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ROFFS™ OIL OCEANOGRAPHIC ANALYSIS UPDATED ON WED. 01 DECEMBER 2010

We are providing this update as we have not provided a public analysis in quite a while. Overall we have been monitoring the circulation in the Gulf of Mexico in the areas that are of interest for short-term and long-term ecosystem damage assessment and recovery. Figures 1-3 in the following pages are examples of the work that we have been involved as it relates to monitoring the currents associated with the so-called subsurface oil-dispersant plume cloud (see Figures 3-5). While we have not observed any oil on the surface of the ocean since August there have been reports of tar balls in DeSoto Canyon during the second week of October. In addition we have received numerous telephone reports of oil on the beaches from Pensacola, FL to the barrier islands south of Houma, LA. (see Figures 5 and 6).

For the current monitoring we want to understand the connection between the surface and subsurface currents in the area where sampling had indicated the presence of the subsurface oil-dispersant plume cloud to help understand the movements of this toxic cloud. We are studying the effects of upwelling favorable currents to determine if the appearance of tar balls and other petroleum compounds at the surface were associated with the surface and subsurface circulation. We selected 20 stations where acoustic doppler current profilers (ADCP) were measuring surface and subsurface currents (600 meters). While we understand that the subsurface cloud plume located southwest of the Deepwater Horizon spill site was centered near 1300 meter depths, we wanted to maximize the number of relatively deep water measurements over the area of interest from NOAA's MMS National Data Buoy Center website (www.ndbc.noaa.gov/maps/ADCP_WestGulf.shtml). The subsurface plume cloud had been found at different depths northeast of the spill site such as over the DeSoto Canyon area. In addition, oil continues to be found on the sea floor of DeSoto Canyon and other areas closer to shore. We continue to use satellite and surface drifting buoy data from many of the same sources (e.g. ROFFS™, Univ. South Florida IMaRS, NOAA, NASA, ESA) and used sequential image analyses techniques to map the surface currents and water mass boundaries. Our studies are ongoing and unfortunately do not have final results to report. Understanding the area and time coverage, as well as, oil concentration zones (convergence areas) are critical for evaluating the effect of the oil spill on the Gulf of Mexico ecosystem. To date we have observed times when the surface and subsurface currents were moving in the same direction and at other times moving in different directions. This fall we have not observed any oil at the surface offshore. We continue to evaluate the occurrence of oil along the coastlines and the mechanisms that result in the continued re-suspension and arrival.

From the many workshops we have participated and the reports we continue to receive, it is clear that a substantial amount of oil remains in the central Gulf of Mexico both in the ocean, one the sea floor, and along the coastal zone beaches and marshes. It is anticipated that this oil - dispersant mixture will continue to exist in many different chemical forms for many years and decades. The effects of this disaster remain to be determined and many of the effects may not be apparent for years to come. The impacts are likely to be seen at the habitat, organism, population and ecosystem levels. The impacts probably will range from slight degradation to total loss of essential habitats. Changes in habitat connectivity as a result of oil spill responses by humans (e.g. new beach barriers, new islands, increased freshwater outflow from pumping, digging, etc.) are already obvious. At the organism level, effects are likely to be manifested in direct injury and death (already seen), external and internal deformities, cancer and other diseases, genetic defects, reduction of feeding efficiency, changes in benthic survival, as well as, changes in social and sexual behavior. At least some of these are likely to have negative biological impacts at the population level. Changes are likely to be seen in the survival and growth at different life stages (egg to adult), changes in the reproductive potential of populations due to changes in endocrine systems (e.g. number and quality of eggs), changes in migration and distribution along with effects on the predator – prey dynamics. There is great concern whether the biological impacts at the individual and population level will have cascading impacts on

food webs and ecosystems such as loss of prey species (menhaden, other herrings/sardines, jacks, shrimp, etc.) bases along with loss of large pelagic (mammals, tunas, billfishes, sharks, etc.) and benthic (e.g. snappers and groupers) species. Remember that snappers, groupers and other organisms burrow into the bottom where oil has been found and probably still occurs.

