

Using Drifters to Simulate Oil Spill Trajectories and Enhance Response Timeliness

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Outline:

- Inspiration
- Relative/Related Drifter Studies
- Methods
- Results
- Desired Implementation

Inspiration ↔ Relative/Related Drifter Studies

- **Global Ocean Surface Velocities from Drifters: Mean, Variance, El Niño – Southern Oscillation Response, and Seasonal Cycle**
(Lumpkin and Johnson, 2013)
- **Evaluating Where and Why Drifters Die**
(Lumpkin, Maximenko, & Pazos, 2011)
- **Lagrangian Eddy Scales in the Northern Atlantic Ocean**
(Lumpkin, Treguier, & Speer, 2001)
- **Surface Drifter Exchange between the North Atlantic Subtropical and Subpolar Gyres** (Brambilla & Talley, 2006)
- **Lagrangian Data in a High-Resolution Numerical Simulation of the North Atlantic**
I. Comparison with in-situ Drifter Data (Garraffo et al., 2000)
- **Statistical Analysis of the Surface Circulation in the California Current System Using Satellite Tracked Drifters** (Poulain & Niiler, 1989)
- and more....

Inspiration ↔ Relative/Related Drifter Studies

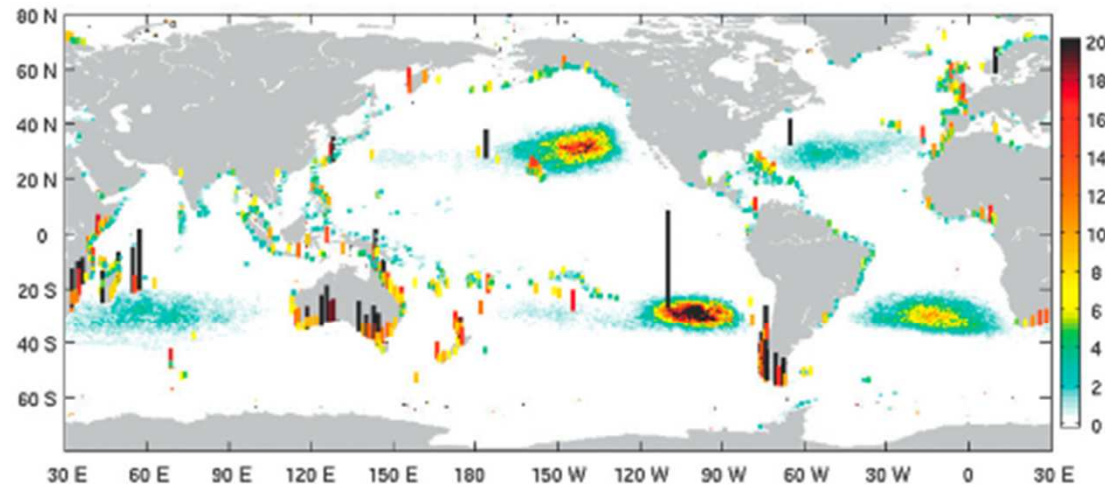


FIG. 9. Distribution of the concentration of floating marine debris in arbitrary units, after 10 years of integration from an initially homogeneous distribution of concentration unity. Vertical bars indicate the concentration of material that has washed ashore, with color corresponding to 10 times the value in the color bar.

(Lumpkin, Maximenko, & Pazos, 2013)

- NOAA's Marine Debris Tracking Web Sites
<http://marinedebris.noaa.gov/>
http://www.noaa.gov/features/o2_monitoring/marinedebris.html

