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Systems Ideas for the Scientific and Societal Imperatives of the Coastal Ocean: Case of the BP Oil Gusher in the Gulf of Mexico, Spring & Summer 2010

Christopher Mooers
Portland State University

SYSTEMS IDEAS FOR SCIENTIFIC & SOCIETAL IMPERATIVES IN THE COASTAL OCEAN: GULF OF MEXICO EXAMPLE, INCLUDING BP OIL SPILL

RES.PROF. CHRIS MOOERS,
CEE/CECS/PSU

{A PHYSICAL OCEANOGRAPHER}

ATTRIBUTES OF OCEAN PREDICTIONS (I.E., SIMULATIONS, HINDCASTS, NOWCASTS, & FORECASTS)

*TARGET:4D "OCEAN WEATHER"

*CONSTRAINED BY OBSERVATIONS & PHYSICS

*COUPLED PDEs

*FORCED & FREE DYNAMICS

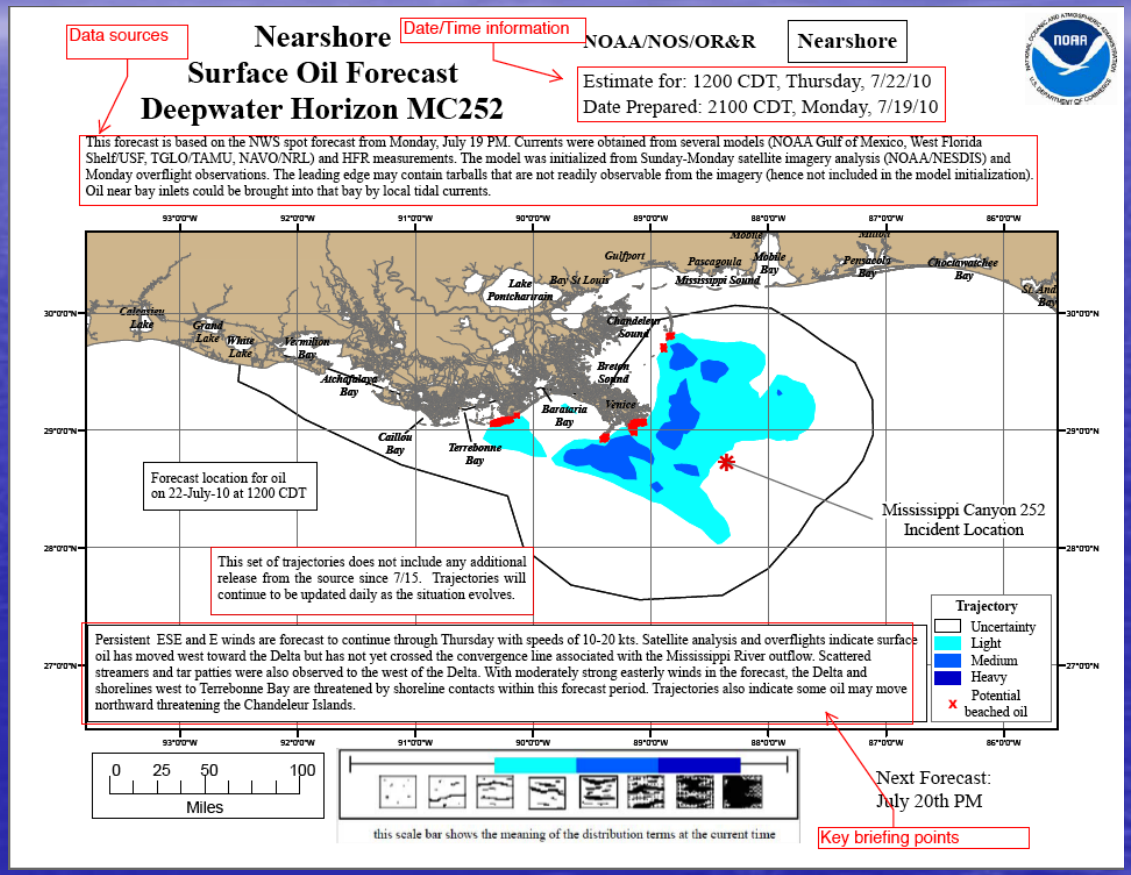
*SUPPORTS ECOLOGICAL PREDICTION

INTRODUCTION

- INFORMATION SYSTEMS ARE NEEDED FOR OCEAN STATE ESTIMATION (HISTORIC, SYNOPTIC, & FORECAST)
- COMPONENTS: OBSERVING SUBSYSTEMS, MODELING SUBSYSTEMS, AND DATA MANAGEMENT SUBSYSTEMS
- PRESENT STATUS: EMBRYONIC, AD HOC, & CHAOTIC WITHOUT SYSTEM DESIGN = STALLED