Over the entire Gulf of Mexico one needs to be cautious about apparent short-term increases in catch rates that may stem from changes in the catchability (availability and vulnerability), but not due to increases in the absolute abundance of the fish stocks. While there have been some reports in the media to the contrary, It is highly unlikely that depressed populations have increased their abundance significantly due to the relatively short-term stoppage of fishing. One needs to understand that some of the effects on the ecosystem are likely to be subtle at first, but significant over time. Apparent changes natural mortality and fishing mortality will have to be studied through fishery independent population assessments that produce size structured population estimates in space and time.

Some people have stated that the oil has degraded to the point that it is more like asphalt, i.e. rock-like in composition and no longer is a problem. We have asked these people if they would take freshly laid asphalt and put it in their vegetable gardens to grow food that they would want to eat.

Of the many aspects that continue to be reinforced during this episode is the lack of baseline biological data over large areas and long periods of time, as well as, surface and subsurface ocean circulation data along with reliable predictive models. More on this subject will be considered in future updates. In the meantime review the Figures in the complete report on our website below that were introduced at the beginning of this update. We hope you find it useful. Feel free to contact us about this.

Figure 1: ROFFS™ derived surface currents using satellite imagery, drifting buoys and surface acoustic doppler current profilers (ADCP) on October 11, 2010. When reviewing this figure realize that the scale of the surface data (black and blue arrows) is different from the scale of the surface (red) vectors. The black and blue arrows simply show direction of the flow, while the ADCP red arrows show both speed and direction.