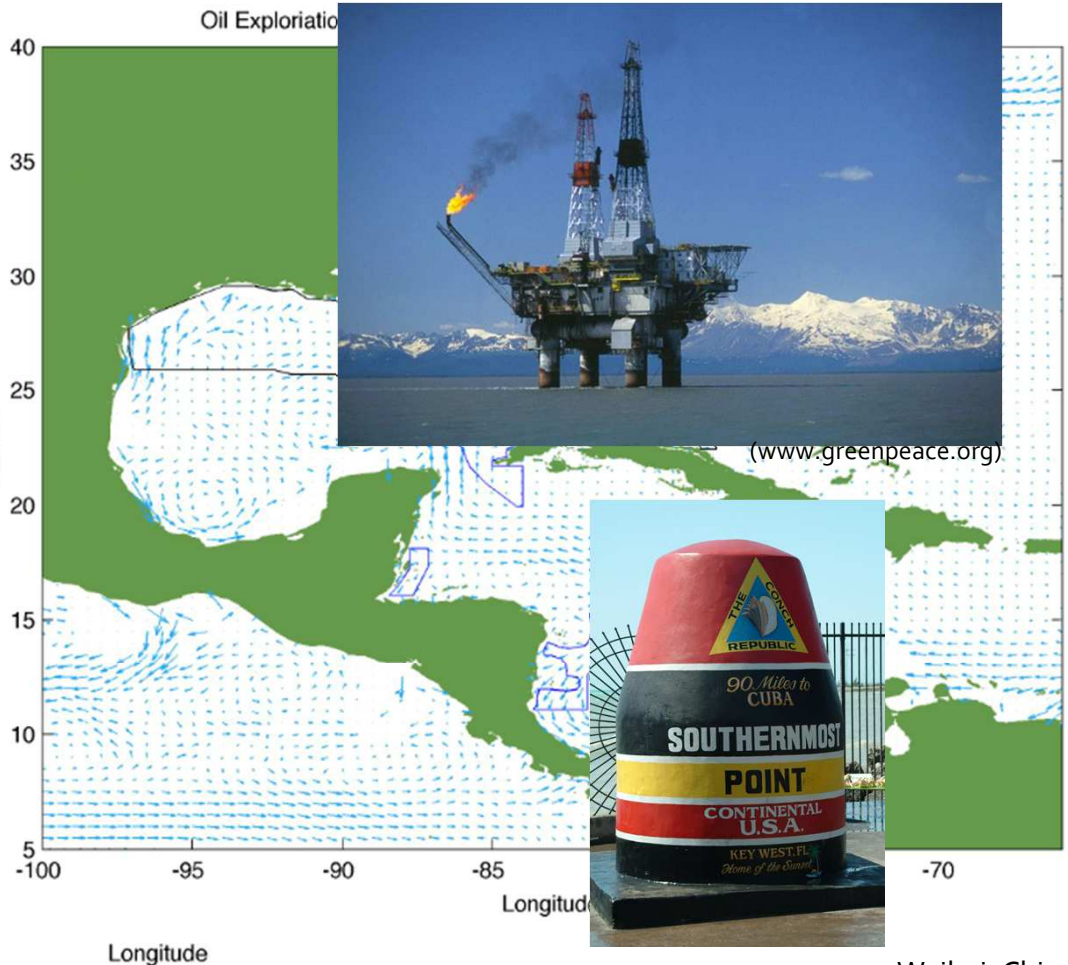
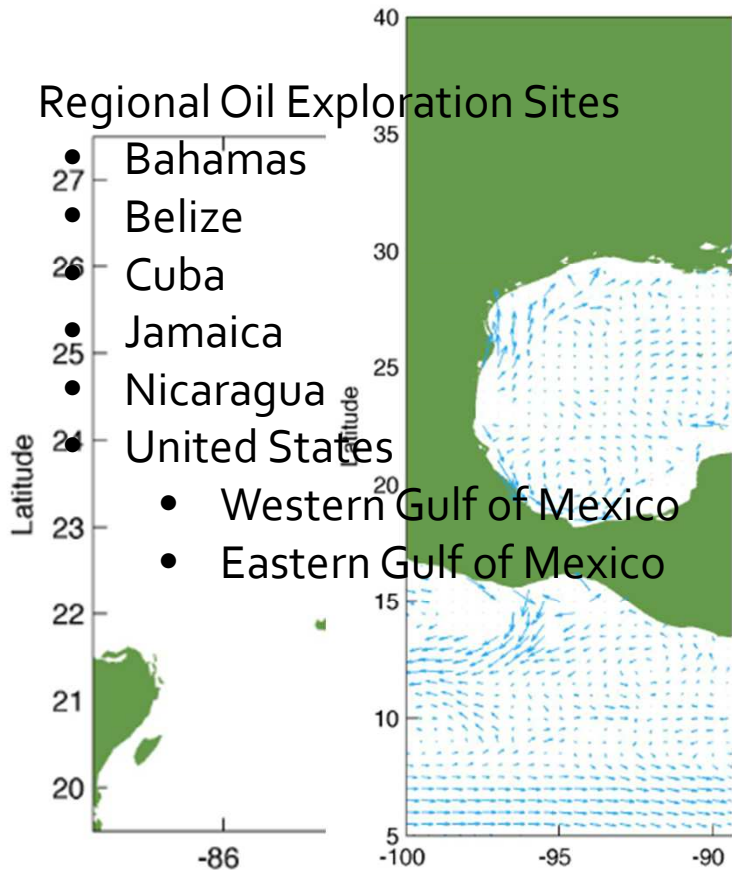
Inspiration ↔ Relative/Related Drifter Studies

