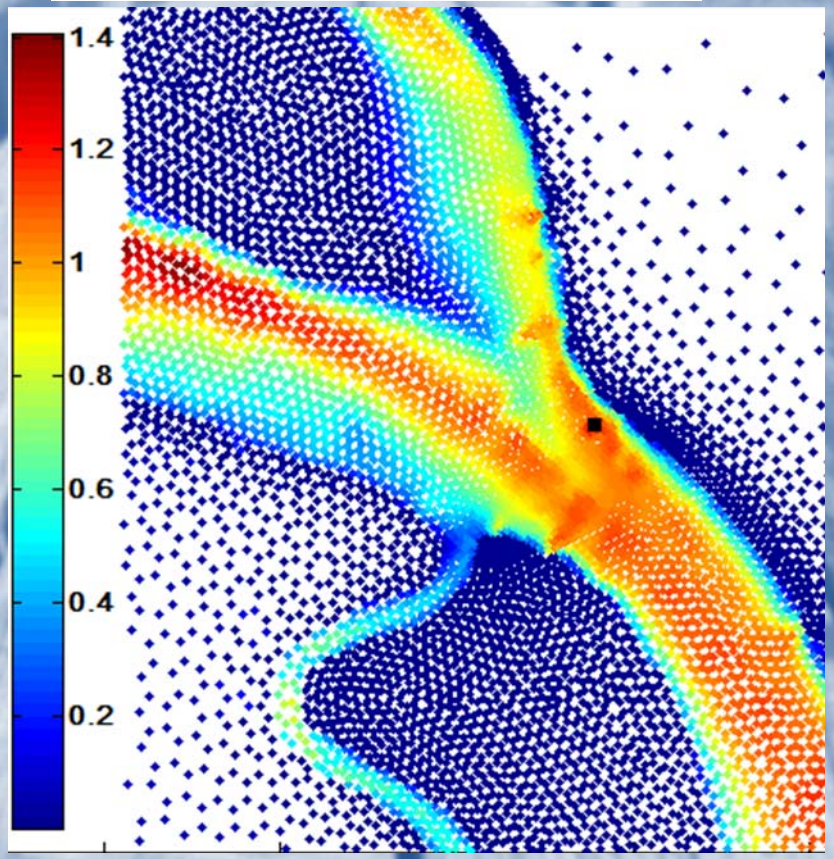




- **Date Simulated: December 22, 2011**

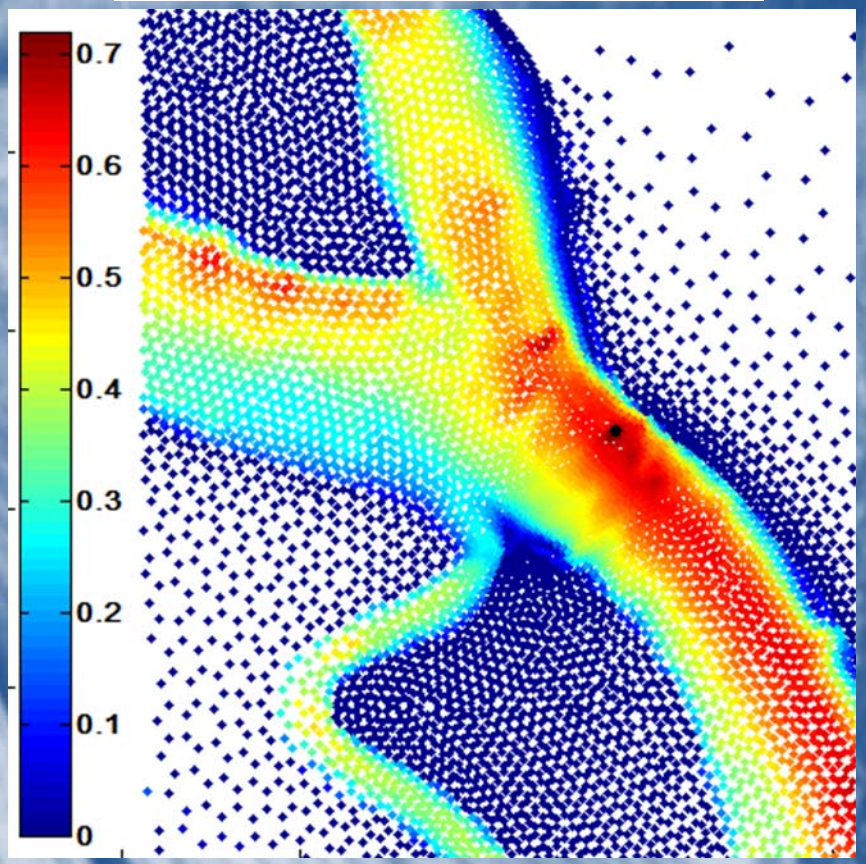
- **Flow constriction from bathymetry and channel collision**
- **Clear Influence of Centrifugal Acceleration**
- **Different spatial variation for flood and ebb tides**