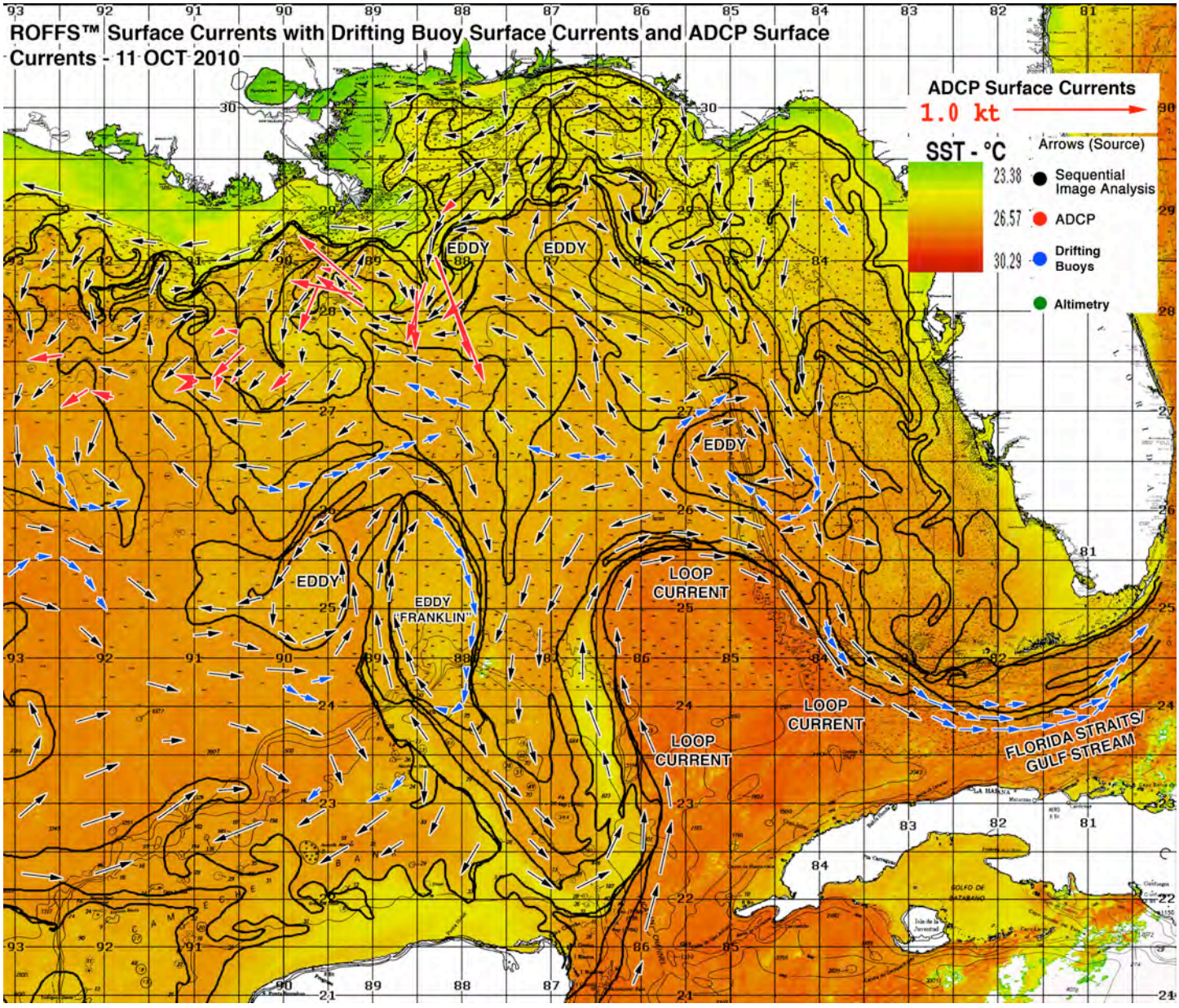


Figure 2: ROFFS™ derived surface currents using satellite imagery, drifting buoys and sub-surface (600 meter depths) acoustic doppler current profilers (ADCP) on October 11, 2010. When reviewing this figure realize that the scale of the surface data (black and blue arrows) is different from the scale of the subsurface (red) vectors. The black and blue arrows simply show direction of the flow, while the ADCP red arrows show both speed and direction and are not the same scale as Figure 1.

