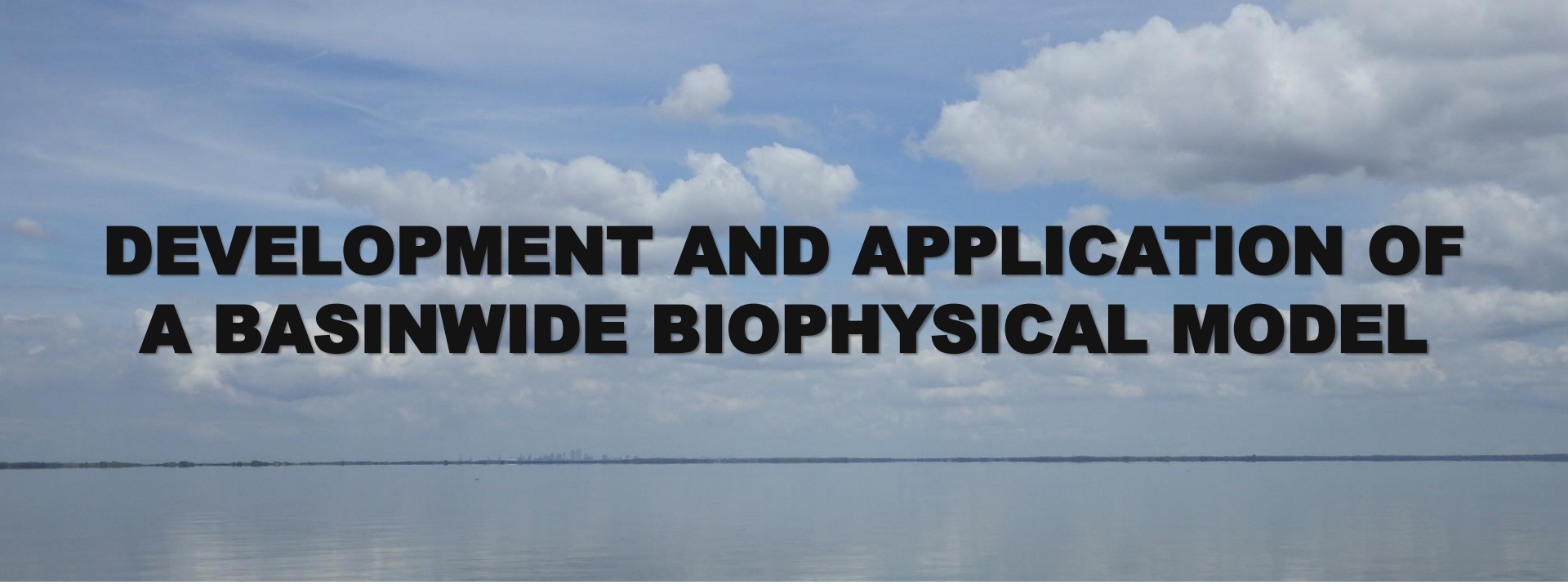

DEVELOPMENT AND APPLICATION OF A BASINWIDE BIOPHYSICAL MODEL

Ehab Meselhe & Melissa Baustian

The Water Institute of the Gulf

THE WATER INSTITUTE
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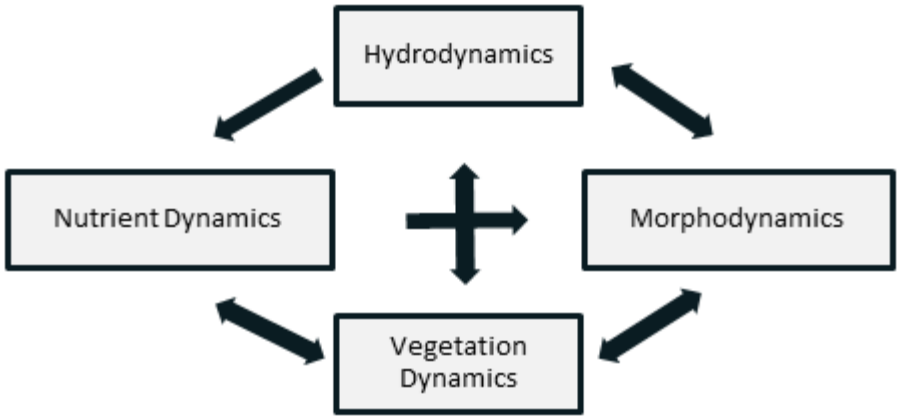
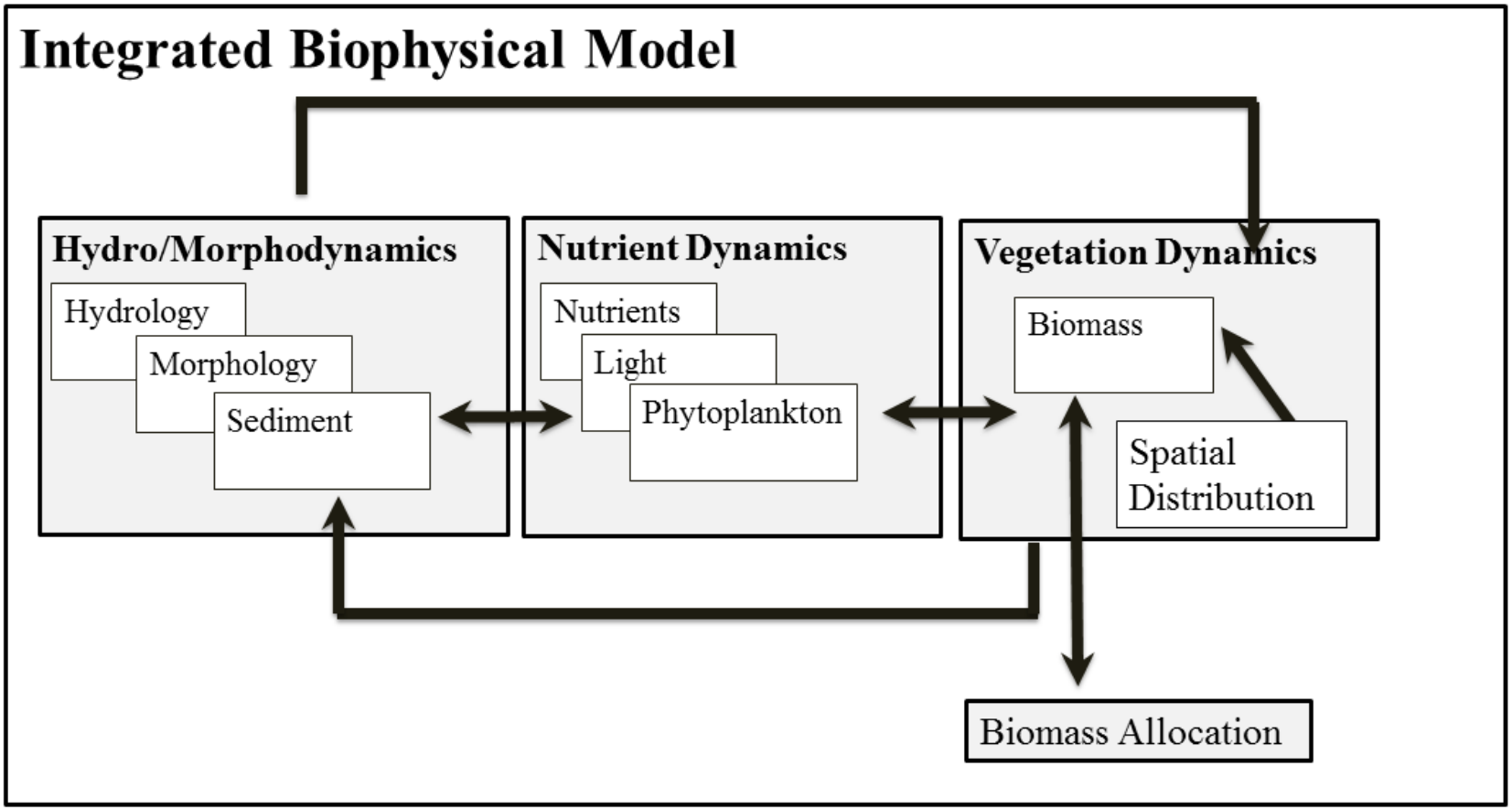
WHY DEVELOP AN INTEGRATED ECOSYSTEM MODEL?

