end-member chemical composition analysis of the well fluids, a dissolved oxygen anomaly is found large enough to account for the respiration of all released methane, as well as most of the additional hydrocarbons in the deep ocean waters.

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Subtidal circulation on the Alabama shelf during the Deepwater Horizon oil spill

Water column velocity and hydrographic measurements on the inner Alabama shelf are used to examine the flow field and its forcing dynamics during the Deepwater Horizon oil spill disaster in the spring and summer of 2010. Comparison between two sites provides insight into the flow variability and dynamics of a shallow, highly stratified shelf in the presence of complicating geographic and bathymetric features. Seasonal currents reveal a convergent flow with strong, highly sheared offshore flow near a submarine bank just outside of Mobile Bay. At synoptic time scales, the flow is relatively consistent with typical characteristics of wind-driven Ekman coastal circulation. Analysis of the depth-averaged, along-shelf momentum balance indicates that both bottom stress and along-shelf pressure gradient act to counter wind stress. As a consequence of the along-shelf pressure gradient and thermal wind shear, flow reversals in the bottom currents can occur during periods of transitional winds. Despite the relatively short distance between the two sites (14 km), significant spatial variability is observed. This spatial variability is argued to be a result of local variations in the bathymetry and density field as the study region encompasses a submarine bank near the mouth of major freshwater source. Given the physical parameters of the system, along-shelf flow in this region would be expected to separate from the local isobaths, generating a mean offshore flow. The local, highly variable density field is expected to be, in part, responsible for the differences in the vertical variability in the current profiles.

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Variations in fluorescent dissolved organic matter components during laboratory degradation of Macondo crude oil

To better understand the fate and transformation of oil in the Gulf of Mexico from the Deepwater Horizon oil spill, laboratory degradation experiments have been conducted using Macondo crude oil. UV-vis absorption and fluorescence spectroscopy and PARAFAC modeling were used to characterize oil components and their variations during photochemical degradation. Crude oil was dispersed into seawater or de-ionic water in light and dark bottles incubated in a water bath receiving natural sunlight for 120 days. Results from time series measurements show a dramatic decrease in UV-vis absorbance and fluorescence intensities of dissolved organic matter during oil degradation. The concentration of dissolved organic carbon in light bottles steadily increased in seawater during the first 40 days of oil degradation, with a negative correlation between dissolved organic carbon and SUVA, indicating production of water-soluble dissolved organic matter through photo-degradation and preferential degradation of optically active dissolved organic matter. Spectral slopes slightly increased in both light and dark bottles, suggesting preferential decomposition of higher molecular weight DOM. Based on PARAFAC modeling, three oil components were identified with Ex/Em maximum at 226/328, 260/315, and 246/366 nm, respectively. Fluorescence intensities of these components all decreased with time during degradation in the light bottles. However, the fluorescence intensity ratios of oil components, such as C2/C1 and C3/C1, consistently increased with time, suggesting a preferential degradation of C1 component. In black bottle treatments, the C2/C1 ratio did not vary significantly with time, suggesting little degradation of C2 or C1 without sunlight. In contrast, C3/C1 value increased slightly with time in black bottles, suggesting a rather slow degradation rate of C3 in dark bottles. The differences in fluorescence component ratios likely reflect the degradation status of oil in marine environments. The addition of dispersant, at an oil to dispersant ratio of 10:1, resulted in a shift in fluorescence EEM spectra with a characteristic Ex/Em maximum at 240/446 nm and seemed to enhance the degradation of oil. Photo-degradation is an effective degradation pathway of oil components, resulting in lower molecular weight dissolved organic matter with red-shifted fluorescence maxima. New results from laboratory degradation experiments should help the interpretation of field data and provide insights into degradation pathways and mechanisms and the fate and transport of oil components in the Gulf of Mexico.