- Cuban Oil Exploration Near Florida Keys

- Cuban Oil Exploration Map

- Regional Oil Exploration Sites

- Bahamas
- Belize
- Cuba
- Jamaica
- Nicaragua
- United States
 - Western Gulf of Mexico
 - Eastern Gulf of Mexico



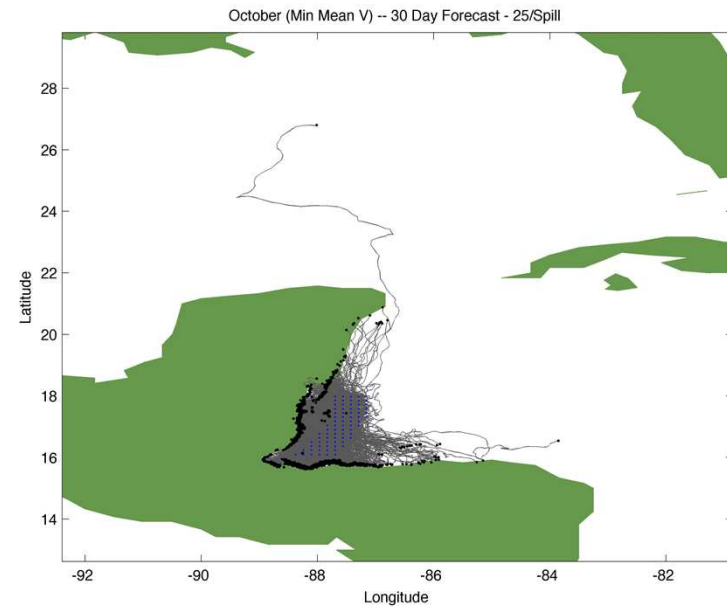
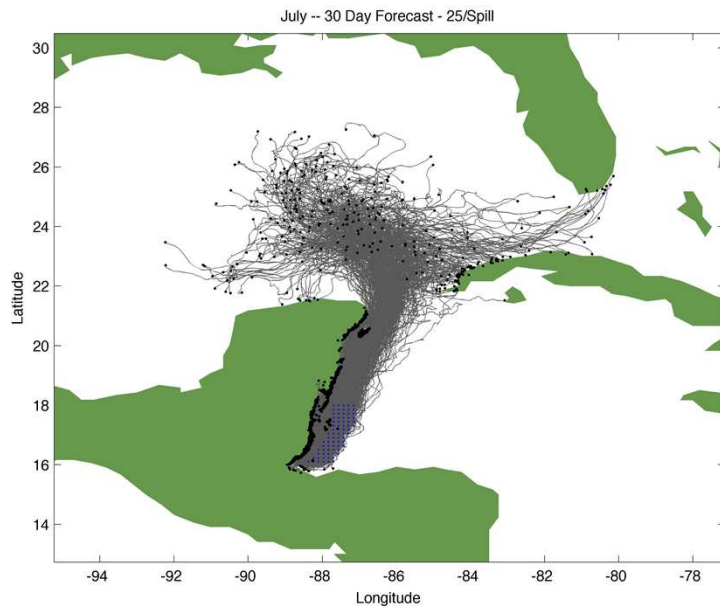
(www.greenpeace.org)



