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Concerns and Their Impact on Offshore Design and Operations: Were Hurricanes Ivan 2004 and Katrina and Rita 2005 100-Year Events or a Result of Moving Over a Warm Loop Current?

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Abstract

The return of strong Gulf of Mexico hurricanes has resulted in a re-examination of the 100 year return periods over the Gulf oil leases. Hurricane Ivan in 2004 went through Atwater Valley, Mississippi Canyon, Viosca Knoll, and Main Pass. Hurricane Katrina in 2005 traveled across Lund, Atwater Valley, Mississippi Canyon, West Delta, South Pass, Main Pass and Breton Sound. Hurricane Rita in 2005 moved across Walker Ridge, Green Canyon, Vermilion, East Cameron, and West Cameron. Do these three devastating hurricanes change the 100 year recurrence values for these oil leases, or were they 200 or 300 year events? Are there more and stronger Gulf oil leases hurricanes over the leases closest to the warm loop current?

ESRI's ArcView Software was used to plot all of the hurricanes since 1900 which had maximum sustained winds greater than 99 knots. The area of the oil leases was defined as an area north of 25N and west of 85W. The software was also used to find all of the tropical cyclones that have moved through the following oil leases: Atwater Valley, Mississippi Canyon, Walker Ridge, and East Cameron. The results of these plots were used to estimate the 100 year return period for each of these oil leases.

If you review the major hurricanes that have moved through the Gulf Oil leases since 1900, you will find that there have been 37 hurricanes which have caused maximum sustained winds of 100 knots or more. There have been 7 years when there was more than one major hurricane over the leases: 1909, 1915, 1916, 1975, 1985 and 2005. The highest observed maximum sustained wind over the Gulf oil leases as defined above was 165 knots during Hurricane Camille on August 17, 1969 as it tracked through Mississippi Canyon,

Main Pass and Chandeleur Sound. The next highest observed maximum sustained wind of 155 knots was during Hurricane Allen on August 9, 1980 south of Alaminos Canyon and Keathley Canyon. Hurricane Katrina in 2005 and Hurricane Carla in 1961 both had maximum sustained winds of 150 knots. Hurricane Rita in 2005, Hurricane Beulah in 1967 and Hurricane Ethel in 1960 all had maximum sustained winds of 140 knots. In any year the Gulf of Mexico oil leases have a 36% chance of experiencing an intense hurricane with maximum sustained winds of 100 knots or more, since there have been 37 out of the last 104 years with hurricanes with winds of 100 knot or greater winds.

There seem to be more and stronger hurricanes over the oil leases closest to the warm loop current. The paper will give the 100 year values for maximum sustained winds based on 104 years [1900-2003] and 54 years [1950-2003] for Atwater Valley, Mississippi Canyon, Walker Ridge, and East Cameron. The author will then show how Hurricane Ivan in 2004, Hurricane Katrina in 2005 and Hurricane Rita in 2005 rate.

INTRODUCTION:

Designing offshore structures requires a method of estimating the maximum forces, moments, tensions, and stresses on various structural components as well as the entire structure. The Hurricane Seasons of 2004 and 2005 with the movement of Hurricane Ivan, Katrina and Rita through the offshore oil leases put the accepted design conditions to the test. It has been recommended that instead of using the 104 year periods from 1900 to 2003 one should use the 54 year period from 1950 to 2005 since the offshore winds and pressures in cyclones prior to 1950 are suspect as satellite and other observations were not available.

A problem with using such a short period [50 to 54 years] for hurricanes in the Gulf of Mexico is that one risks under estimating or over estimating the extreme conditions in some of the leases since cycles of hurricane activity are possibly for longer periods than a 50 year period. The author demonstrates that there are 30 year cycles of active and inactive periods of major hurricane activity in the Gulf of Mexico. This could cause the estimate of the 100 year value to be either over or under estimated over many of the oil leases.