Final forecast product…

- In the past, trajectory forecasts provided ony to the SSC who briefs the FOSC
- Forecasts were distributed widely and in a number of formats (e.g. GIS shapefiles) to a much broader audience than in previous incidents
- Effective communication of results remains a key challenge

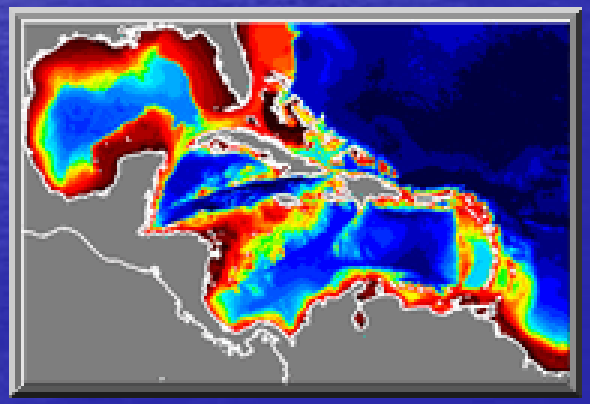


IASNFS

Intra-Americas Sea Ocean Nowcast/Forecast Systems

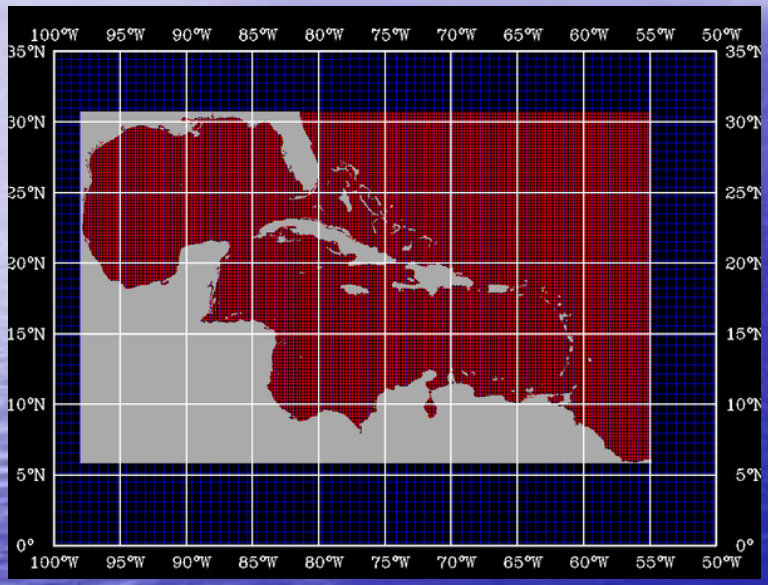
Dong S. Ko

Naval Research Laboratory