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Changes in health and well-being in communities affected by the Deepwater Horizon disaster

To improve our understanding of the impacts of hazards such as the Deepwater Horizon oil disaster on the basic needs, health, economies, and social structure of coastal communities, we are exploring changes in the health and well-being of residents as they relate to changes in environmental health and the provision of ecosystem services. To do this, we are developing a method that will use indicators which were identified in collaboration with other Federal, state, and academic programs. We are focusing on coastal counties directly affected by oil-contaminated shorelines, as well as a selection of comparison counties. By establishing a way of monitoring changes in well-being around these hazards, we will be better able to assess the social impacts of environmental disasters and changing conditions, from oil spills and hurricanes to decreasing water quality and changing shorelines. This project will help local officials protect communities before the disaster by predicting potential social and economic changes and assist in recovery efforts afterwards through providing a way of assessing the impacts of the disaster.

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Interdisciplinary topic map and thesaurus for understanding the impact of oil spills

The goal of the project is to develop an interdisciplinary topic map to facilitate the understanding of the impact of the Gulf of Mexico oil spill incident. Two topic maps are to be developed, a general one for the public, journalists, and politicians, and an interdisciplinary one for oil spill researchers. The interdisciplinary topic map is expected to facilitate knowledge discovery through interdisciplinary knowledge fusion. Topic maps are a new semantic approach to information organization and were designed to enhance navigation and information retrieval in large sets of information resources. A topic map presents topics/concepts, their relationshps, and the documents that address those topics. Once developed, such a topic map can be used to display the major issues (concepts and relationships) related to the oil-spill incident and to navigate the information resources.

APPENDIX 5: ACRONYMS

ADCP	Acoustic Doppler Current Profiler
API	American Petroleum Institute
BioGoMX	Biodiversity of the Gulf of Mexico
BOEM	Bureau of Ocean Energy Management
CDC	Centers for Disease Control
DOSS	Dioctylsulfosuccinate
DWH	Deepwater Horizon Mississippi Canyon 252
ECSC	Environmental Cooperative Science Center
EEM	Excitation emission matrix
EPA	Environmental Protection Agency
FB	Flocculent blizzard
FDA	Food and Drug Administration
GCOOS	Gulf of Mexico Coastal Ocean Observing System
GOMA	Gulf of Mexico Alliance
GOMRI	Gulf of Mexico Research Initiative
IOOS	Integrated Ocean Observing System
IPA	Importance Performance Analysis
IRSSS	Use of In Situ and Remote Sensors, Sampling and Systems
JSOST	Joint Subcommittee on Ocean Science and Technology
LSU	Louisiana State University
LSUHSC-NO	Louisiana State University Health Sciences Center—New Orleans
NASA	National Aeronautics and Space Administration
NCCOS	National Centers for Coastal Ocean Science
NGO	Nongovernmental organization
NIEHS	National Institute of Environmental Health Sciences
NIUST	National Institute for Undersea Science and Technology
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NSF	National Science Foundation
NSTC	National Science and Technology Council
OGP	International Association of Oil and Gas Producers
OR&R	Office of Response and Restoration
OSTP	Office of Science and Technology Policy
PAH	Polycyclic (or polynuclear) aromatic hydrocarbon
PARAFAC	Parallel Factor Analysis
ROFFS	Roffer's Ocean Fishing Forecast Service
ROMS	Regional Ocean Modeling System
SABGOM	South Atlantic Bight and Gulf of Mexico Model
SEAMAP	Southeast Area Monitoring and Assessment Program
SIMAP™	Spill Impact Model Analysis Package
SAIC	Science Applications International Corporation
SAR	Synthetic aperture radar
SOST	Subcommittee on Ocean Science and Technology
TBR	Toxic bathtub ring
UM RSMAS	University of Miami – Rosenstiel School of Marine and Atmospheric Science
UNC	University of North Carolina
USF	University of South Florida
USGS	United States Geological Survey
UV-vis	Ultraviolet-visible
WHOI	Woods Hole Oceanographic Institution

XBT	Expendable bathythermograph
XCP	Expendable current profiler
XCTD	Expendable conductivity-temperature-depth