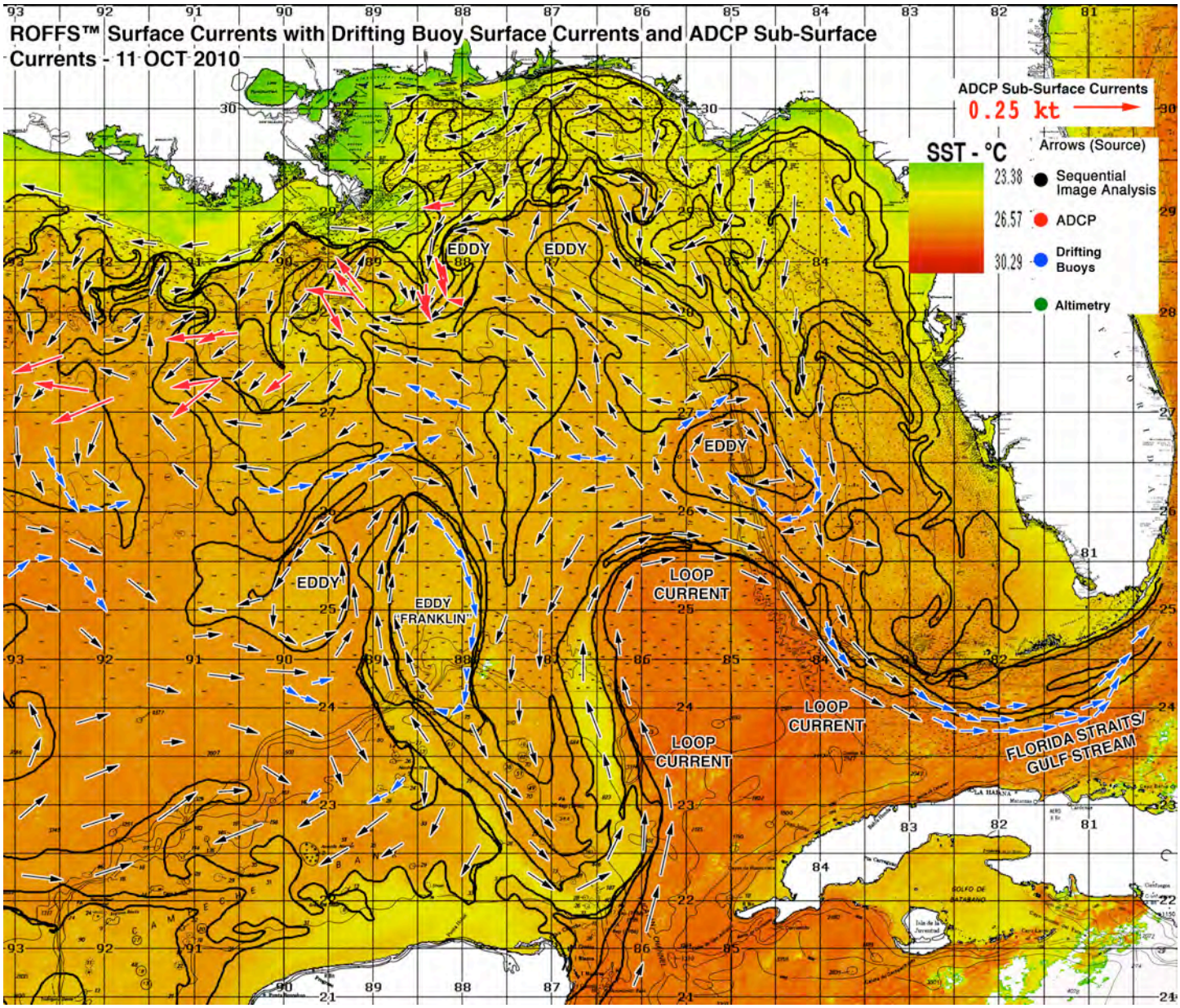


Figure 3: ROFFS™ derived surface currents using satellite imagery, drifting buoys and sub-surface acoustic doppler current profilers (ADCP) on October 11, 2010. When reviewing this figure realize that the scale of the surface data (black and blue arrows) is different from the scale of the subsurface (red) vectors. The black and blue arrows show the direction of the flow, while the ADCP red arrows show both speed and direction and are not the same scale as Figure 1. The olive green area is the area ROFFS™ was monitoring as it was related to the subsurface oil-dispersant cloud derived from a variety of data sources including NOAA and University of South Florida (Hollander and Peebles).