# Additional Results

**Peak Ebb**




**Peak Flood**



# Tidal Energy Assessment

**Three points in close proximity to the hotspot are selected for power calculations**

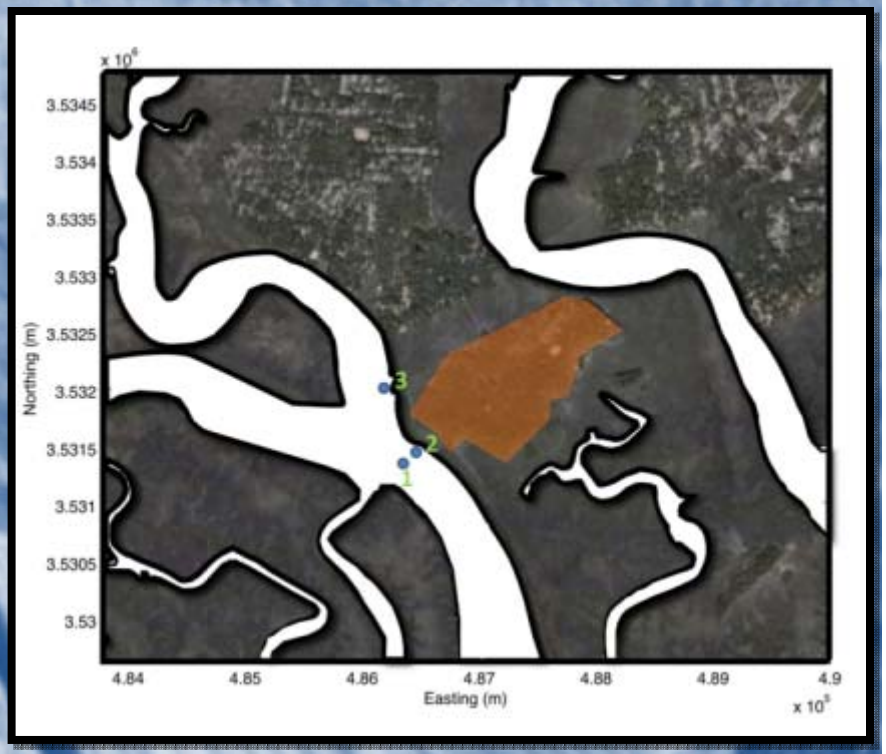
$$P_k = 0.5\rho\left|\vec{u}\right|^3 E_f A_s$$

