GULF OF MEXICO HURRICANES
PAST – PRESENT – FUTURE

MTS

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www.wxresearch.com
Using GIS to determine if there are more hurricanes.

1900-1959 Hurricanes East of 45W

1960-2006 Hurricanes East of 45W
Using GIS to determine if there are more hurricanes.

Conclusion: Since satellite use started after 1960, more hurricanes must be the result of better tracking of hurricanes by satellites.
Major Hurricane History

Data from 1949 in the Pacific, from 1851 in the Atlantic
## Central Pressure/Wind Relationship

960 mbs – Sustained winds of 100 knots – 115 mph – Cat 3
945 mbs – Sustained winds of 115 knots – 132 mph – Cat 4
931 mbs – Sustained winds of 128 knots – 147 mph – Cat 4
922 mbs – Sustained winds of 135 knots – 155 mph – Cat 4
914 mbs – Sustained winds of 142 knots – 163 mph – Cat 5

### Table 1. Saffir/Simpson Hurricane Scale, modified from Simpson (1974).

<table>
<thead>
<tr>
<th>Scale Number (Category)</th>
<th>Winds (Mph)</th>
<th>Typical characteristics of hurricanes by category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Millibars)</td>
<td>(Inches)</td>
</tr>
<tr>
<td>1</td>
<td>74-95</td>
<td>&gt; 979</td>
</tr>
<tr>
<td>2</td>
<td>96-110</td>
<td>965-979</td>
</tr>
<tr>
<td>3</td>
<td>111-130</td>
<td>945-964</td>
</tr>
<tr>
<td>4</td>
<td>131-155</td>
<td>920-944</td>
</tr>
<tr>
<td>5</td>
<td>&gt; 155</td>
<td>&lt; 920</td>
</tr>
</tbody>
</table>
Hurricane Ike

Just prior to landfall:

Minimum central pressure was 952 mbs

Maximum sustained winds were 95 knots gusting to 115 knots

Radius of Hurricane force winds was 110 nm

Radius of Tropical Storm force winds was 240 nm

A pressure of 952 mbs usually indicates sustained winds of 108 knots.
Atlantic Basin Category 5 Hurricanes

31 Category 5 Hurricanes have occurred since 1900

Lowest Pressure –
Hurricane Wilma 2005 - 882 mbs

Highest maximum sustained winds –
Hurricane Allen 1980 - 165 Knots

Most Category 5 Hurricanes per season
2005 – (Four) – Emily, Katrina, Rita and Wilma
2007 – (Two) – Dean and Felix
1961 – (Two) – Carla and Hattie
1960 – (Two) – Donna and Ethel
## Hurricane Strikes on the United States
### Mainland 1851-2007

<table>
<thead>
<tr>
<th>Category</th>
<th>Strikes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>73</td>
</tr>
<tr>
<td>1</td>
<td>111</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>280</strong></td>
</tr>
<tr>
<td><strong>Major</strong></td>
<td><strong>96</strong></td>
</tr>
</tbody>
</table>

**Category 3 or higher at landfall**
GULF OF MEXICO HURRICANES – Orange are Category 3 hurricanes, Red are Category 4 hurricanes and Purple are Category 5 hurricanes.
NOTABLE CATEGORY 5 GOM LEASE HURRICANES

165 kts  Hurricane Camille  1969
155 kts  Hurricane Allen  1980
155 kts  Hurricane Rita  2005
150 kts  Hurricane Carla  1961
150 kts  Hurricane Katrina  2005
140 kts  Hurricane Beulah  1967
140 kts  Hurricane Ethel  1960
135 kts  Hurricane Betsy  1965
The Oil Industry moved offshore into the Gulf of Mexico after World War II in 1947.

Figure 2.4. Existing offshore structures on the Gulf of Mexico OCS, 1947-1997.
Harris and Knox [1947] “In 100 feet of water, waves will probably seldom if ever, exceed 20 feet in height.” Decks thus should be placed “20 feet above the still water line”. 
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During the 1949 Freeport Hurricane, a platform with a 26 foot depth suffered damages while a platform with a 33 foot deck showed no damage.
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More than 1,000 platforms had been built in the Gulf by the mid 60’s.
Until 1964, no major hurricanes moved over the areas of high concentrations of offshore operations. Three hurricanes Hilda (1964), Betsy (1965) and Camille (1969) demonstrated that the risks presented by major hurricanes was gravely underestimated.
Hurricane Hilda 1964 – 100 year Storm
   13 platforms destroyed and 5 more damaged beyond repair
Hurricane Betsy 1965 – 100 Year Storm
   8 platforms destroyed and damaged others
Hurricane Camille 1969 – 400 year Storm
   Shell measured waves of 70 to 75 feet.
Under development

The Weather Research Center [WRC]

