Deepwater Horizon Science

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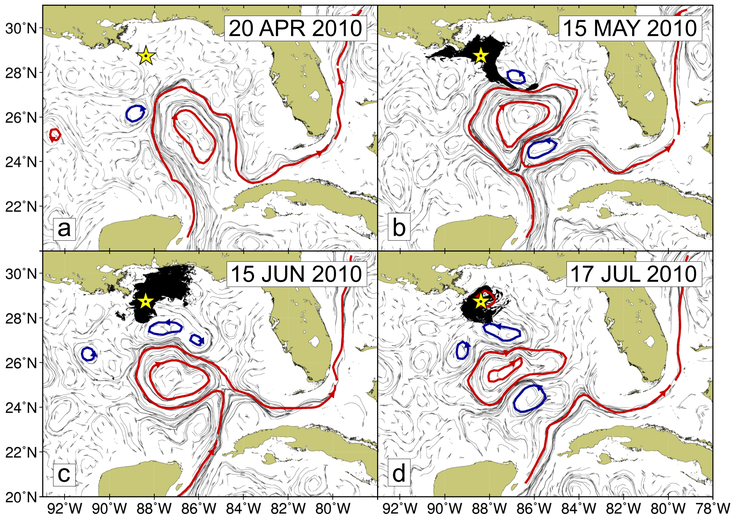
Using In Situ Observations and Satellite Measurements to Examine the Extent and Variability of the 2010 Oil Spill

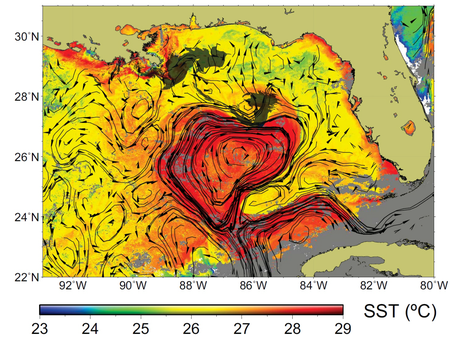
During May-June 2010, while oil was still flowing from the Macondo well following the Deepwater Horizon (DWH) platform explosion on April 20th, drifter trajectories, satellite observations, and numerical simulations indicated a potential for direct connectivity between the northern Gulf of Mexico (GOM) and the Florida Straits via the Loop Current.

This pathway could have potentially entrained particles, including northern Gulf contaminants related to the oil spill, carrying them directly towards the coastal ecosystems of south Florida and northern Cuba.

Real-Time AOML Blended Satellite Data Products

Utilized by the NOAA Office of Response and Restoration (ORR) and others as a planning tool for response efforts.



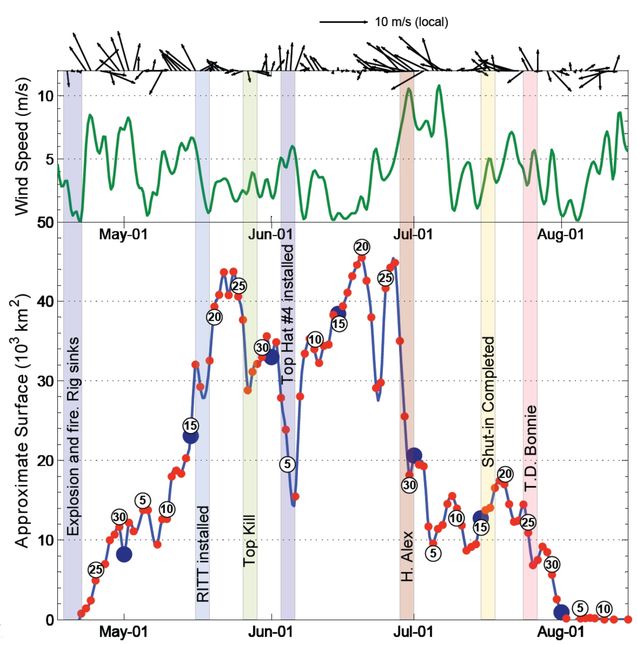


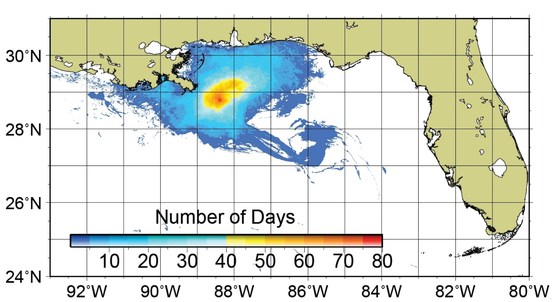
Above, a blended AOML data product used during the 2010 oil spill. Altimetry-derived geostrophic surface currents (11 days of data, centered about 15 May 2010), the sea surface temperature field for 20 May 2010, and the MPSR oil coverage estimate for 20-21 May 2010.