Weihai, China

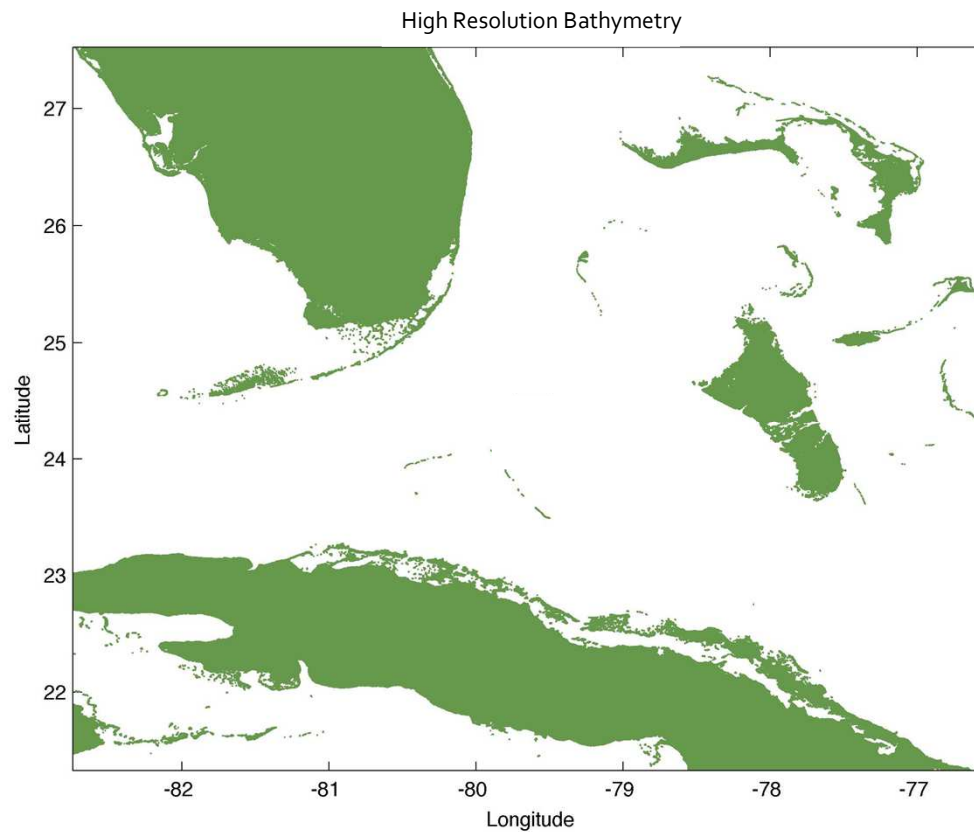
Methods / Results

- Incorporate Surface Currents at One Half Degree Resolution
 - (Lumpkin & Johnson, 2013)
- Identify Regional Time Interval
 - Calculated using results from (Lumpkin & Johnson, 2013)
- Annual Mean vs. Monthly Mean?
 - Identified Significant Monthly Variations within the Region



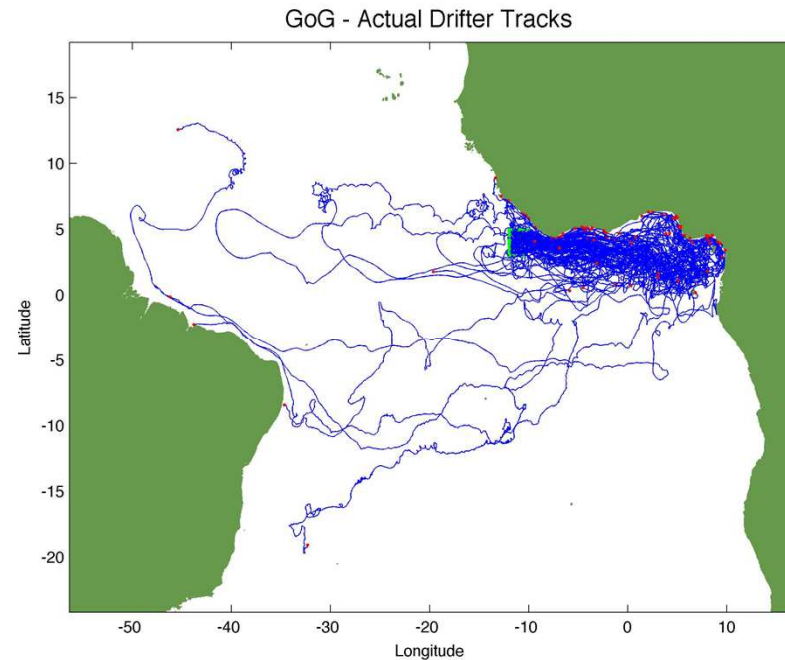
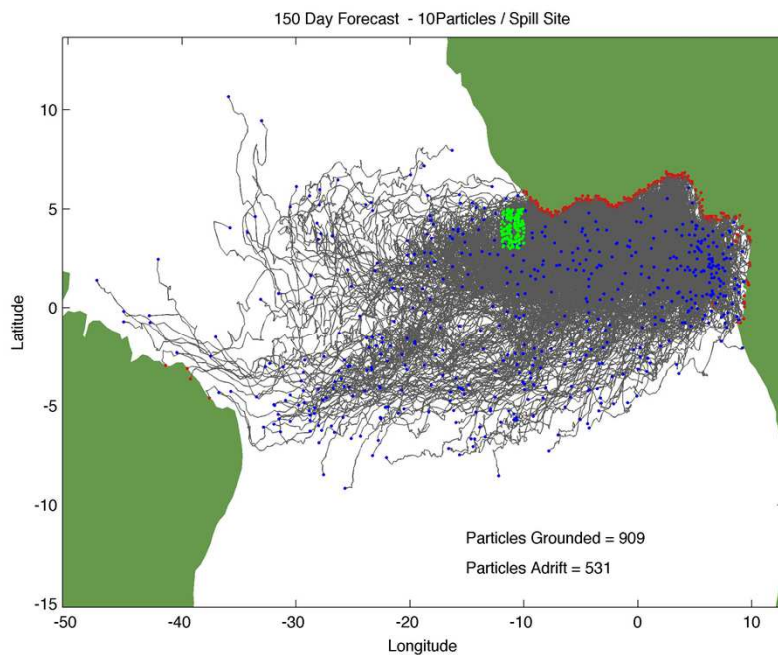
Methods / Results