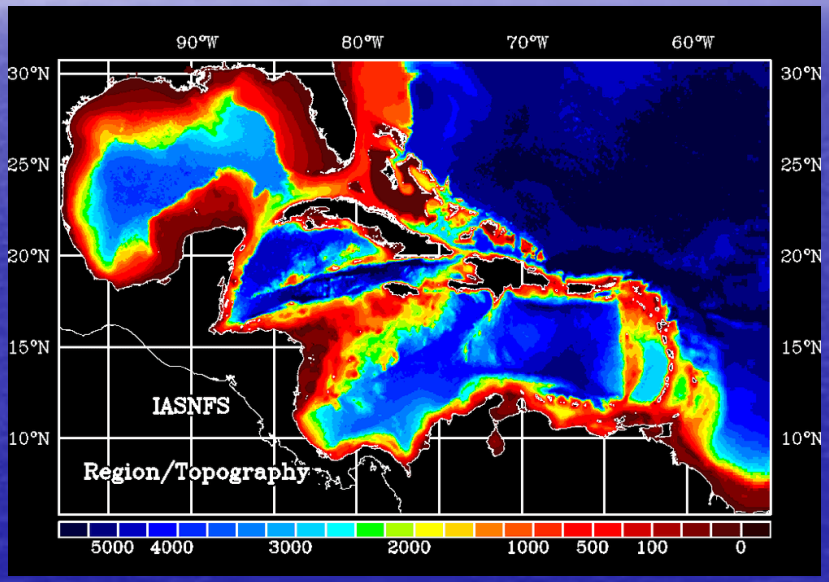


NRL Intra-Americas Sea Ocean Nowcast/Forecast System IASNFS

Grid



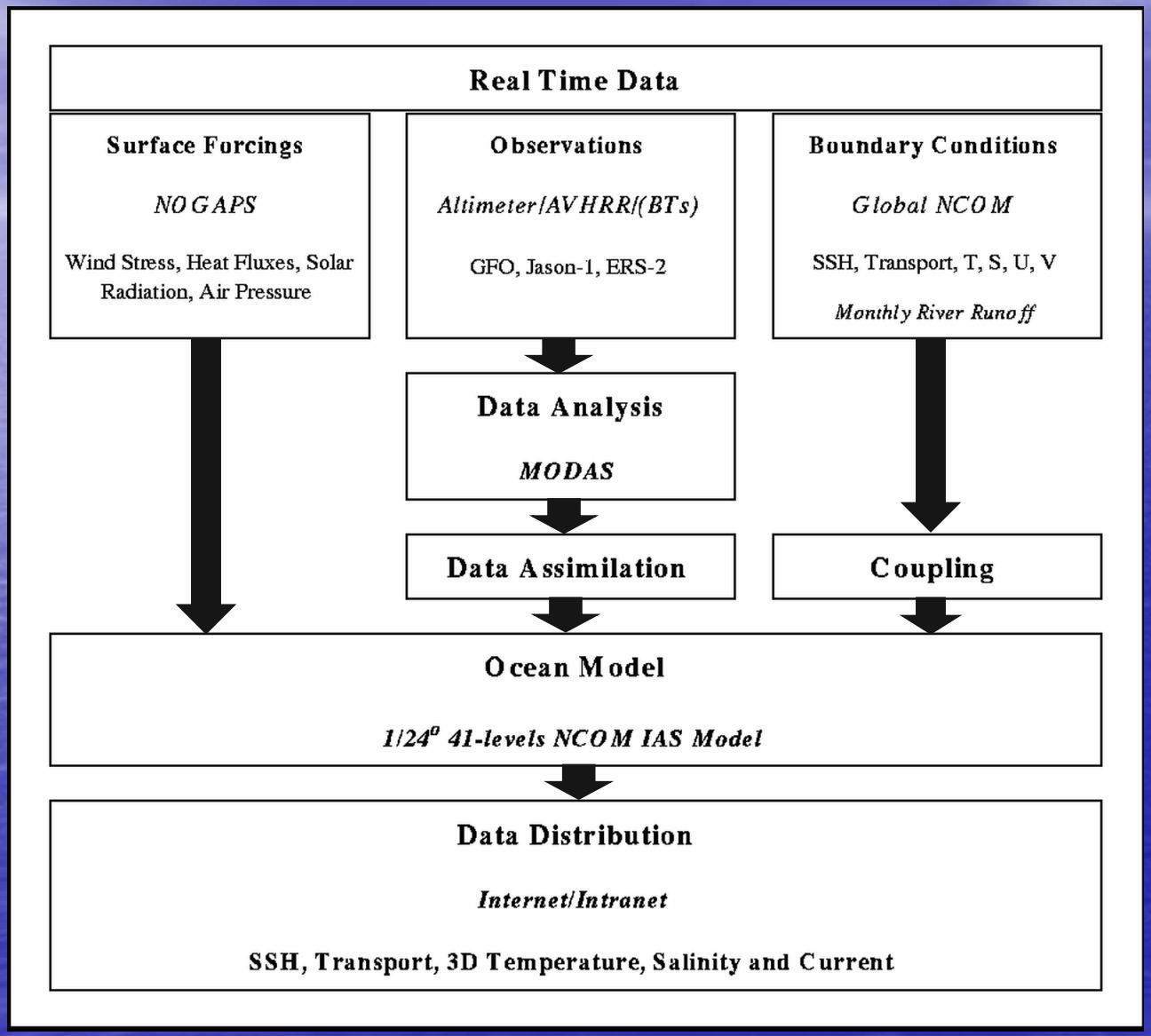
Topography
from NRL DBDB2



- Longitude : 98 W – 55 W; Latitude : 5 N – 31 N
- Horizontal Resolution : 1/24 Degree (~ 6 km)
- Vertical Resolution : 40 Layers (19 Layers on the shelf)
- Forced with NOGAPS Wind, Air Pressure and Heat Fluxes (Solar Radiation)
- Coupled to NRL Global NCOM
- Assimilation of Satellite Altimetry and MODIS SST/SSS
- 140 River Discharges