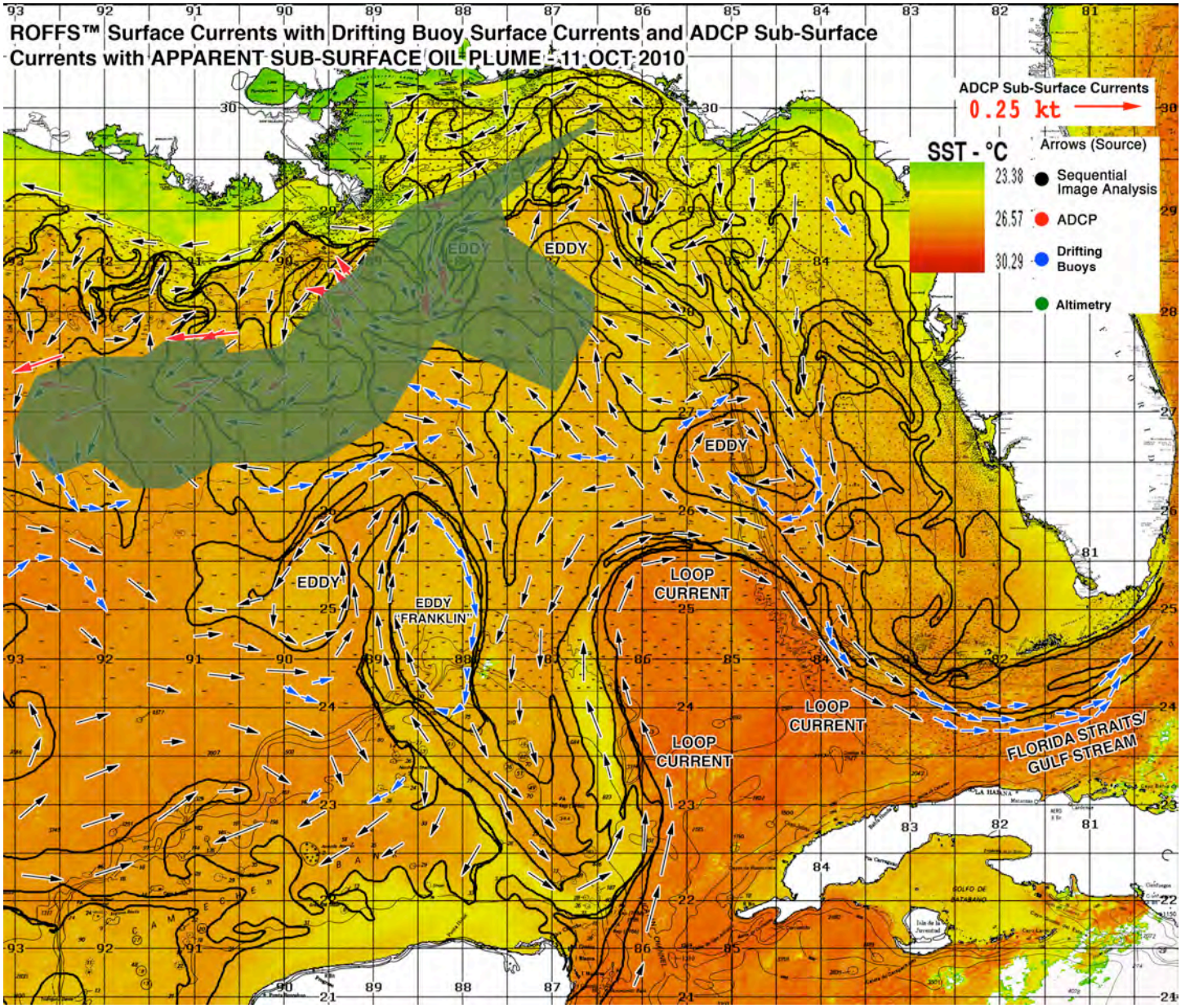


Figure 4. Cumulative dissolved oxygen anomaly August 03 – September 30, 2010. This data is the most recent data available from NOAA's oil information website, GeoPlatform (www.geoplatform.gov). The existence of abnormally low dissolved oxygen levels (green dots) is believed to be associated with biological metabolism of petroleum compounds (oil and degradation compounds) and dispersants derived from the Deepwater Horizon well. ROFFS™ combined this data with data provided by Hollander and Peebles (University of South Florida) to derived the study area shown in Figure 3.