- Utilize High Resolution Bathymetry Data for Accurate Coastal Topography
 - Global Seafloor Topography from Satellite Altimetry and Ship Depth Soundings (Smith & Sandwell, 1997)



Methods / Results

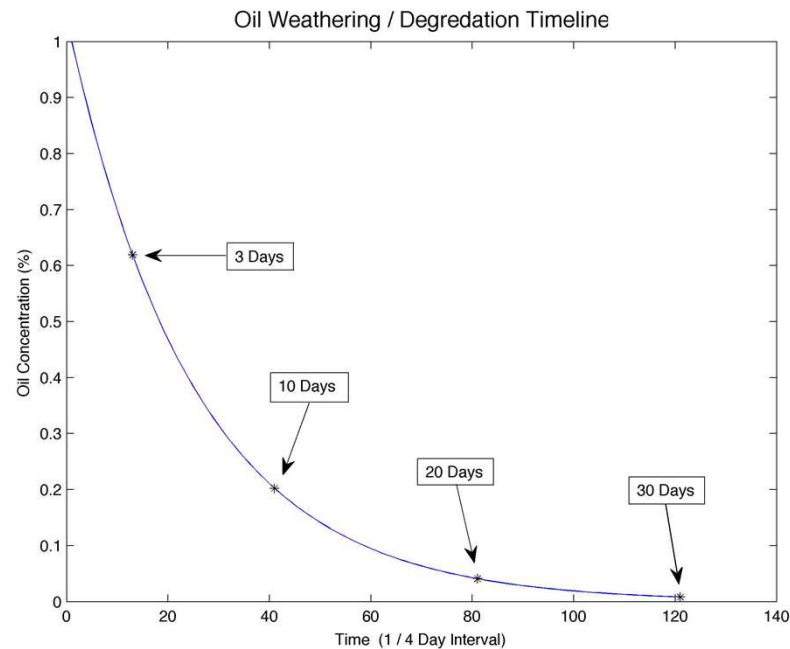
Model Validation — Without Wind Implementation



- 60% Ran Aground
 - 68% Ran Aground
- Evaluating Where and Why Drifters Die**
(Lumpkin, Maximenko, & Pazos, 2012)
http://www.aoml.noaa.gov/phod/dac/drifter_deaths.html