Catastrophic Model for Hurricanes
WRC Meteorologists

-Computed the Maximum sustained windfields for the Category 4 and 5 hurricanes over the GOM Leases
-The windfields were then plotted using GIS Software
-Visually showing
Size Matters!
Size of the windfield can change during the life of a hurricane. The windfield of Rita expanded as the storm weakened from a Category 5 hurricane.
<table>
<thead>
<tr>
<th>STORM</th>
<th>Platform Destroy</th>
<th>Damage</th>
<th>Toppled Satellites</th>
<th>Platform Rigs Destroy</th>
<th>Structural Damage</th>
<th>MODUS Damage</th>
<th>Broken mooring</th>
<th>Jack Ups Capsized Damage</th>
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</thead>
<tbody>
<tr>
<td>Ike 2008</td>
<td>52</td>
<td>62</td>
<td></td>
<td>1</td>
<td></td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Rita 2005</td>
<td>66</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td>13</td>
<td>8</td>
<td></td>
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<tr>
<td>Katrina 2005</td>
<td>47</td>
<td>23</td>
<td></td>
<td>3</td>
<td></td>
<td>11</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Ivan 2004</td>
<td>7</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lili 2002</td>
<td>7</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Andrew 1992</td>
<td>13</td>
<td>21</td>
<td></td>
<td></td>
<td>105</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Significant Waves

- 28 - 34 Feet
- 35 - 43 Feet
- 44 - 49 Feet
- 50 - 59 Feet
- 60 - 70 Feet

Hurricane Rita 2005 Significant Waves
GOM Damage

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Significant Waves

Hurricane Ivan 2004 Significant Waves
GOM Damage

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The result of this research will be the definition of The WRC Hurricane Damage Potential Scale [HDP Scale]
Hurricane Force Winds for Gustav and Ike 2008
Gustav and Ike Significant Waves
Red - 28 to 34 feet
Purple 35 to 43 feet
Lite Purple - 44 to 50 feet
Hurricane Ike 2005 Significant Waves
GOM Damage

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1851 to 1899

15 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]
1851 to 1899

15 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

2 years when there were 2 or more intense hurricanes - 1856 and 1886
1851 to 1899

15 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

2 years when there were 2 or more intense hurricanes - 1856 and 1886

There were 13 years with intense hurricanes in these 50 years giving a probability of experiencing an intense hurricane over the GOM oil leases of 26% in any year.
1900 to 1949

17 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]
1900 to 1949

17 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

3 years when there were 2 or more intense hurricanes - 1909, 1915 and 1916
1900 to 1949

17 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

3 years when there were 2 or more intense hurricanes - 1909, 1915 and 1916

There were 14 years with intense hurricanes in these 50 years giving a probability of experiencing an intense hurricane over the GOM oil leases of 28% in any year.
1950 to 1999

19 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases
[North of 25W and West of 85W]
1950 to 1999

19 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

1 year when there were 2 or more intense hurricanes - 1985
1950 to 1999

19 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

1 year when there were 2 or more intense hurricanes - 1985

There were 18 years with intense hurricanes in these 50 years giving a probability of experiencing an intense hurricane over the GOM oil leases of 36% in any year.
2000 to 2007

5 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]
2000 to 2007

5 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

1 year when there were 2 or more intense hurricanes - 2005
1900 to 2007

41 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]
1900 to 2007

41 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

5 Years when there were 2 or more intense hurricanes - 1909, 1915, 1916, 1985 and 2005
1900 to 2007

41 Intense hurricanes [maximum sustained winds of 100 knots or greater] over the GOM Oil leases [North of 25W and West of 85W]

5 Years when there were 2 or more intense hurricanes - 1909, 1915, 1916, 1985 and 2005

There were 35 years with intense hurricanes in these 108 years giving a probability of experiencing an intense hurricane over the GOM oil leases of 32% in any year.
Comparing the last three 50 year periods: 1851 to 1899, 1900 to 1949 and 1950 to 1999

Assuming that the maximum sustained 1 minute winds in hurricanes prior to 1950 were underestimated, 15 knots was added to the 1 minute winds. The number of Category 4 and 5 cyclones over the Gulf of Mexico Oil Lease is:

<table>
<thead>
<tr>
<th></th>
<th>1851-1899</th>
<th>1900-1949</th>
<th>1950-1999</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+15 kts</td>
<td>+10 kts</td>
<td>+15 kts</td>
</tr>
<tr>
<td>CAT 5</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>CAT 4</td>
<td>13</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>CAT 3</td>
<td>17</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>33</td>
<td>28</td>
<td>27</td>
</tr>
</tbody>
</table>
Number of Intense Hurricanes by Decade over the Gulf of Mexico Oil Leases
GOM OIL LEASE INTENSE HURRICANES BY DECADE AND 30 YEAR CYCLES

<table>
<thead>
<tr>
<th>CYCLE 1</th>
<th>CYCLE 2</th>
<th>CYCLE 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1851-1860</td>
<td>1861-1870</td>
<td>1871-1880</td>
</tr>
<tr>
<td>1881-1890</td>
<td>1891-1900</td>
<td>1901-1910</td>
</tr>
<tr>
<td>1911-1920</td>
<td>1921-1930</td>
<td>1931-1940</td>
</tr>
<tr>
<td>2001-2010</td>
<td></td>
<td></td>
</tr>
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</table>

USING 30 YEAR AVERAGES THE FORECAST OF INTENSE GOM HURRICANES

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>2001-2010</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>2011-2020</td>
<td>1.8</td>
<td>2021-2030</td>
</tr>
<tr>
<td>2021-2030</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ACTIVE INACTIVE ACTIVE