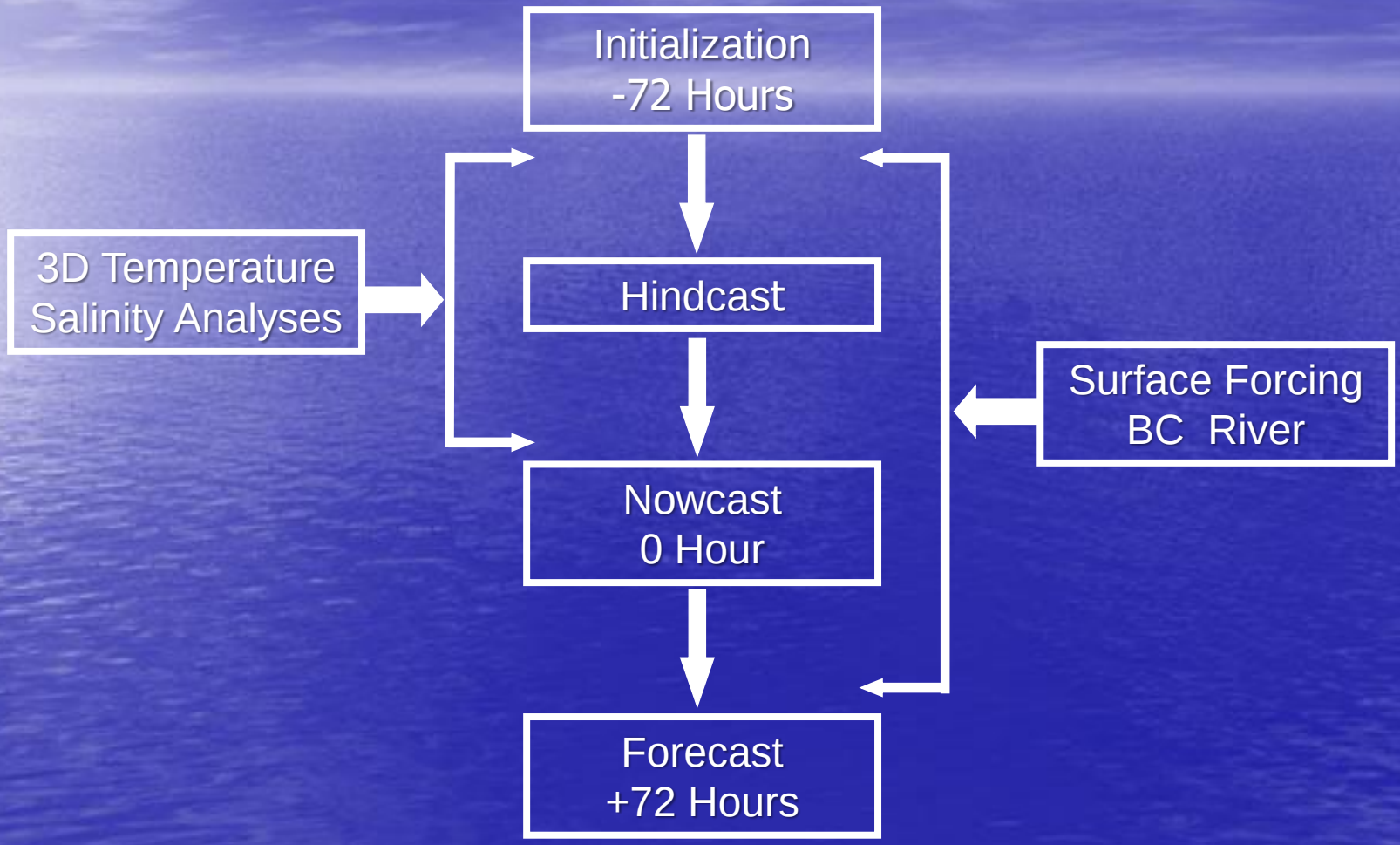
Ko, D.S., R.H. Preller, and P.J. Martin, An Experimental Real-Time Intra Americas Sea Ocean Nowcast/Forecast System for Coastal Prediction, Proceedings, AMS 5th Conference on Coastal Atmospheric & Oceanic Prediction & Processes, 97-100, 2003.