Methods / Results

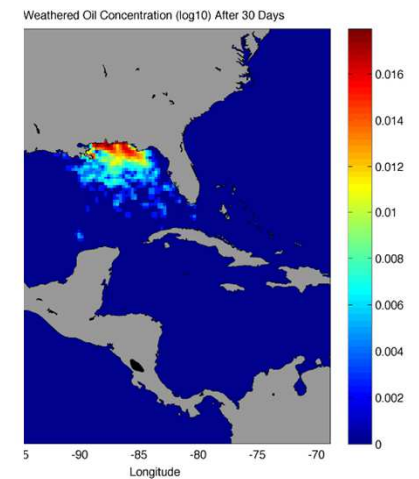
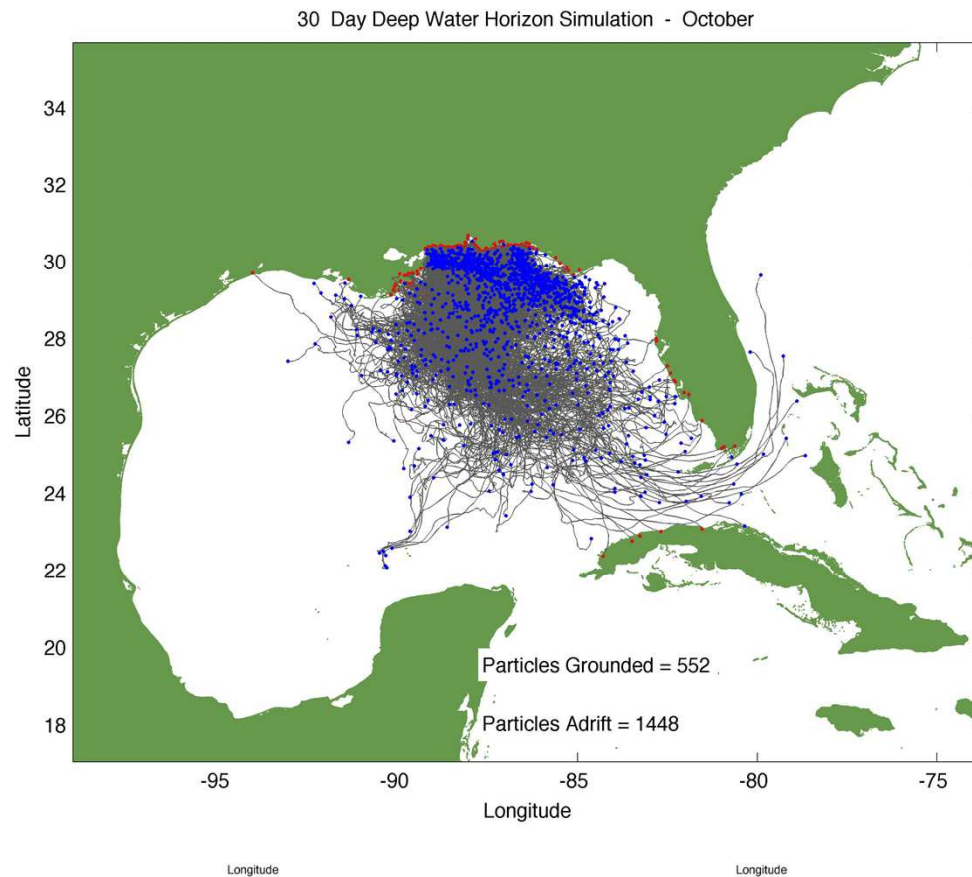
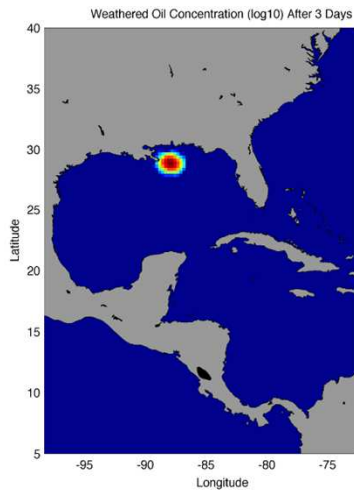
- Implement Weathering / Degredation of Oil



- Implement Regional (Mean) Wind Data
 - NCEP Daily Wind can be Downloaded from <ftp.cdc.noaa.gov> or <http://www.cdc.noaa.gov/cdc/data.ncep.reanalysis.html/#surface>
 - 01-06% (as opposed to the 03% rule)
 - (Smith, 1974; Stolzenbach et al., 1977; Huang, 1983; Lehr & Simecek-Beatty, 2000)

Methods / Results

- Oil Concentration Maps
 - 3,10,20,30 day intervals
 - (Price et al., 2003)



Post Spill Reactions / Response Procedures

- Oil Spill “Treatment”
 - “Beach Ready Wait”
 - Collect Oil Using Booms
 - Marine Protected Areas (MPAs)



(Photo by James Duncan Da)



foilex.com/bilder/sdtdssk/sd_tds20osk_600.JPG)

Desired Implementation

- Improve Readiness
 - Limit Oil Spill Affects To:
 - Land
 - Beaches
 - Mangroves
 - Private Property
 - Marine Protected Areas (MPAs)
 - Spawning Grounds
 - Whale Sharks
 - Sperm Whales
 - Atlantic Bluefin Tuna
 - Fisheries
 - Red Snapper
 - Shrimp
 - Oysters
 - Blue Crab

