J5.5 HURRICANE IKE: USER RESPONSE AND EFFECTIVENESS OF NWS FORECAST PRODUCTS

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1. Introduction

On September 13, 2008, Hurricane Ike made landfall near Galveston, TX as a Category 2 hurricane on the Saffir-Simpson hurricane wind scale. In its wake, Ike produced damage totals close to $20 billion dollars (Berg, 2009). This makes Ike the fourth costliest hurricane to affect the United States; behind only, Hurricane Katrina (2005), Andrew (1992), and Wilma (2005) (Berg, 2009). Although Ike's maximum sustained winds of 110 mph were just under major hurricane criteria (115 mph) at landfall, the hurricane produced a devastating storm surge of up to 17ft in Cameron Parish, Louisiana, and around 15ft along the Bolivar peninsula on the upper Texas coast (Berg, 2009). Ike's large storm surge, both in areal coverage and magnitude, was primarily due to its massive wind field, which was comparable to that of Hurricane Ivan (2004). Water levels rose well above normal more than a day in advance of landfall and caused significant coastal flooding as early as 18 hours before landfall. Because Ike was only a Category 2 hurricane, many Texas coastal residents underestimated the storm surge threat from Ike. It is this underestimation that led to the formation of this study. Therefore, this study investigates user response and preferences, as well as the effectiveness of National Weather Service (NWS) Hurricane Local Statements (HLS) and storm surge products.

2. Data collection and methodology

In order to investigate user response to Hurricane Ike information, an initial 14 question general survey was developed. This survey was designed to assess how residents receive tropical cyclone information, and what they consider to be important decision making information. A subsequent and more detailed survey focused on determining the effectiveness of the NWS HLS and storm surge products. The general survey was disseminated at five different local hurricane workshops, with 500 people responding. These hurricane workshops were open to the general public and had the purpose of informing and preparing citizens ahead of the upcoming 2009 hurricane season. The primary hurricane workshop occurred in Houston, TX, with over 1,500 people in attendance last year. Some other notable city hurricane workshops included: Pasadena, Seabrook, Galveston, and Bayou Vista. A subsequent product survey was made available on the Internet with 81 surveys submitted for evaluation. Example HLS and storm surge products (both textual and graphical) were shown with 21 questions focusing on rating the effectiveness of these products.

After all of the responses were collected from both surveys, they were analyzed using Microsoft Access and Excel. An important distinction was made between inland and coastal residents as these groups have different considerations when there is a threat of a significant storm surge. The boundary to delineate between these two groups was drawn along the border between zip-zones B and C on the Houston-Galveston zip-zone evacuate map (Fig. 1).

3. Results and Conclusions

For the general survey, 67% of the respondents were from inland areas, and 25% were from coastal areas, with 8% unknown. For inland residents, the highest concern from an approaching hurricane was wind damage (41%). This choice was selected from the 4 major hurricane threats: flooding from rainfall, storm surge, tornadoes, and wind damage. For coastal residents, the primary concern was equally distributed between storm surge (34%) and wind damage (32%). Concerning how respondents receive hurricane information, television was the leading response (38%), followed by radio (23%) and the Internet (20%). Although different choices were made available, TV weather reporters was found to be the leading source of information from other surveys after Hurricanes Rita and Ike (Stein, 2009). Therefore, it is clear that television remains a critical media outlet for hurricane information. Concerning evacuation decisions for Ike, the Saffir-Simpson hurricane wind scale category led the way as a deciding factor (22%), followed closely by location (20%), and recommendations from local officials (20%). This result is concerning because the Saffir-Simpson category only accounts for the magnitude of the maximum winds and does not take into account other important considerations such as the size of the storm, and the explicit storm surge threat. It does appear from the results of this question, that many use multiple sources of information when making an evacuation decision. This is in agreement with a previous survey after Hurricane Rita threatened the Texas gulf coast, where it was stated that survey results indicated that many people evaluate risk for themselves and in doing so they utilized multiple sources of information (Zhang, 2007).

Two results from our general survey that indicate more education efforts are needed for

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residents to make well informed decisions are: (1) 70% of all respondents did not know the elevation of their residence, and (2) the NWS HLS product is not well known by the general public, as 66% responded that they were not aware of this product. Therefore, detailed storm surge information provided in an HLS is likely only reaching most residents indirectly. It is also apparent that storm surge forecasts need to be in the form of inundation since most respondents did not know their elevation.

Results from the product survey include a slight preference for a graphical inundation storm surge forecast (49% gave the highest rating) as compared to a surge relative to MSL forecast (43%). It should be noted that when all effectiveness ratings were considered (1-5), both products were equally rated very high, with over 70% rating the products as a 4 or a 5. The graphical HLS also received a slightly higher rating than the textual HLS (35% vs. 32%) concerning the percentage giving the product the highest rating of a 5. However, when respondents were given graphical and textual information together as an option, 74% liked this combination. This is an encouraging result, because the NWS currently utilizes a graphical HLS with text available as a mouse over option available on weather forecast offices' websites.

5. References

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Figure 1. Inland/ Coastal Boundary of Respondents