NRL Ocean Nowcast/Forecast System



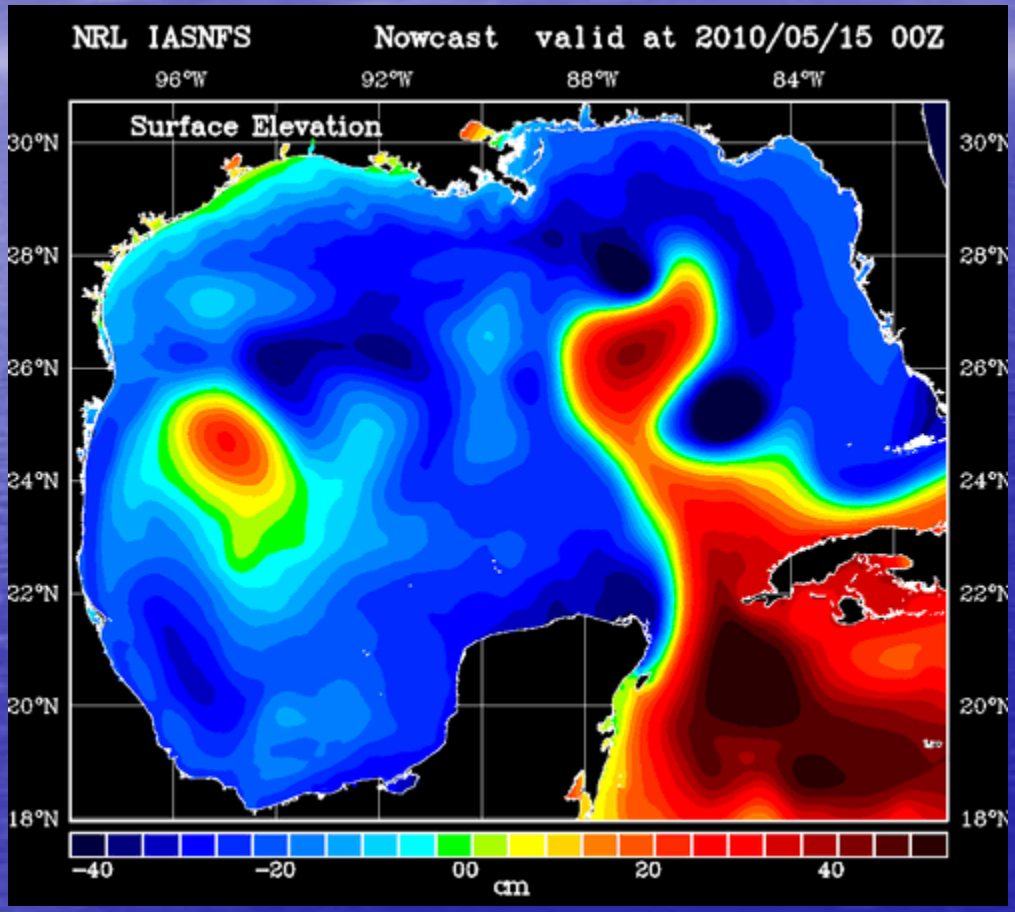
Ko, D.S., P.J. Martin, C.D. Rowley, and R.H. Preller, A real-time coastal ocean prediction experiment for MREA04, *J. Marine Systems*, 69, 17-28, doi:10.1016/j.jmarsys.2007.02.022, 2008.