$\vec{u}$ **Velocity at the assumed turbine depth**
**Cut in Speed (50 cm/s)**

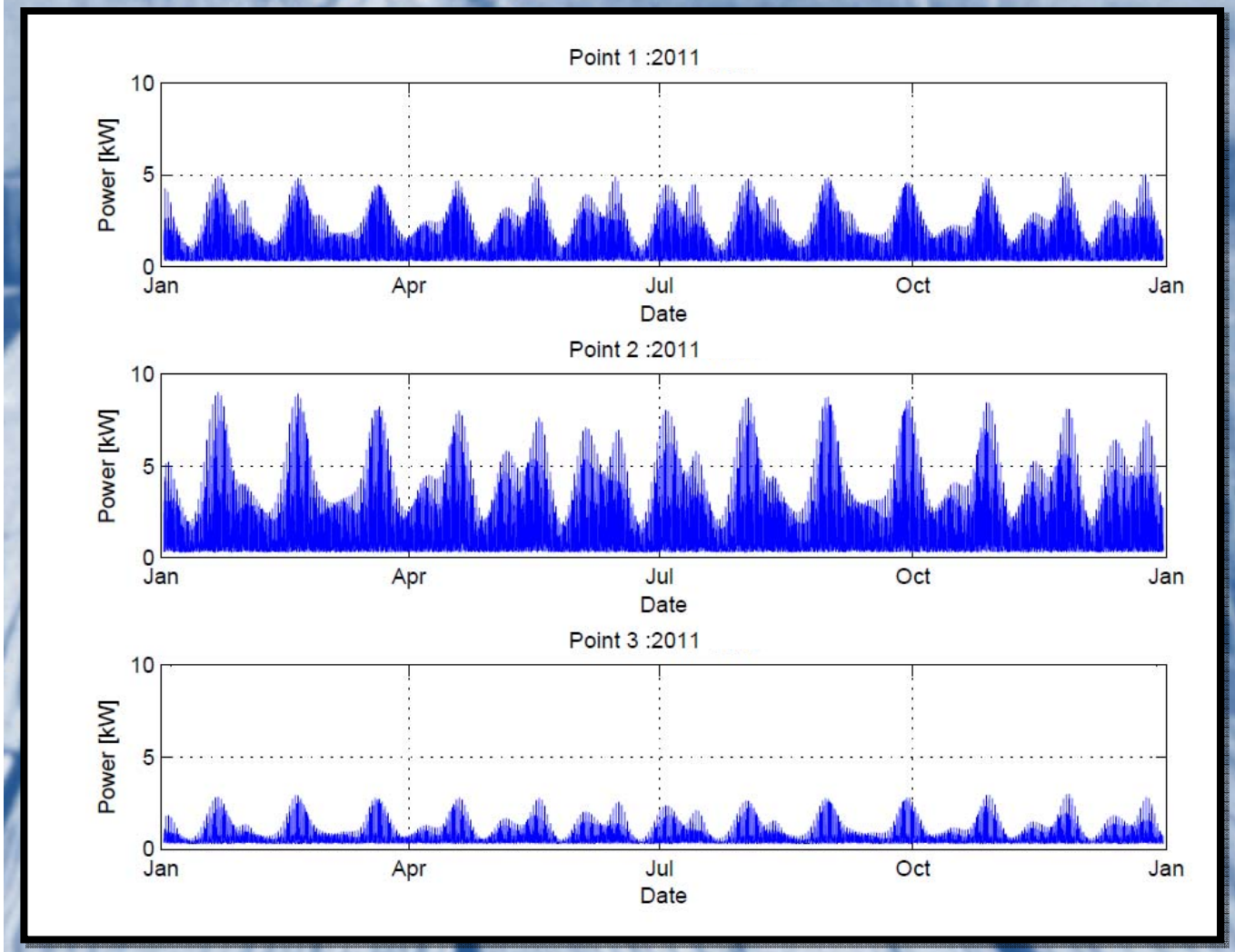
$\rho$ **Water density (1025 kg/m^3)**

$E_f$ **Efficiency (45%)**

$A_s$ **Swept area of devices (5 devices*2 m²)**



# Tidal Energy Assessment



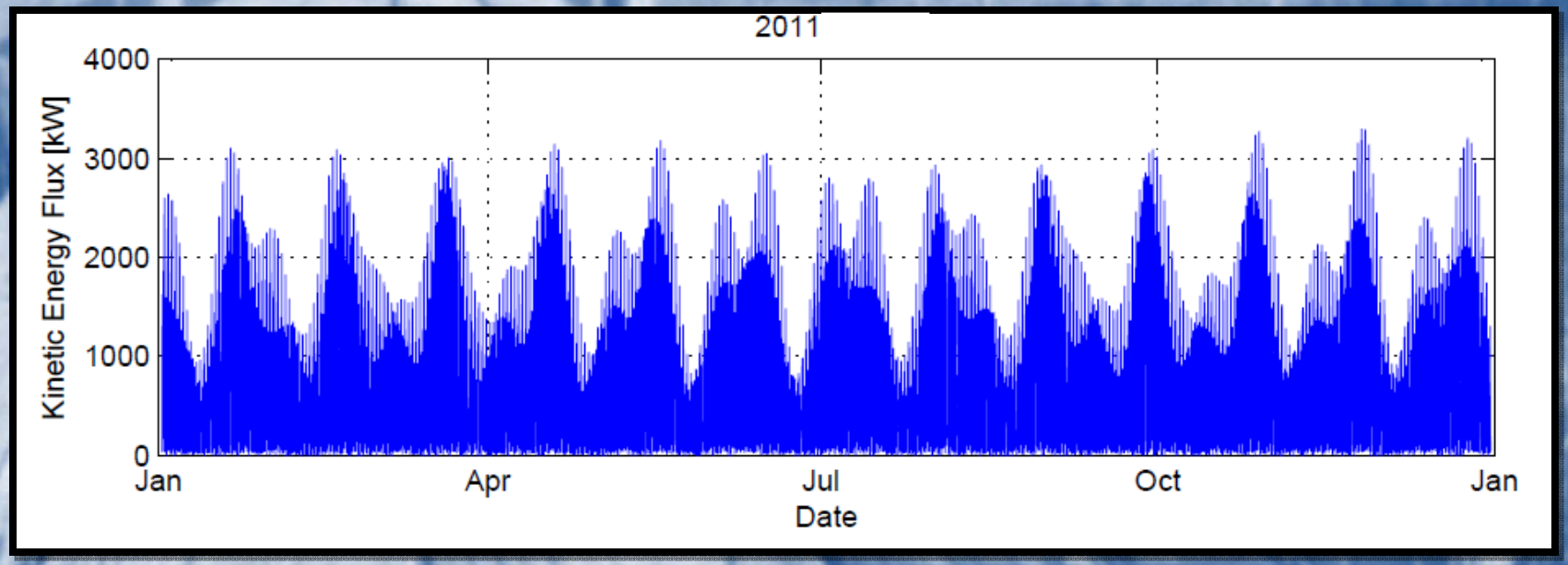

**7.6 MWh per year**

**13 MWh per year**

**3.2 MWh per year**

# Tidal Energy Assessment

**Total kinetic power in the cross-section**




- **Extraction for Rose Dhu would be small fraction of total power in the channel, minimizing the environmental impacts**
- **Max extraction from G&C estimate would be 6 MW**

# Conclusions

- South channel has higher current velocities, more applicable for tidal power assemblies
- Flow is ebb dominated, dictated by intertidal storage induced by wetlands. Highly dependent on relative elevation to mean sea level and tidal amplitude.
- Energy ‘Hot Spots’ migrate along a channels cross section throughout the tidal cycle
- There is adequate available hydrokinetic energy for the Girl Scouts needs