Outline of talk

• Field program information
• Outreach – citizen science
• CONCORDE Meteorological Analysis (CMA) dataset
• Impact of Hurricane Patricia’s remnants on ocean biology and salinity plumes
• Impact of CMA on ocean model ROMS

Authors of abstract

Pat Fitzpatrick    MSU
Jessie Kastler    USM
Frank Hernandez    USM
Carla Culpepper    USM
Candace Bright    USM

But whole CONCORDE team contributed to results
How do complex fine-scale structure and processes in coastal waters dominated by pulsed-river plumes control the exposure, impacts, and ecosystem recovery from offshore spills like the Deepwater Horizon release of 2010?

Website – www.con-corde.org
Field program information

- Four cruises (Fall 2015, Winter 2016 (Bonnet Carret spillway opening), Spring 2016, Summer 2016)
- Small boat cruises near Dauphin Island
- Measurements for
  1. Phytoplankton
  2. Chemistry constituents
  3. Ocean currents
  4. Water temperature
  5. Salinity
  6. Wind
  7. Air temperature
  8. Satellite products (Chlorophyll-a, light attenuation, CDOM, SPM)
  9. Ocean model data
  10. Concorde Meteorological Analysis (CMA)
**Objectives**

- Relate distribution of plankton in nearshore habitats at relevant spatial and temporal scales to complex and dynamic physical forcers
- Understand exposure risk of planktonic community during an oiling event

**Objectives and Methodology**
The plankton sub-project will be collecting zooplankton and ichthyoplankton samples using the MININESS and Neuston nets, image data using the DPI, acoustic backscatter data that further complements our plankton samples and DPI images. In addition, we are also using a FlowCam to identify phytoplankton and microzooplankton species.
Example images captured with the ISIIS during the Concorde fall campaign a) siphonophore preying on a larval fish b) larval flatfish c) Two round herring larvae found in dense aggregations d) Doliolid e) Lobate ctenophore (Mnemiopsis spp.) f) larval squid g) trichodesmium h) larval jacks near the bell of a large Aurelia spp. jellyfish
Figure 1. Images of plankton from corridor sampling region from Mobile corridor (top) on October 30th to the Eastern corridor (bottom) on October 31st. Photo credits: Hernandez lab.

Zooplankton captured with the plankton nets to compare to image data
The Ocean Weather Lab provided daily satellite and modeled ocean data to assist with strategic cruise planning, glider deployment, and sampling locations.
Identified regions influenced by spillway, Mississippi River, Mobile Bay, and mixed influences
Outreach and citizen scientists
Citizen Science

• Community Recruitment
  – March 10, 2016 – Biloxi, MS
  – March 16, 2016 – Chalmette, LA

• Training

• Data Collection

• Social Science Research
Citizen Science

• Community Recruitment
• Training
  – March 19, November 19
  – Two more in 2017
• Data Collection
• Social Science Research
• Community Recruitment
• Training
• Data Collection
  – Take Castaway to Fishermen
    (Ycloskey, Bay St. Louis, D’Iberville, Biloxi, Ocean Springs, Gautier)
  – Review methods & remind of limitations
• Social Science Research
Example of Castaway CTD instrument and data
CONCORDE Meteorological Analysis (CMA)

- 1-km, hourly gridded dataset in Mississippi Sound and vicinity (starting April 2015 to current)
- Temperature, wind, pressure
- 1-hr rainfall (radar–derived)
- SST from AVHRR (to capture river plumes and proper fluxes)
- Radiation fields
- Cloud cover

Captures diurnal processes and mesoscale patterns
Example, CMA (Hurricane Patricia’s remnants)
Times series of closest CMA grid point to Shell Beach buoy during Hurricane Patricia’s remnants
Validation shows generally low bias and errors

### Wind speed (ms⁻¹)

<table>
<thead>
<tr>
<th>Station</th>
<th>May 2015</th>
<th>Aug 2015</th>
<th>Oct 2015</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bias</td>
<td>Abs Err</td>
<td>Bias</td>
<td>Abs Err</td>
</tr>
<tr>
<td>KMSY</td>
<td>-1.9</td>
<td>1.9</td>
<td>-2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>BBNL1</td>
<td>0.6</td>
<td>0.8</td>
<td>0.0</td>
<td>0.7</td>
</tr>
<tr>
<td>D6246</td>
<td>1.6</td>
<td>1.9</td>
<td>0.4</td>
<td>1.2</td>
</tr>
<tr>
<td>SHBL1</td>
<td>-0.2</td>
<td>0.9</td>
<td>0.1</td>
<td>1.0</td>
</tr>
<tr>
<td>NNHM6</td>
<td>1.1</td>
<td>1.2</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>KGPT</td>
<td>-2.2</td>
<td>2.2</td>
<td>-0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>42067</td>
<td>-0.6</td>
<td>1.3</td>
<td>-0.9</td>
<td>1.5</td>
</tr>
<tr>
<td>PTBM6</td>
<td>0.2</td>
<td>1.2</td>
<td>-0.6</td>
<td>1.1</td>
</tr>
<tr>
<td>DPIA1</td>
<td>-0.1</td>
<td>1.0</td>
<td>0.7</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### Wind direction (deg)