Real-Time Ocean Nowcast/Forecast



IASNFS Real-Time Prediction

Sea Surface Elevation

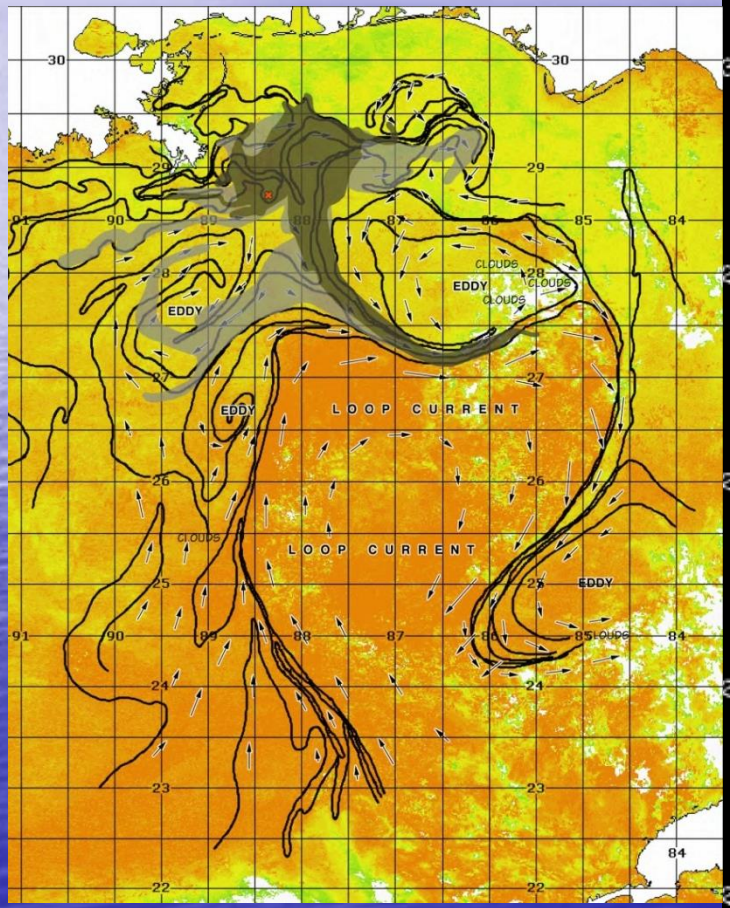


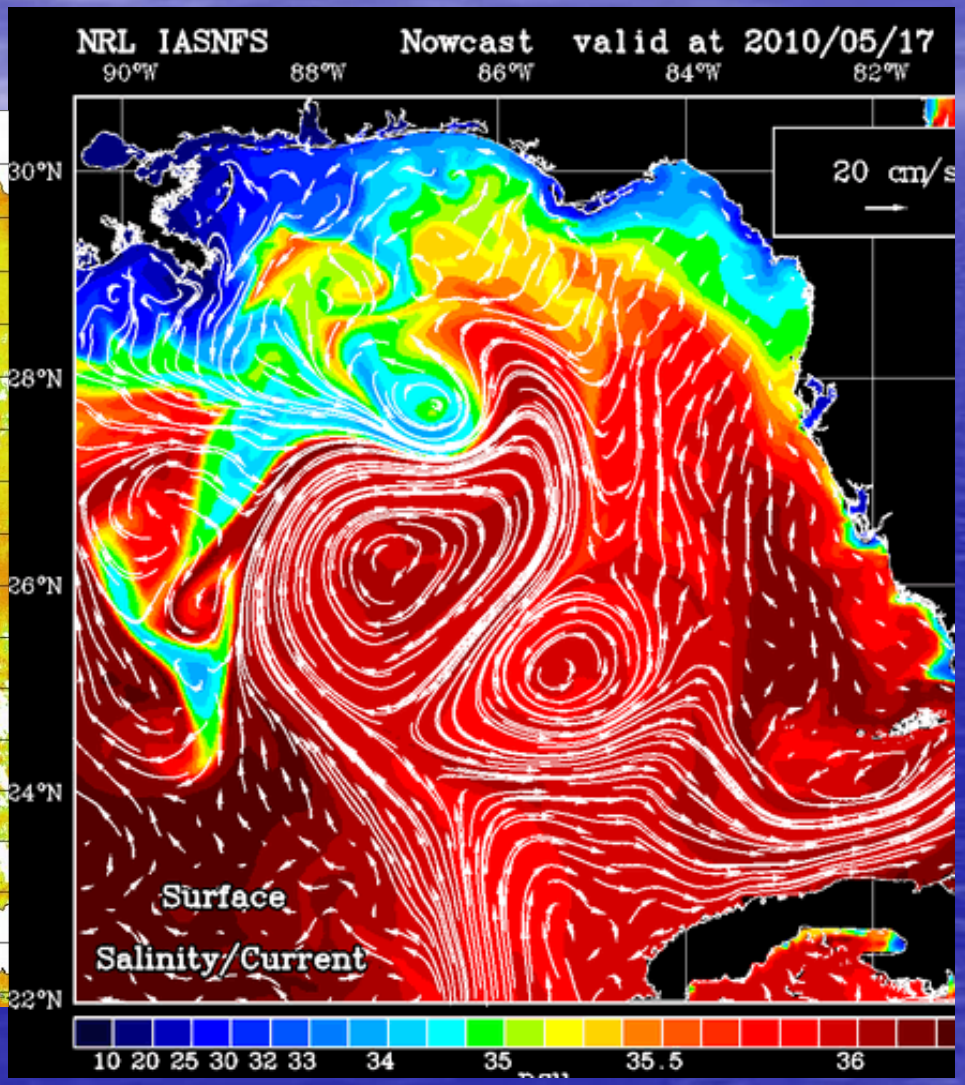