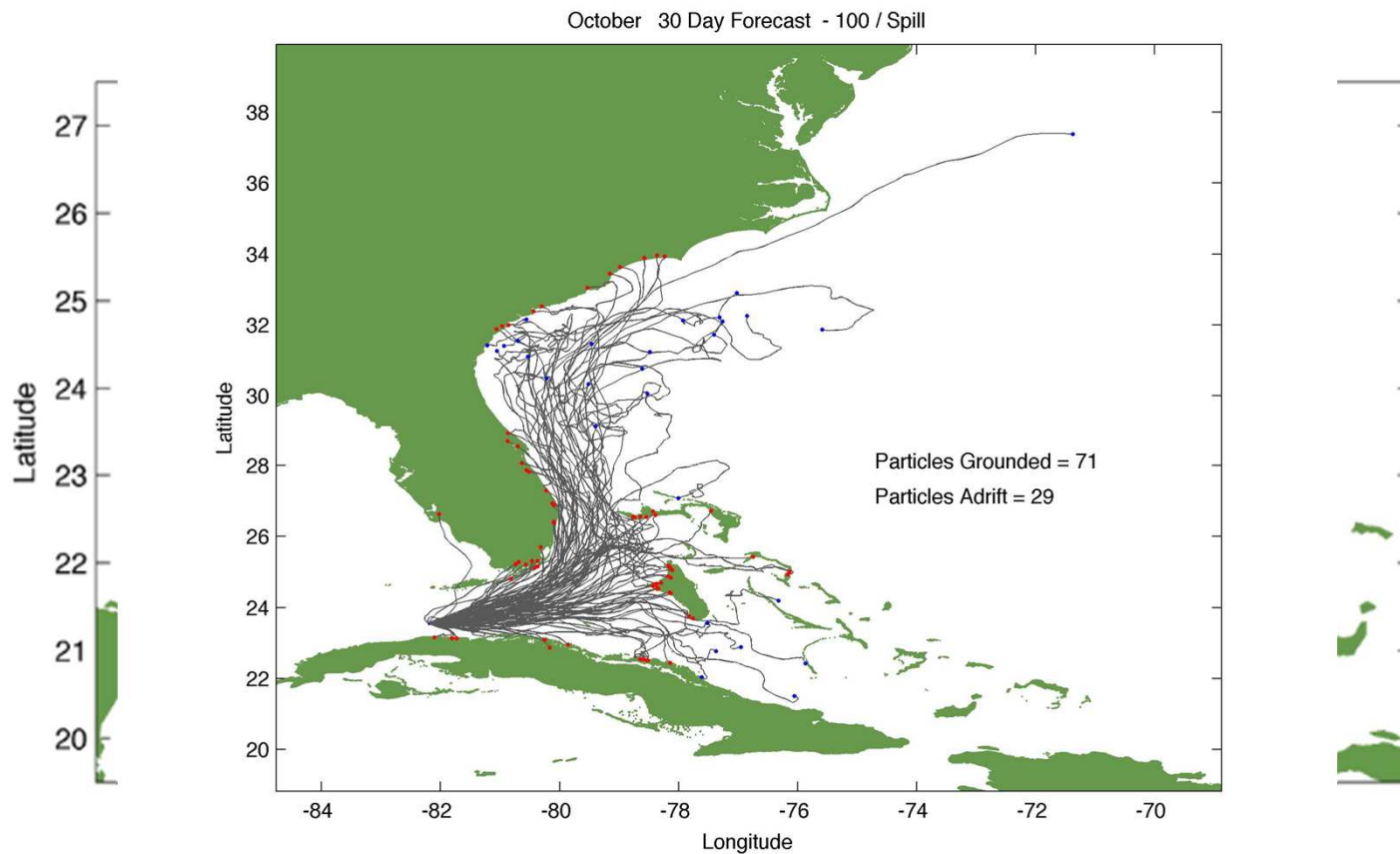
Thank You



(Photo Credit: Anastasia Novak)

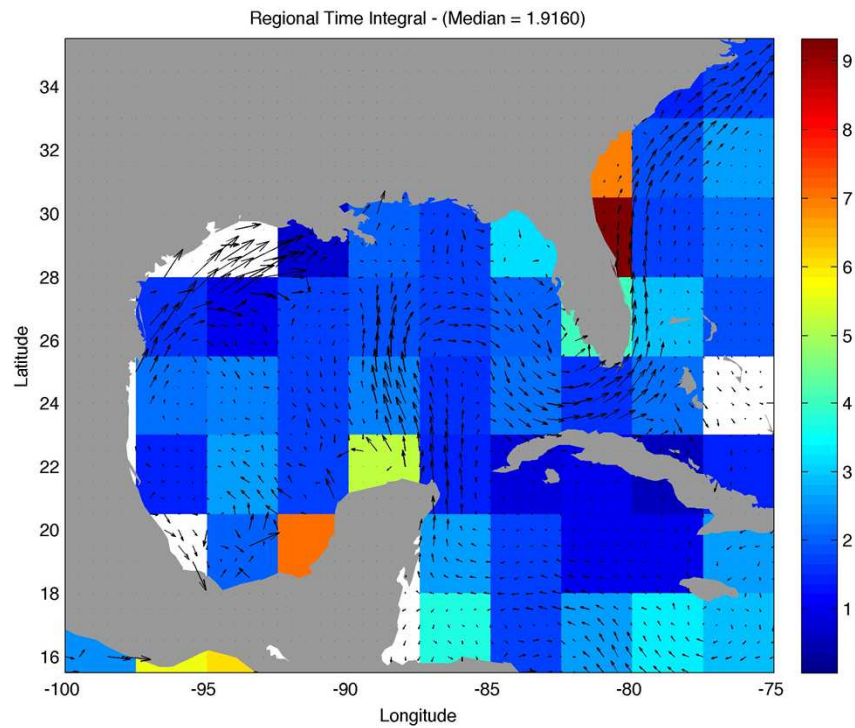
Inspiration ↔ Relative/Related Drifter Studies