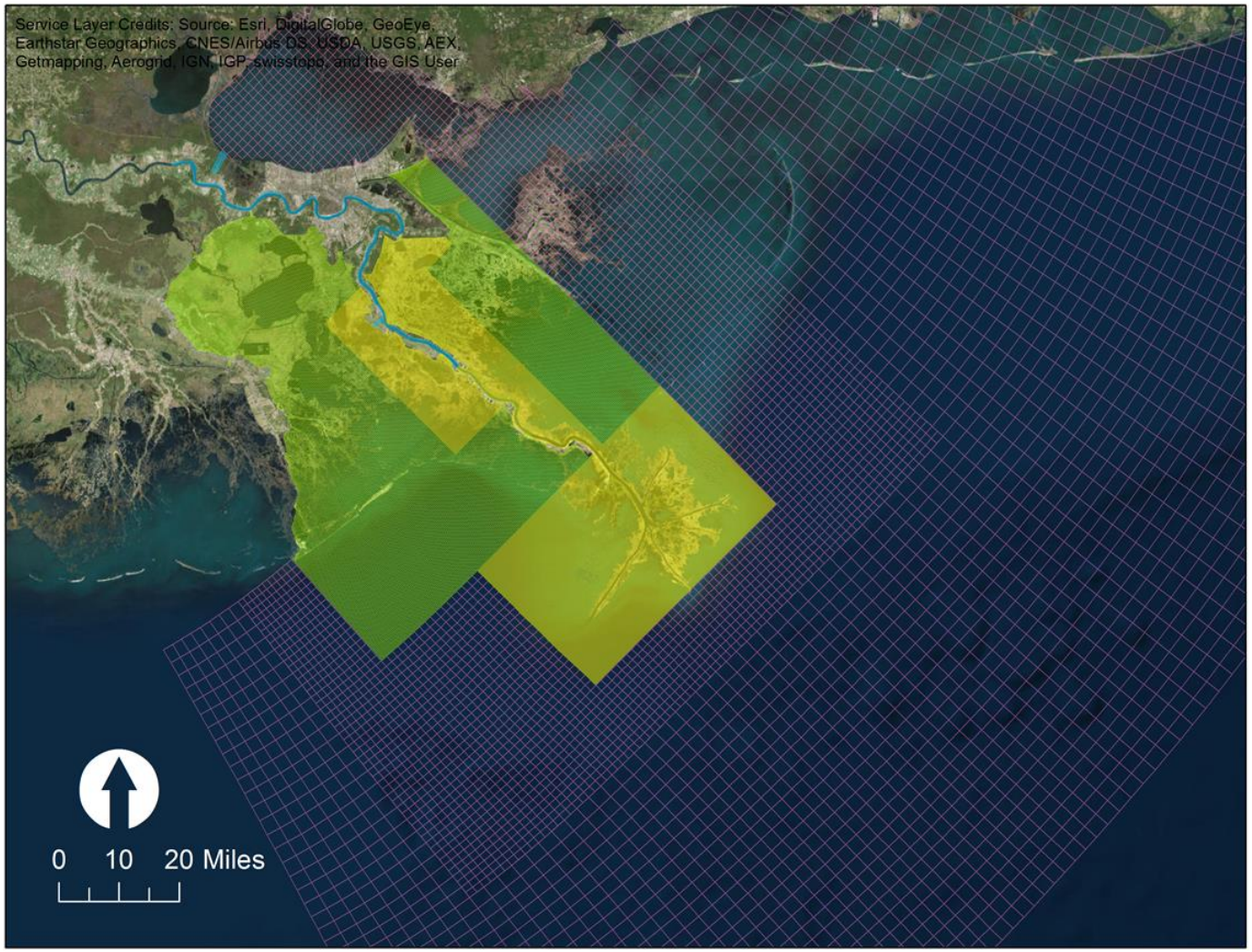
- Link ecosystem components to represent the essential processes and feedbacks in ecosystems
- Research ecosystem level responses to climate change or restoration
- Support managers and planners to inform decisions on an array of restoration projects