http://www7320.nrlssc.mil/IASNFS_WWW/

IASNFS Real-Time Prediction

Sea Surface Salinity/Current

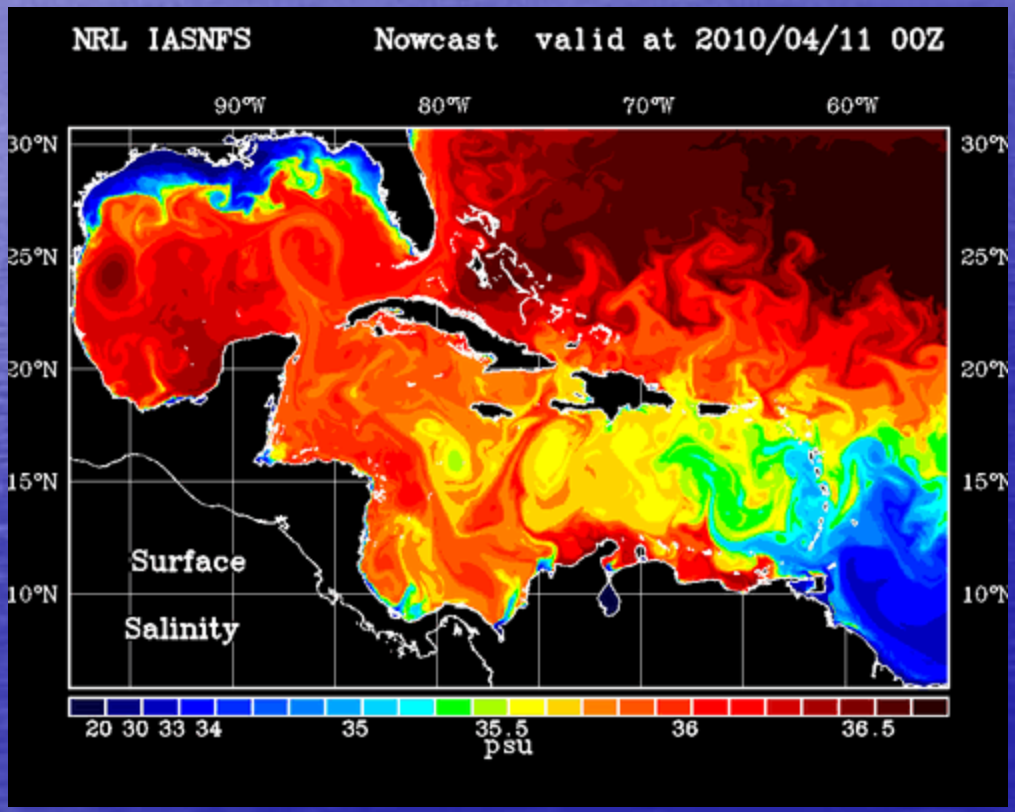
Loop Current/Eddy frontal location based on satellite thermo image





