METHODS AND RESULTS

Marine scientists from the Gulf Coast Research Laboratory (GCRL) and the National Marine Fisheries Service planned and initiated an investigation of eddies in the northeastern Gulf of Mexico in 1987. While monitoring Advanced Very High Resolution Radiometer (AVHRR) imagery of sea surface temperatures from the National Oceanic and Atmospheric Administration's satellites during the winter of 1987-1988, formation of paired vortices south of Mobile Bay and Pensacola, Florida was observed on January 27, 1988. The R/V Tommy Munro, with marine scientists from GCRL aboard, was dispatched to study the phenomena. Locating stations within and on the peripheries of the eddies was facilitated by real-time acquisition and near-real-time processing of satellite AVHRR imagery. After selecting sites for initial hydrographic stations based on geo-referenced and processed AVHRR thermal imagery, the oceanographer at the land-based satellite receiving station relayed the station positions to the scientific party aboard the research vessel. Coordinates for additional hydrographic stations were relayed to the vessel as quickly as satellite imagery from subsequent passes was received and processed.

The sequence of AVHRR imagery of sea surface temperatures spanning the period January 27 - 29, 1988, shows the development of twin eddies centered at approximately 29°30'N latitude. The satellite imagery depicts a tongue of seaward-directed shelf water encountering a band of warm Gulf water. The band of warmer, saltier Gulf waters encircled the cooler, less saline shelf waters, forming oppositely rotating vortices. The cooler shelf waters became the core waters of both vortices.

The west member of the vortex pair rotated anticyclonically while the east member rotated cyclonically. During the period that the eddies were tracked via satellite imagery, the pair moved northeasterly at an average translation speed of 0.5 km hr⁻¹. As the vortex pair became better developed, their shape at the sea surface changed from elliptical, with minor and major axial dimensions of 72 km and 120 km, respectively, to circular with diameters of approximately 52 km.

Two transects were made by the research vessel, one through each of the eddies, to obtain temperature profiles of the water column, measure surface salinities, measure surface water chlorophyll-a concentrations, and collect plankton samples. The transect through the west eddy along 88°W longitude

INTRODUCTION

An interdisciplinary study of eddies in the northeastern Gulf of Mexico was initiated in the winter of 1987 to investigate the role and potential impact of eddies on the distribution and fate of eggs, zooplankton, and larvae in the waters over the continental shelf, slope, and upper continental rise. The presence of eddies over the continental shelf/slope in the northeastern Gulf of Mexico has been reported based on analyses of water column temperature and salinity data (Drennan 1968), investigations employing numerical simulation (Hurlbert and Thompson 1980), and observations via satellite imagery (Herron pers. comm. 1987). Numerical simulations of Gulf circulation (Thompson pers. comm. 1989) showed frequent formation of eddies along the continental slope in the vicinity of DeSoto Canyon; these either moved across the shelf and dissipated or impinged upon the shelf where they lingered for a time before moving into the open Gulf. Eddies that form over the continental shelf/slope and draw and entrain waters from the shelf may be important mechanisms in the northeastern Gulf for cross-shelf material transport; e.g., nutrients, pollutants, eggs, zooplankton, and fish larvae.
formed a chord that passed through only the outer region of the eddy core. Temperatures of surface waters were between 16.5°C and 20.0°C with the lower values occurring within the eddy core and shoreward over the continental shelf. Contour charts of temperature cross sections depict a 100-m thick layer of 20°C Gulf water extending shoreward dipping beneath the eddy core and rising again shoreward of the core. The 19°C - 17°C isothermal surfaces rise seaward of the shelf break and reach the sea surface, forming the shoreward side of this eddy. Along this transect through the eddy, the thermal structure indicates that the eddy did not reach a depth greater than 50 m.

The second transect bisected the other member of the vortex pair. Surface water temperatures measured were between 17.0°C and 18.6°C with the cooler temperatures associated with the core water. The temperature cross section of the water column, again, indicated that the eddy did not extend beyond a depth of 50 m.