<table>
<thead>
<tr>
<th>Station</th>
<th>May 2015</th>
<th>Aug 2015</th>
<th>Oct 2015</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bias</td>
<td>Abs Err</td>
<td>Bias</td>
<td>Abs Err</td>
</tr>
<tr>
<td>KMSY</td>
<td>-3.7</td>
<td>12.0</td>
<td>-2.8</td>
<td>20.7</td>
</tr>
<tr>
<td>BBNL1</td>
<td>20.6</td>
<td>24.7</td>
<td>15.3</td>
<td>32.8</td>
</tr>
<tr>
<td>D6246</td>
<td>12.5</td>
<td>14.0</td>
<td>2.4</td>
<td>25.6</td>
</tr>
<tr>
<td>SHBL1</td>
<td>7.1</td>
<td>10.7</td>
<td>14.7</td>
<td>29.3</td>
</tr>
<tr>
<td>NNHM6</td>
<td>14.8</td>
<td>17.9</td>
<td>-1.6</td>
<td>33.1</td>
</tr>
<tr>
<td>KGPT</td>
<td>4.4</td>
<td>9.1</td>
<td>-4.2</td>
<td>17.3</td>
</tr>
<tr>
<td>42067</td>
<td>-2.7</td>
<td>10.4</td>
<td>-6.2</td>
<td>24.1</td>
</tr>
<tr>
<td>PTBM6</td>
<td>7.5</td>
<td>12.3</td>
<td>-8.7</td>
<td>22.8</td>
</tr>
<tr>
<td>DPIA1</td>
<td>4.8</td>
<td>12.4</td>
<td>8.2</td>
<td>21.3</td>
</tr>
</tbody>
</table>
Impact of Patricia’s remnants
Zooplankton density after Patricia - Inshore versus offshore

Chlorophyll-a (top) and salinity (bottom) before and after Patricia
CMA impact on ocean model ROMS
NARR (30 km, time interpolated) vs CMA (1 km, reanalysis)
Ocean model results
CTD profiles from
CONCORDE spring cruise
in 2016

Result:

<table>
<thead>
<tr>
<th>Location</th>
<th>Temperature RMSE</th>
<th>Salinity RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME9S</td>
<td>1.04°C</td>
<td>1.96 psu</td>
</tr>
<tr>
<td>W5S</td>
<td>0.52°C</td>
<td>1.47 psu</td>
</tr>
<tr>
<td>W2S</td>
<td>0.51°C</td>
<td>3.31 psu</td>
</tr>
<tr>
<td>W7S</td>
<td>0.38°C</td>
<td>2.22 psu</td>
</tr>
</tbody>
</table>
Model results vs NDBC buoys in 2015

- **T at MBLA1**: RMSE=0.94°C
- **T at BSCA1**: RMSE=1.62°C
- **T at PPTA1**: RMSE=1.39°C
- **S at MBLA1**: RMSE=7.02psu
- **S at BSCA1**: RMSE=6.82psu
- **S at PPTA1**: RMSE=4.18psu
Post remnants of tropical storm Patricia (10/27/2015), the wind direction rotated suddenly, and the fresh water rushed out of the Main Pass. The plume is stronger if the model is driven by high resolution CMA forcing.
In the beginning of April 2016, the wind direction rotated in a clockwise direction. Model driven by CMA shows higher mixing rate.
Summary

1) Model-observation comparisons suggest that the model performance is improved by high resolution CMA forcing.

2) The freshwater plume coming out of the Mobile Bay post Hurricane Patricia is stronger when the model is driven by CMA forcing. The model driven by CMA forcing displays a higher mixing rate compared with the model results derived from NARR forcing.

This research was made possible by a grant from The Gulf of Mexico Research Initiative (GoMRI).

Data are publicly available through the Gulf of Mexico Research Initiative Information & Data Cooperative (GRIIDC) at https://data.gulfresearchinitiative.org