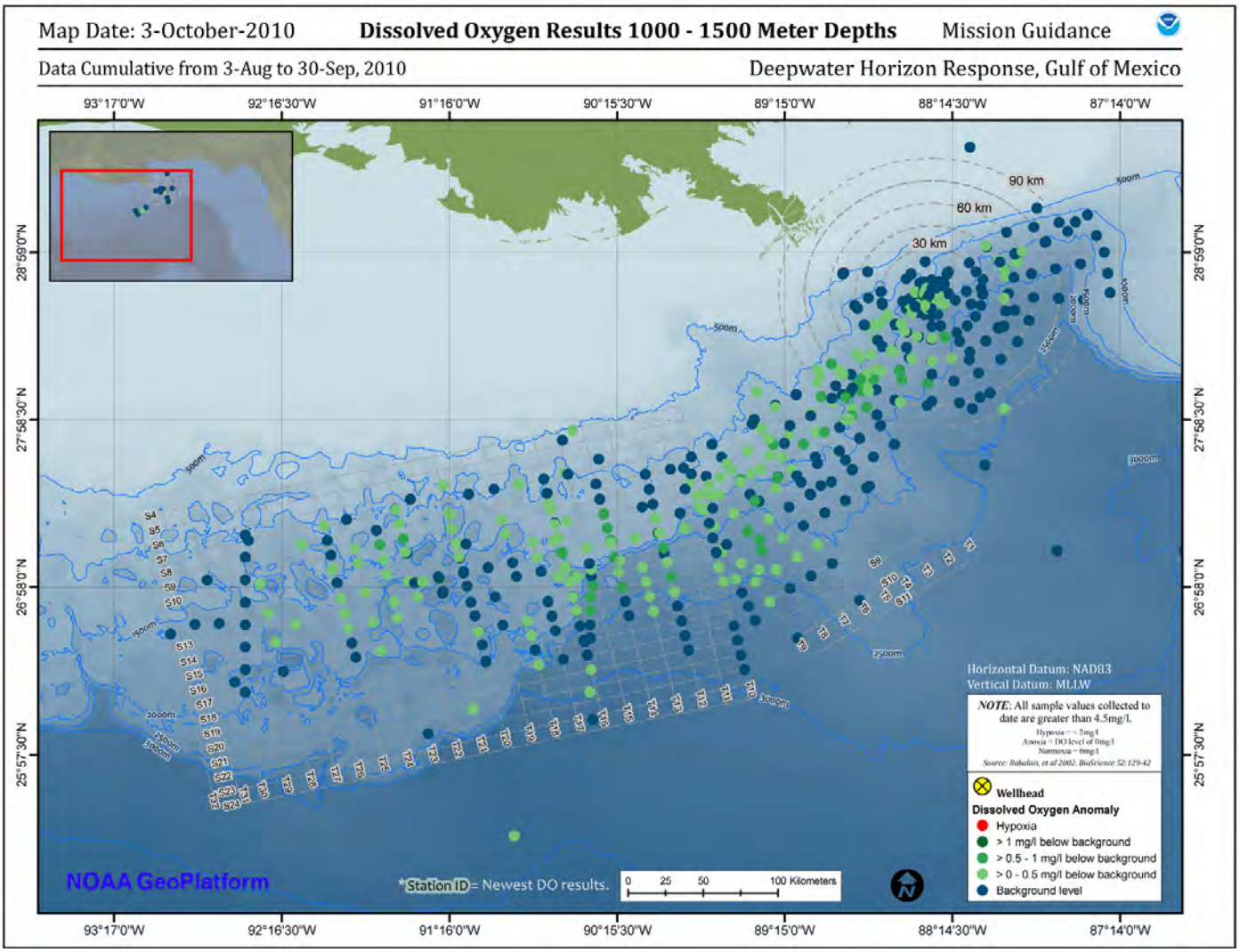


Figure 5. Preliminary dissolved oxygen anomaly from September 01-28, 2010 derived from data shown on NOAA's GeoPlatform (www.geoplatform.gov). This is the most current data available from NOAA. The existence of abnormally low dissolved oxygen levels (green dots) is believed to be associated with biological metabolism of petroleum compounds (oil and degradation compounds) and dispersants derived from the Deepwater Horizon well. Along the coastline the areas with colored areas show the location of oil that continues to come on land. See Figures 6 for a closer view.