- Cuban Oil Exploration article sites/sources



Methods / Results

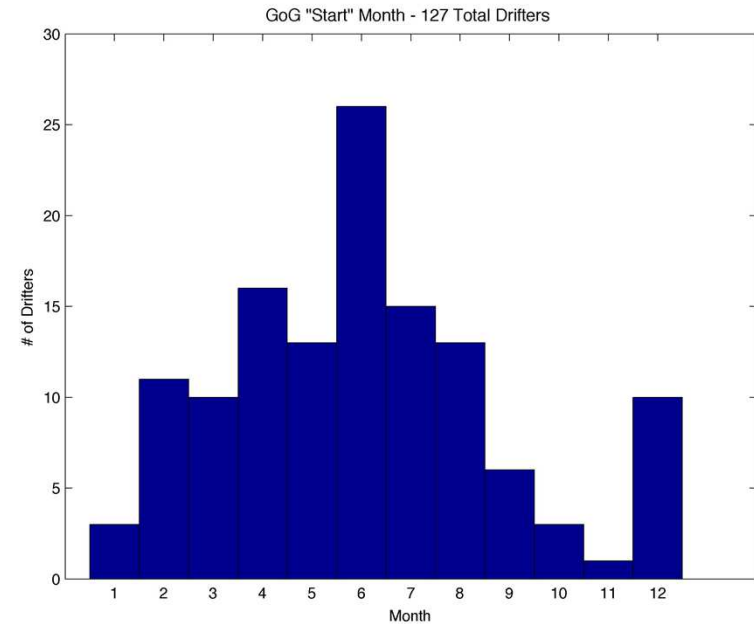
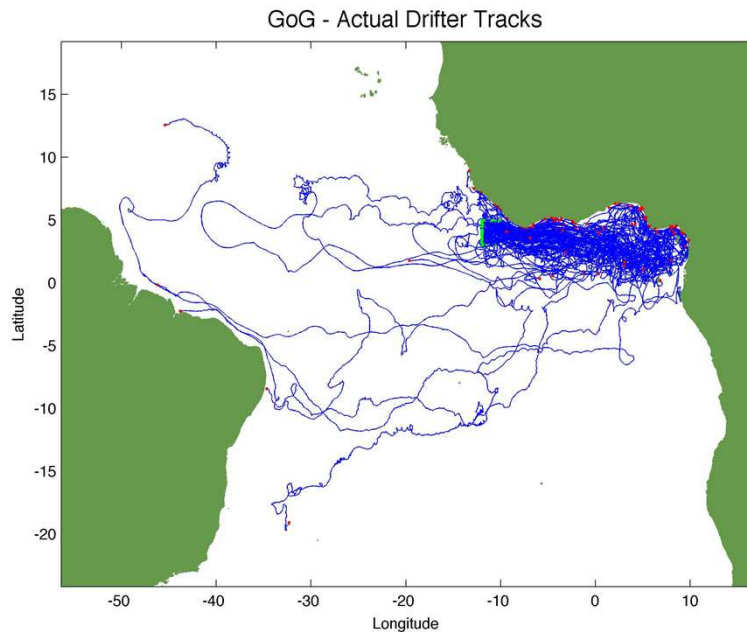
Regional Time Interval



- [site Lumpkin & Johnson, 2013]

Methods / Results

Model Validation — Without Wind Implementation



- "Start" Dates Refer to Time when Drifters Pass Through Selected Parameter (5N-3N, 10W-12W)
- Distribution of "Start" Dates Throughout the Year
 - Annual Mean Data Used for Model Validation