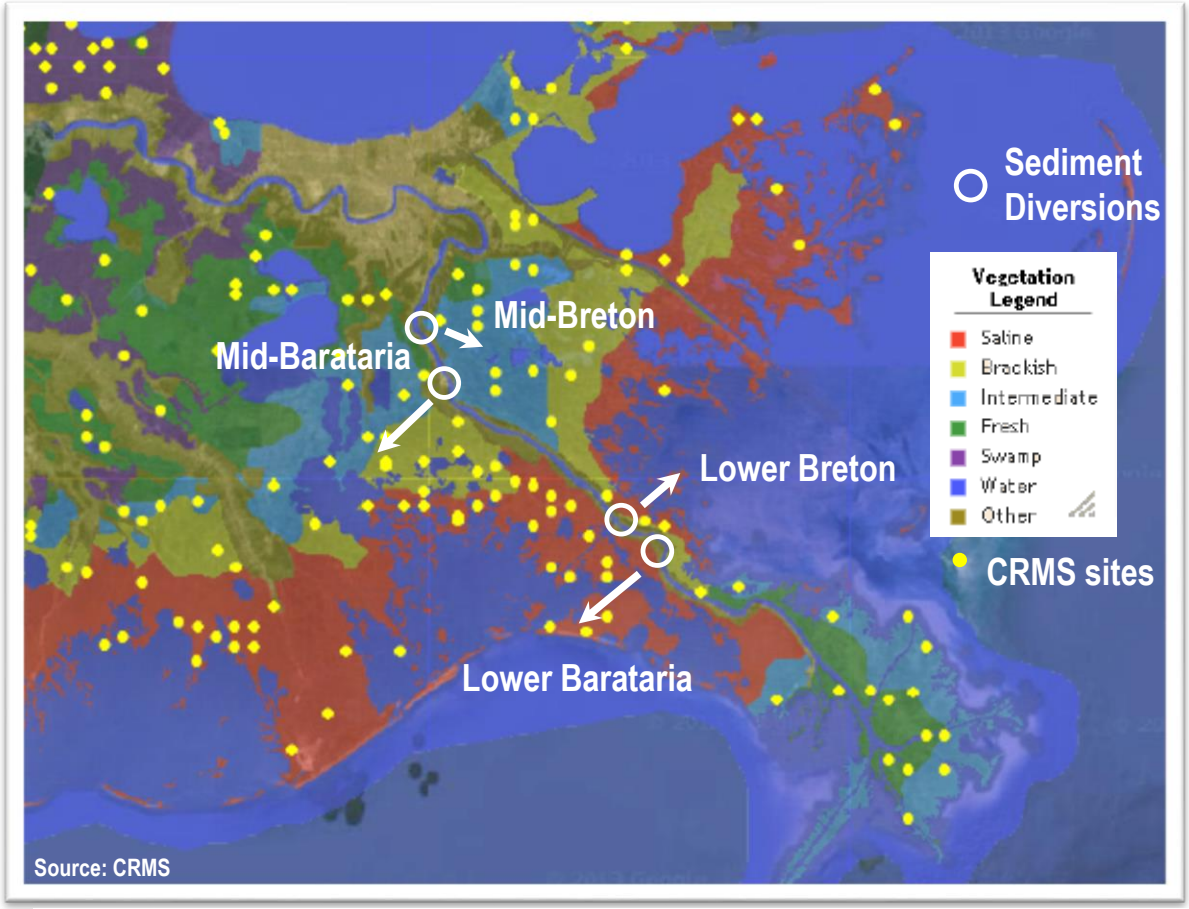
MODEL DEVELOPMENT



DELFT-3D MODEL: DOMAIN AND GRID DESIGN



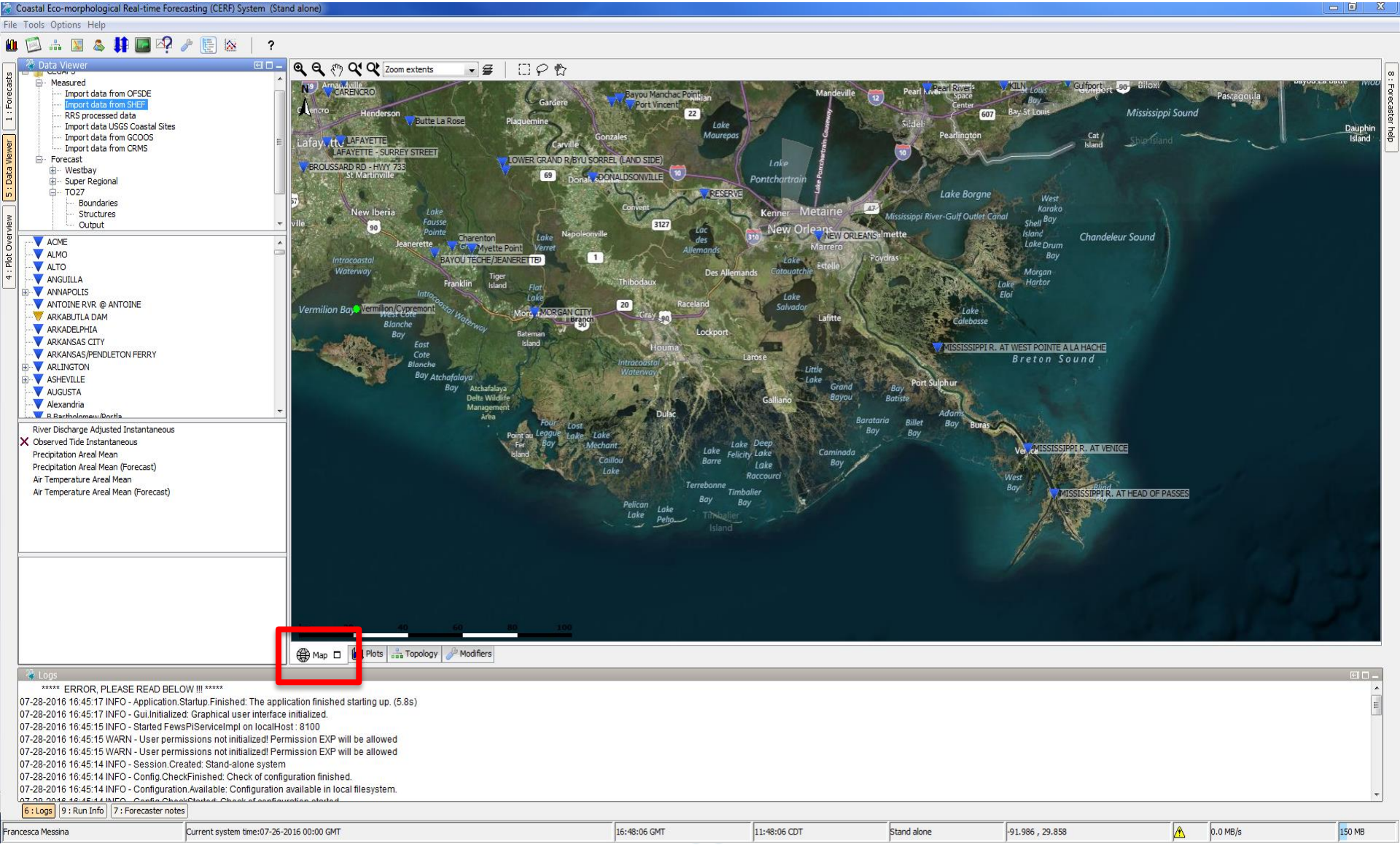