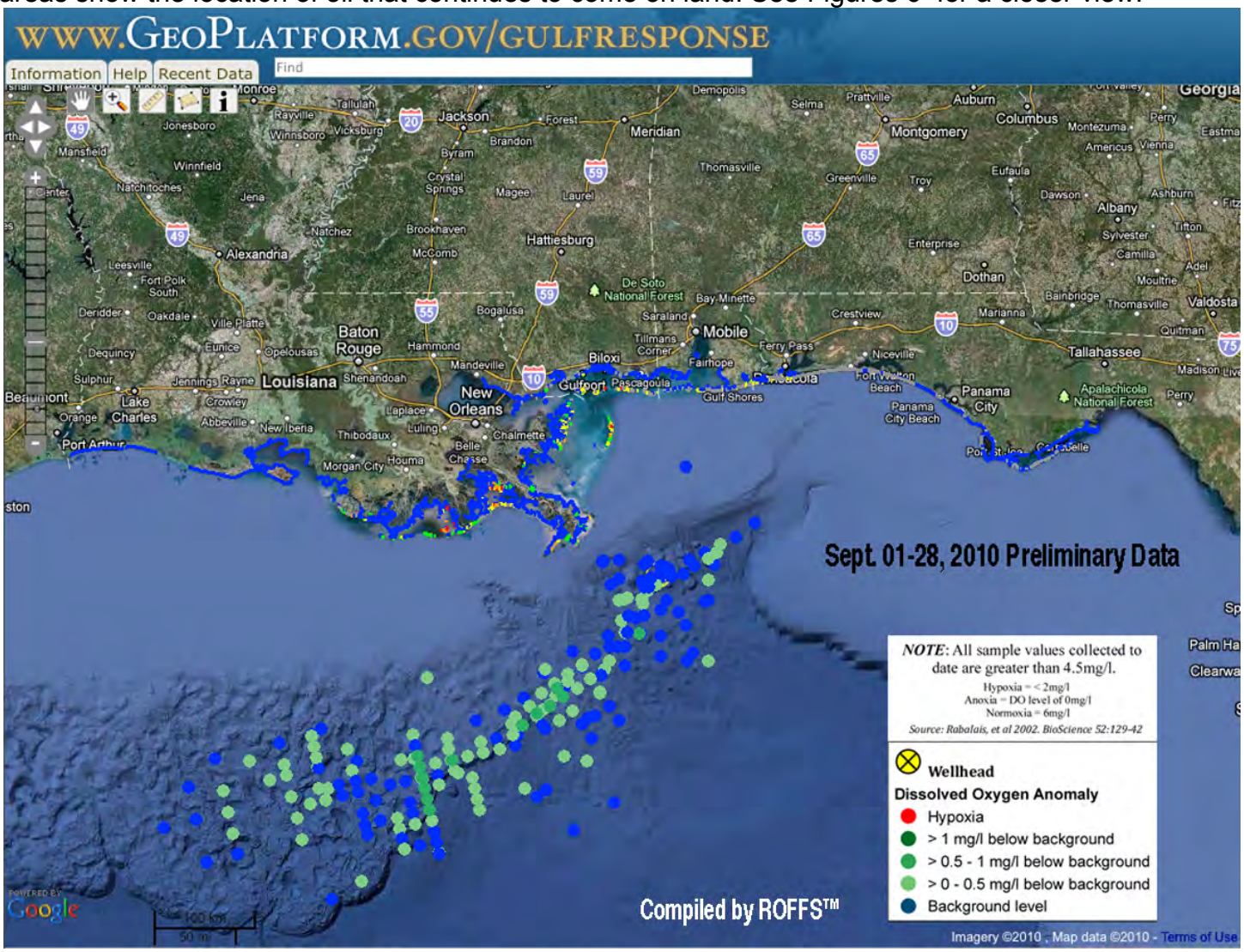
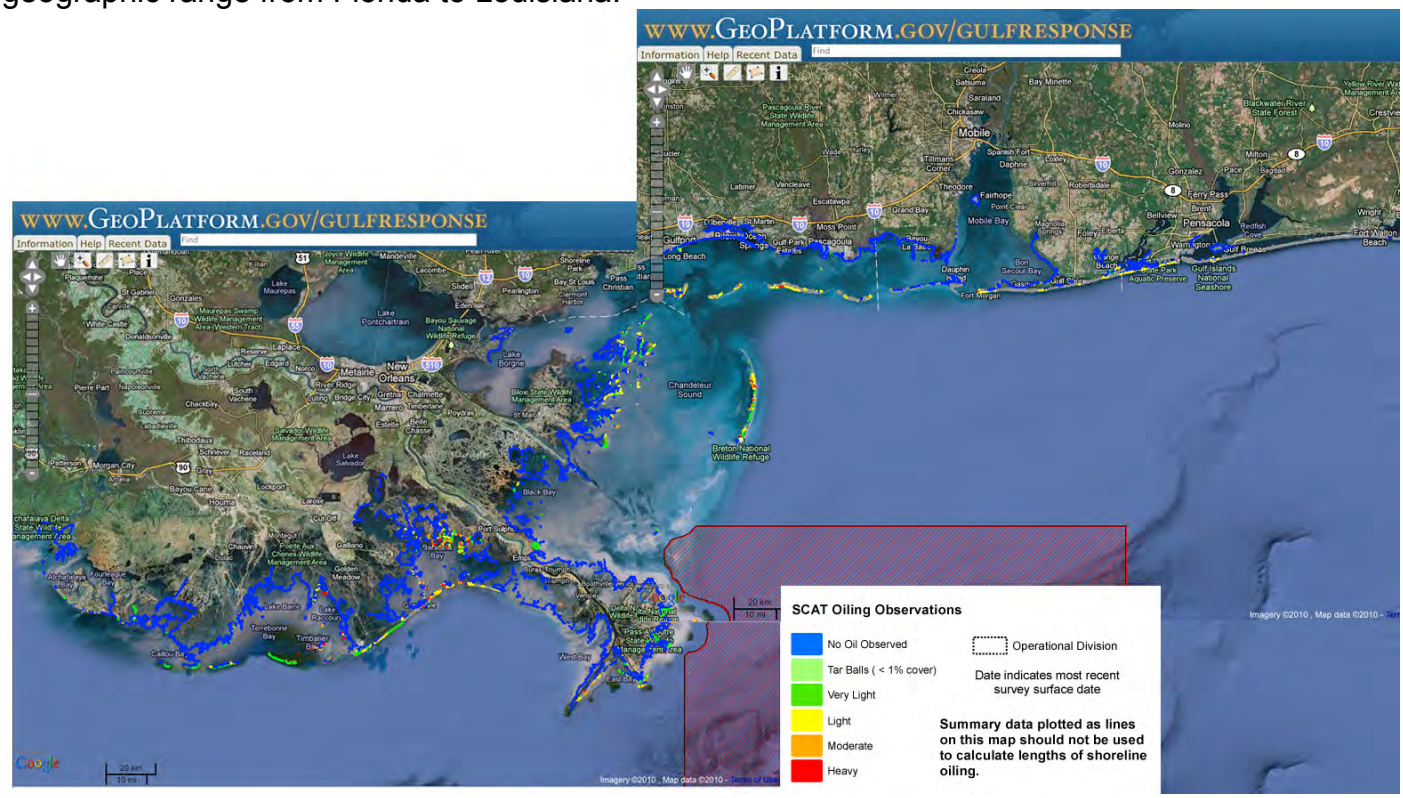


Figure 6. Latest (November 28-29, 2010) shoreline oiling observations derived from the NOAA GeoPlatform website ((www.geoplatform.gov). The non-blue colored areas are the locations where oil has been observed. The red hashed area east of the Mississippi delta is the area closed to shrimp fishing due to the recent capture of oil in shrimp nets. Note that the oil on land extends over a wide geographic range from Florida to Louisiana.



End of update.