The relationships of zooplankton composition/density and chlorophyll-a concentrations to the different source waters comprising these vortices have been discussed previously (Steen et al. 1988).

Cloudy skies prevented the continued tracking of the vortex pair via satellite beyond January 28, 1988. Later satellite imagery did not reveal any recognizable signatures of the double vortices. Because of the role these phenomena may play as mechanisms for material transport across the shelf, marine scientists at GCRL have continued to investigate the occurrence of eddies in the northeastern Gulf. Eddies may prove to have a profound impact on fish recruitment in this region of the Gulf of Mexico.

REFERENCES


Dr. Charles Eleuterius has worked at Gulf Coast Research Laboratory for the past 25 years and has been head of the Physical Oceanography Section for the last 20 years. His areas of research interest are estuarine and shelf hydrodynamics. Dr. Eleuterius received his B.S. in mathematics and M.S. in statistics from the University of Southern Mississippi, completed course work toward a Ph.D. in physical oceanography at Texas A&M University in 1971, and received his Ph.D. from the University of Southern Mississippi in 1987.

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NATIONAL WEATHER SERVICE MODERNIZATION PURPOSE

Mr. Billy J. Crouch
National Weather Service
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The modernization and associated restructuring of the National Weather Service (NWS) (Figure 13.23) shall assure that the major advances that have been made in our ability to observe and understand the atmosphere are applied to the practical problems of providing weather and hydrologic services to the Nation.

AUTOMATED SURFACE OBSERVING SYSTEMS

Automated surface observations will relieve staff from the manual collection of surface observations. Over 1,500 automated surface observing systems across the nation (Figure 13.24) will provide data on pressure, temperature, wind direction and speed, runway visibility, cloud ceiling heights, and type and intensity of precipitation on a nearly continuous basis. This is a cooperative effort with the Federal Aviation Administration (FAA). The Department of Defense (DOD) is considering joining this effort and providing additional observation capability.

NEXT GENERATION WEATHER RADARS

Using Doppler radar technology, this next generation weather radar (NEXRAD) system will observe the presence and calculate the speed and direction of motion of severe weather elements such as tornadoes and violent thunderstorms. The NEXRAD will also provide quantitative area precipitation measurements important to flood forecasting. These capabilities will increase the accuracy and timeliness of NWS warning services. A national network (Figure 13.25) of 160 NEXRAD systems will improve the uniform coverage of the Nation over the present-day radar network. The DOD and FAA will operate 39 of these radars and the NWS will operate 121 radars in the network.

SATELLITE UPGRADES

The new satellites will have separate instrumentation that allows simultaneous image and sounding data to be observed and transmitted to ground stations. This GOES 1-M system will provide visible and infrared imagery as frequently as every six minutes during severe weather over selected areas of the Nation.

NATIONAL CENTER ADVANCED COMPUTER SYSTEMS

Present-day Class VI computers will be replaced with Class VII computers, which have processing capabilities an order of magnitude greater. This will allow improved models with greater spatial resolution to be run more frequently and support the warning and forecast operations at each office.

ADVANCED WEATHER INTERACTIVE PROCESSING SYSTEM

The Advanced Weather Interactive Processing System (AWIPS) will be the nerve center of operations in each weather office. The AWIPS will receive high resolution observational data and centrally prepared analysis and guidance products. The integration of these data represents the data base from which all warning and forecast products will be prepared. The system includes NOAAPORT, a satellite communications capability that interconnects weather offices for exchange of data. The NOAAPORT will also deliver a wide range of products, such as oceanographic and environmental data, to external users including other government agencies, universities, private research organizations and business interests.

Mr. Billy J. Crouch is the Meteorologist in Charge and Area Manager of the Weather Service Forecast Office for New Orleans located in Slidell, Louisiana. He has considerable experience as a forecaster, meteorologist, and manager with the Weather Service in the Gulf of Mexico area. Working assignments since the 1950's included Texas, Louisiana, and Alabama. He also has worked in Alaska, the Canadian Arctic weather station, and as a forecaster with the U.S. Air Force. He holds a B.S. in meteorology from Florida State University.
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