POTENTIAL SEDIMENT DIVERSION LOCATIONS



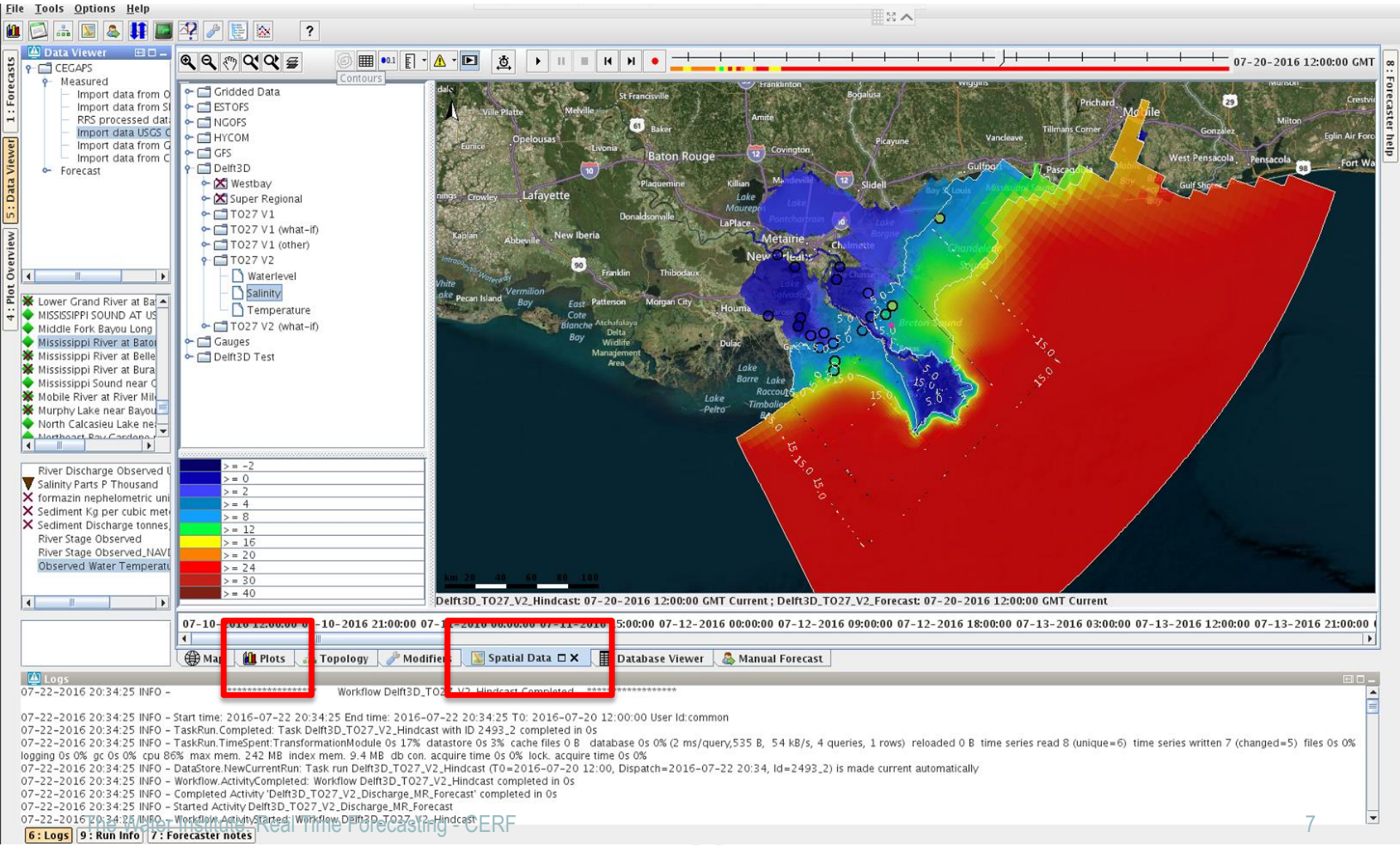
Likely flow conditions of four sediment diversions:

- ~35-75,000 CFS (~ 1,000-2,100 CMS)