Above, altimetry-derived geostrophic surface velocity fields (gray vectors) are shown for selected dates: 20 April, 15 May, 15 June, and 17 July 2010. Major cyclonic (blue lines) and anticyclonic (red lines) mesoscale circulation features are indicated. Concurrent Marine Pollution Surveillance Report (MPSR; produced by NOAA/NESDIS) surface oil coverage estimates are shown in black.

Right, summer 2010 surface wind velocity time-series for the GOM (NOAA/NCDC 1/4° NCEP2 surface winds) paired with areal MPSR surface oil extent time-series.

Below, cumulative surface oil coverage produced from MPSR time-series (87 days; April-August 2010).

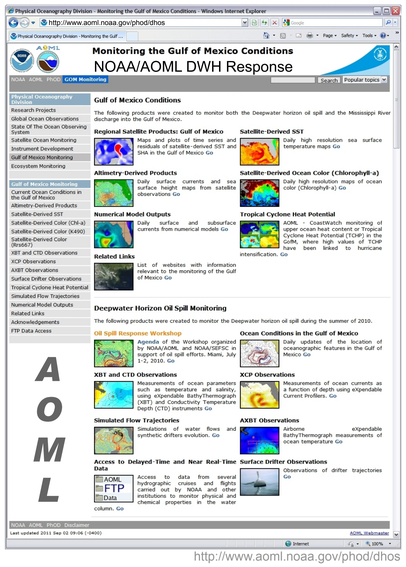




AOML DWH Response Efforts:

In partnership with:
NESDIS, ORR, NMFS, RSMAS, USF, USM, LSU, UGA, ROFFS, and others...

- ***Real-time oceanographic data products (via web, ftp, GTS)***
- ***Research cruises and drifter deployments***
- ***AXBT deployment flight coordination and data quality control***



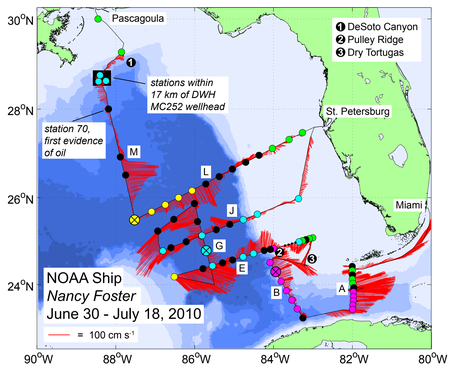
The AOML DWH website served real-time data throughout the spill. It continues as a GOM oceanography resource today (above).

In Situ Findings:

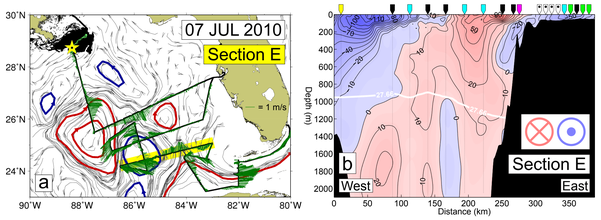
- Tar balls sourced to the Macondo well were observed at 26°45.85'N 86°03.65'W on June 8, 2010.
- In July 2010, no surface/subsurface oil was found in the GOM south of 28°N along the NOAA Ship *Nancy Foster* NF1013 survey track.
- A direct pathway from the northern GOM to the Florida Straits was no longer in place by July 2010.
- On July 17, 2010, a subsurface hydrocarbon plume was confirmed 15 km southwest of the wellhead at 1154 m depth.

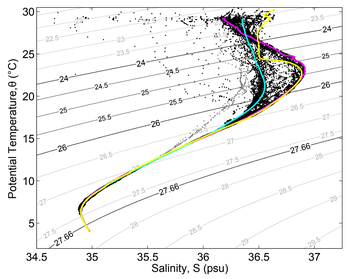
Remotely-Sensed Findings:

- Daily mean surface oil extent: 20,000 km².
- Surface oil coverage area reached a southernmost extension at ~ 27°N, 85°W in early June 2010.
- Total cumulative surface oil extent over 87 days of the spill: 130,000 km².
- The greatest increase in coverage occurred between April 22 and May 22, 2010. The mean daily increase during this time was 1,300 km².
- Daily surface oil extent exceeded 40,000 km² multiple times between late May and the end of June.
- Southeast winds from Hurricane Alex helped to reduce pre-storm surface oil coverage (>45,000 km²) by more than one half (~20,000 km²).



Above, July 2010 in situ surface current velocity vectors (red) and sampling stations. Marker colors indicate station θ-S profile classification as either GCW (blue), LCW (magenta), EFCW (yellow), CSW (green), or mixed/interleaved (black). Classifications were based upon comparison with prototype θ-S profiles (colored profiles shown below; locations marked with an "x" above).



Left (panel b), the current velocity structure normal to Section E (highlighted in panel a), produced from continuous SADCP data and discrete LADCP data, is displayed.

Above (panel a), SADCP surface current vectors (green) with synoptic fields of altimetry-derived surface velocity (gray) for the highlighted Section E. Major cyclonic (blue lines) and anticyclonic (red lines) mesoscale circulation features are indicated. MPSR estimated surface oil coverage for the same period is shown in black.