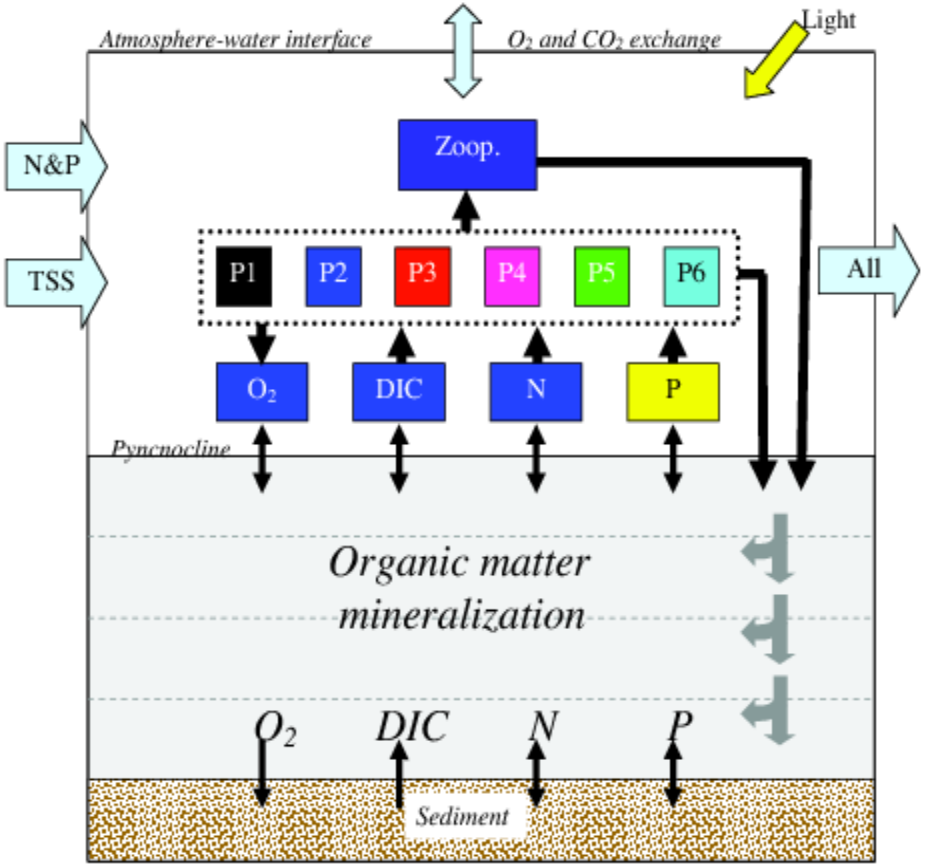
IASNFS Real-Time Prediction

Sea Surface Salinity
for NOAA/AOML Ocean Acidification Estimation



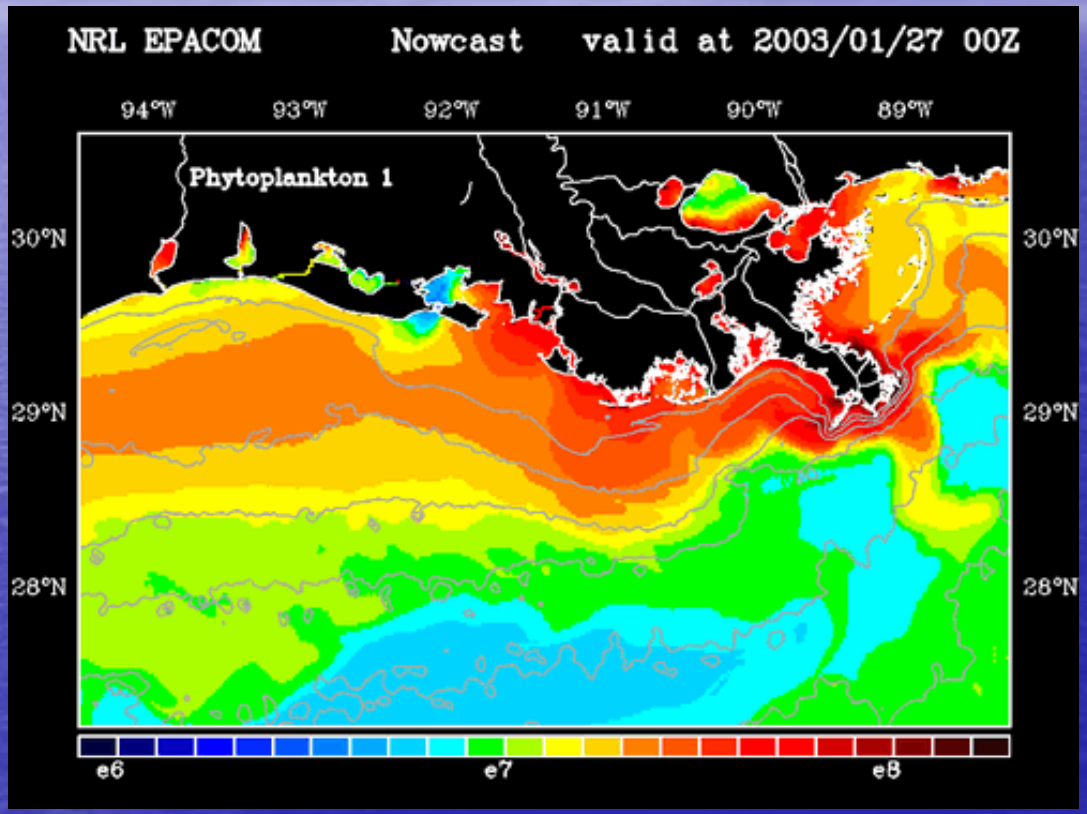
EPA General Environment Model for Hypoxia

Peter M. Eldridge and Daniel L. Roelke



IASNFS/Hypoxia Model

Simulation of Phytoplankton Dynamics



SUMMARY

*OCEAN PREDICTION HAS A BRIGHT FUTURE

*ITS PRESENTLY IN TRANSITION BETWEEN R&D AND "ROUTINE OPERATIONS"

*IT SUPPORTS BASIC RESEARCH & SOCIETAL APPLICATIONS

CONCLUSION: THE WAY AHEAD

- SYSTEM TESTBEDS FOR R&D (EVALUATE, INTEGRATE, SUSTAINED BUT FLEXIBLE)
- SYSTEMS ENGINEERING WITH STAKEHOLDER GROUPS (OPERATIONS:REQUIREMENTS, METRICS, COST-BENEFITS, DESIGN, ETC.)
- SYSTEMS SCIENCE WITH INTERFACES BETWEEN NATURAL SCIENCE & SOCIETY (SYSTEM OF SYSTEMS, STABILITY, SUSTAINABILITY)