CERF: MAP OVERVIEW

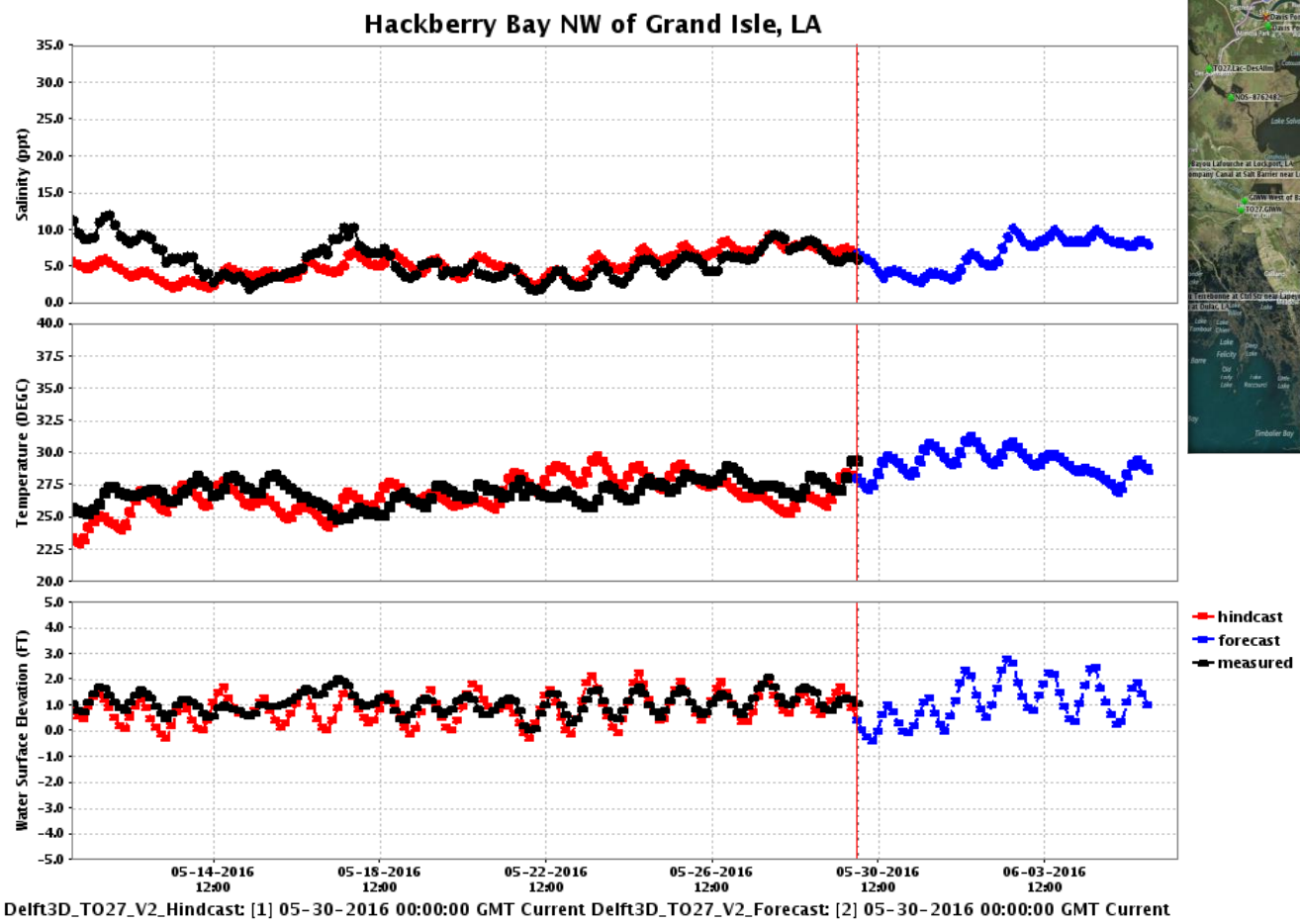


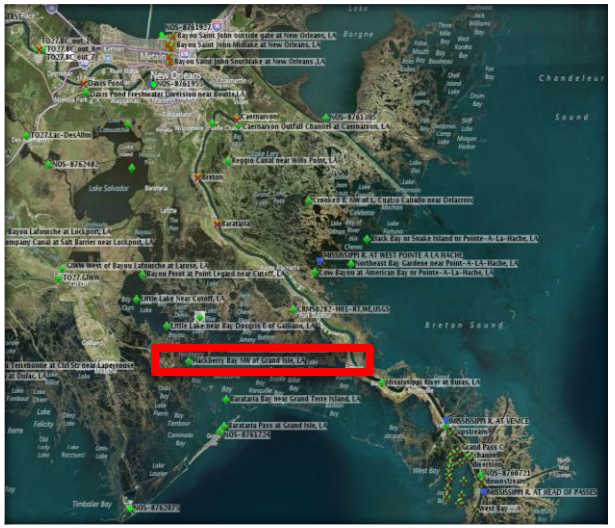
CERF: MODEL OUTPUT



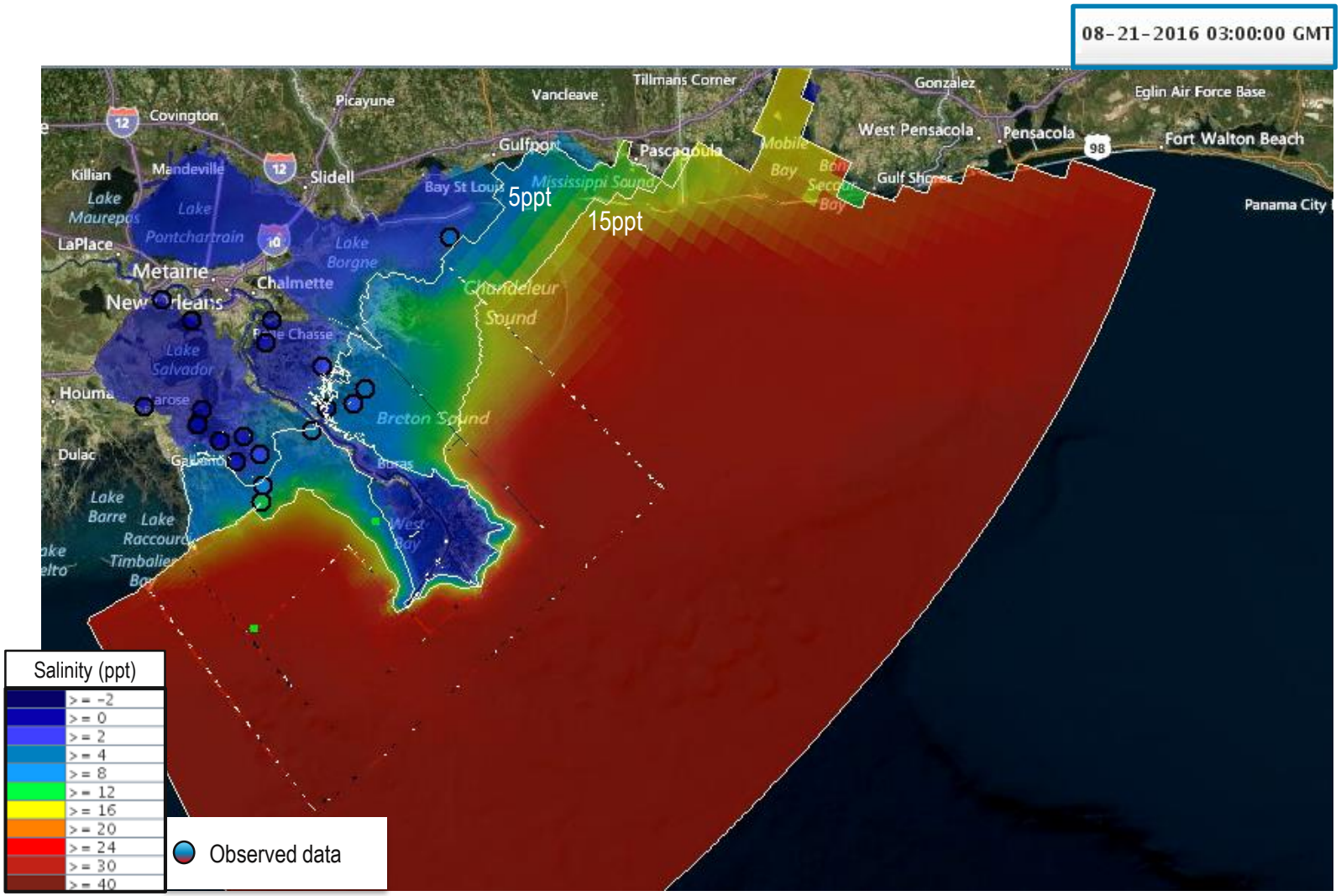
MODEL OUTPUT

TIMESERIES

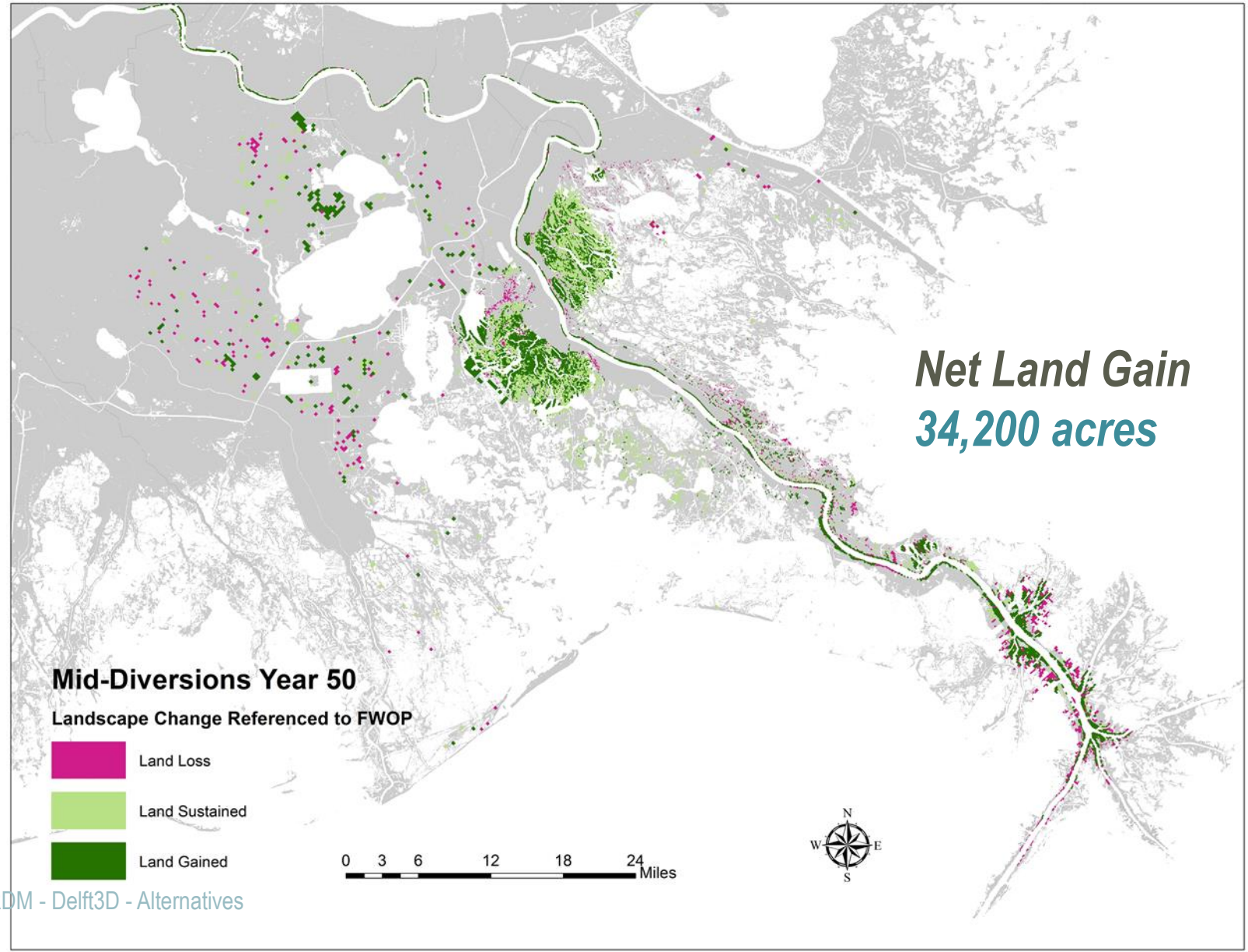




SALINITY ANIMATION: CURRENT FORECAST



LAND CHANGE BY YEAR 2070
MID DIVERSIONS

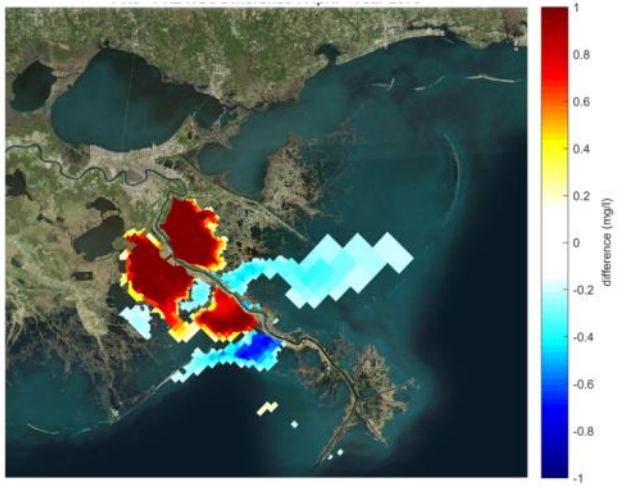


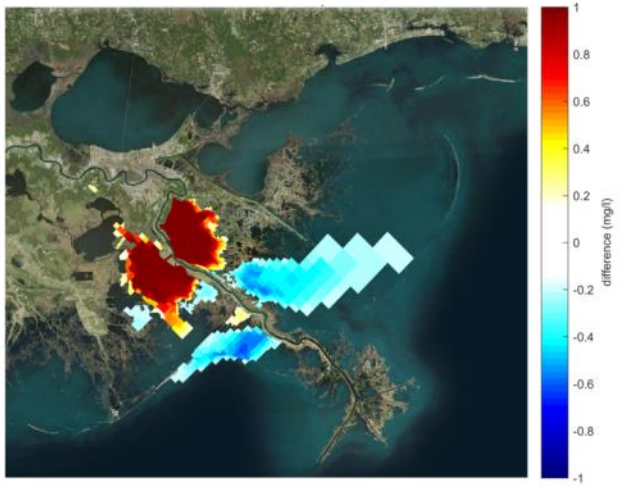
NITRATE: YEAR 2070

All Diversions – FWOP

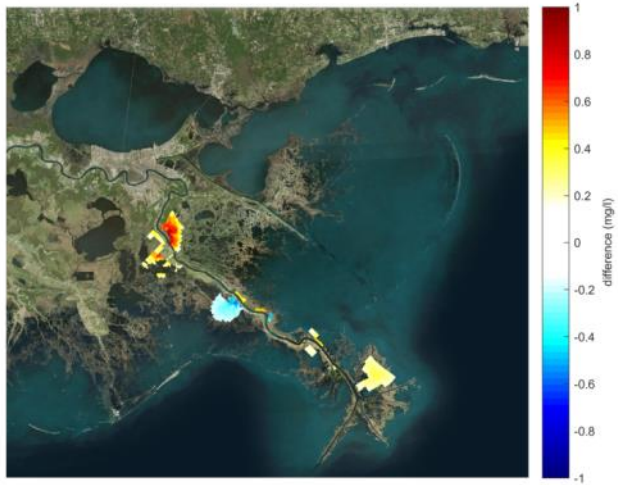
Mid Diversions – FWOP

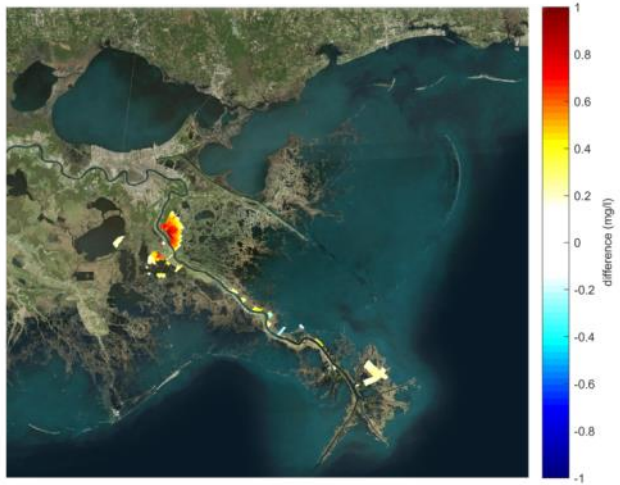
April





October



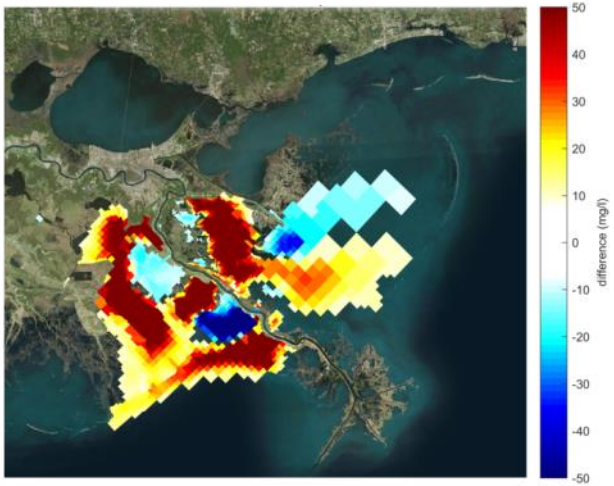


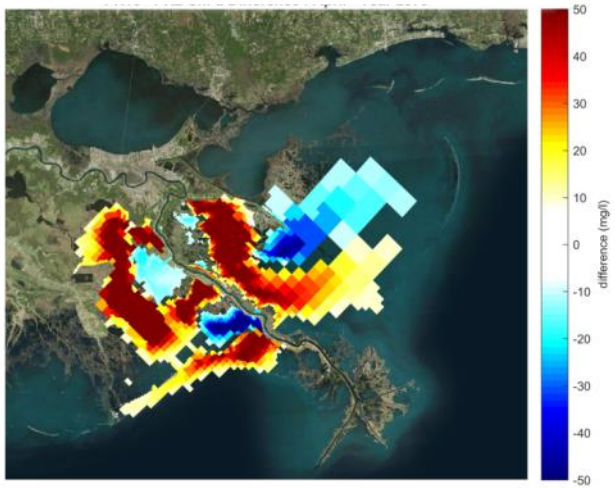
CHLOROPHYLL A : YEAR 2070

All Diversions –FWOP

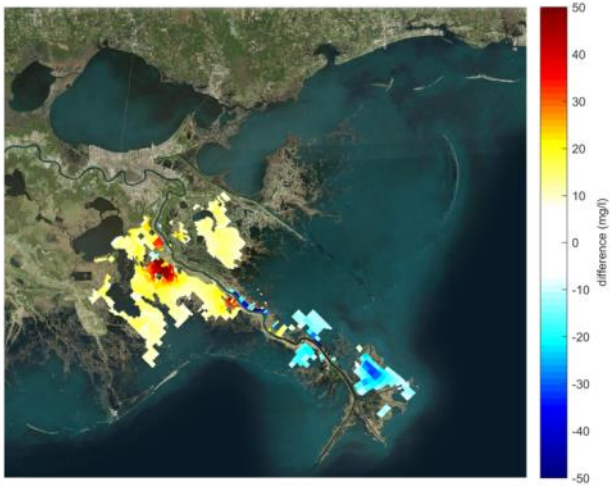
Mid Diversions – FWOP

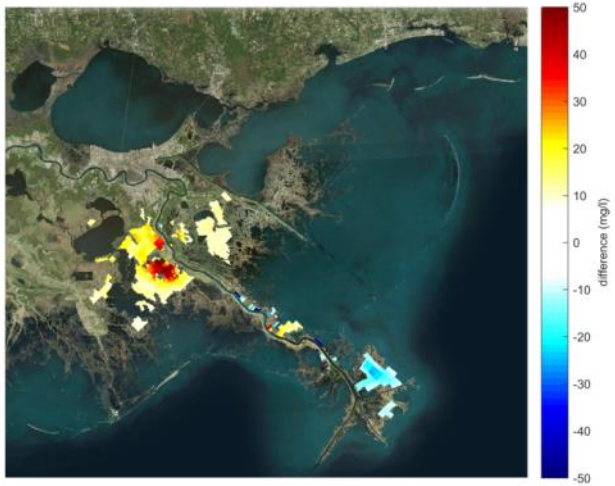
April





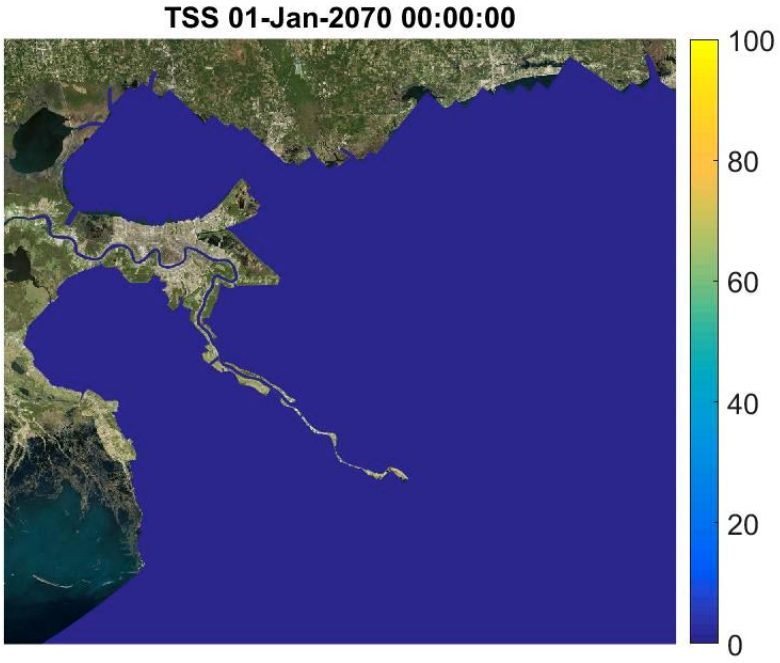
October



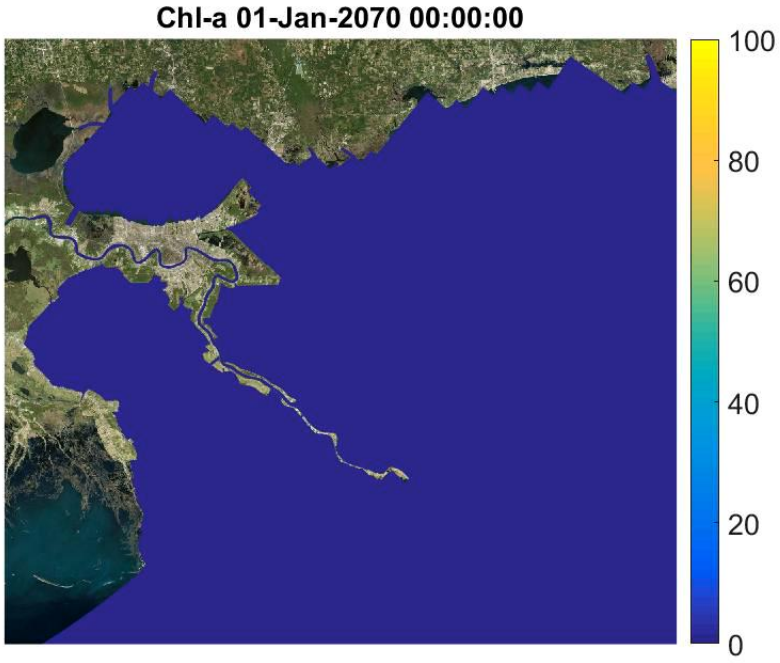


YEAR 2070 ANIMATIONS

TSS



CHL A



SEDIMENT DIVERSIONS AND COASTAL HYPOXIA

- Key questions:
  - What is the expected role of proposed sediment diversions in reducing nutrient loading to the Gulf?
    - Uncertainty on how significant sediment diversions will be in reducing nutrient loading.
    - Scientific community needs to help via:
      - Modeling, monitoring and laboratory experiments.

SEDIMENT DIVERSIONS AND COASTAL HYPOXIA

- Key questions:
  - What is the importance of hypoxia monitoring to assessing the expected benefit of proposed sediment diversions?
    - Very important for assessing the nutrient reduction goal of the MS River watershed and for calibrating and validating models.
    - Example: Need data (flow, salinity, nutrients, etc) of the 8 Barataria passes
    - Need consistent and continual monitoring of coastal hypoxia on continental shelf

MODELING OF SEDIMENT DIVERSIONS AND HYPOXIA

- Limitations:
  - Data availability for parameterization, baselines, calibration, and validation;
    - Need better estimates of the estuarine and coastal margin processes (e.g., denitrification) during sediment diversion conditions (nutrient and sediment rich freshwater)
    - More collaborations among researchers to help with the models

MODELING OF SEDIMENT DIVERSIONS AND HYPOXIA

- Limitations:
  - Availability of (and linkage to) spatial hydrodynamic and landscape evolution models.
    - We currently developed an integrated biophysical model that already links hydrodynamics, morphology, vegetation and nutrient dynamics
    - We are about to start a new project with researchers, K. Rose and D. Justic to link models from the MS River watershed to the coastal basins (with proposed sediment diversions) to the continental shelf

MODELING OF SEDIMENT DIVERSIONS AND HYPOXIA

- Limitations:
  - Predictive understanding of the magnitude of nutrient loading to be reduced by proposed sediment diversions
    - We need to work on this! Scientific community needs to join forces and work on field, laboratory and modeling tasks to help better understand!

MODELING OF SEDIMENT DIVERSIONS AND HYPOXIA

- Uncertainties on the near-field and far-field effects:
  - Need to investigate the combined effects of nutrients, turbidity, temperature and salinity that proposed sediment diversions will produce on the ecosystem
    - Especially, prior, during, and after operation of diversions
  - Near field: estuarine open water and wetland habitats
  - Far field: coastal waters of continental shelf where hypoxia is observed

CONCLUSIONS

- Extensive land loss and need for restoration
- One restoration strategy: large-scale sediment diversions to build land
- Estuarine dynamics will be significantly altered, including hydrology, morphology, nutrients, and vegetation
- Restoration at this scale requires research to decrease the uncertainties and understand the potential consequences

PROJECT SUPPORT

Model development was funded by the Coastal Protection and Restoration Authority under Task Order 27.1.

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THANK YOU

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