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Memo: response to the reviewer's comments concerning "Predicting the Texas Windstorm Insurance Association claim payout of commercial buildings from Hurricane Ike"

Issue	Response/Correction
Reviewer #1	
Please find attached the pdf file with comments	The authors would like to first thank the editor who allowed us opportunities to revise and resubmit the paper. We also sincerely appreciate the anonymous reviewer who provided thorough reviews and valuable comments to help us improve the manuscript. We strongly believe that in the revision we have fully addressed all the reviewer's comments and concerns and carefully revised the manuscript based on the feedback we have received. Please see the following sections below responding to each reviewer's comments. Thank you again.
p3814, ln 17-19, "Accordingly, the models and findings may possibly provide vital references for government agencies, emergency planners, and insurance companies hoping to predict hurricane damage." trying?	We revised the sentence as follows: *"Accordingly, the models and findings may possibly provide vital references for government agencies, emergency planners to establish the hurricane damage mitigation strategies. In addition, insurance companies could utilize the model to predict hurricane damage."*
p3814, ln 21, "1.1 Escating demand for natural diaster damage prediction" several typo errors	Thank you for your comment. We revised the title. *"1.1 Escalating demand for natural disaster damage prediction"*
p3815, ln 4-5, "This estimate does not cover indirect costs such as insurance compensation from the US government or indirect costs to companies and individuals." These are not indirect costs. Do you know the correct definition of indirect costs?	As the reviewer points out, there are not indirect costs. We revised the sentence as follows: *"This estimate does not cover other losses such as insurance compensation from the US government or insured losses to companies and individuals."*
p3815, ln 7, Not only has the US suffered significant losses, it also has spent a tremendous amount of money on restoration: $150 billion between 2004 and 2005 alone (Pielke Jr. et al., 2008).	"…Not only ~~has~~ the US suffered significant losses, it also has spent a tremendous amount of money…"
p3815, ln 14-15, "Although damage is inescapable, creating damage prediction models can provide a key solution for decreasing these losses." It is possible to reduce damage so it is not inescapable.	As the reviewer points out, it is possible to reduce damage so it is not inescapable. Therefore, we revised the sentence. ~~"Although damage is inescapable, creating damage prediction models can provide a key solution for decreasing these losses."~~

	"...Hence, creating damage prediction models can provide a key solution for decreasing these losses and mitigation plans...."
p3815, ln 18-22, "Nevertheless, their research has not comprehensively identified the interrelationships among the vulnerabilities, natural disasters, and economic losses of commercial buildings. Consequently, this research will fill this gap in hurricane damage prediction using Hurricane Ike in Texas's coastal counties as a case study." 1) What this sentence means? Did your works failed in its objectives? 2) Is this a consequence of what you state before?	We revised the sentence as follows: *"However, the previous studies have not identified the interrelationships among the vulnerabilities, natural disasters, and economic losses of commercial buildings. Therefore, a comprehensive study is necessary to identify the interrelationships. To address this issue, this study will fill this gap in hurricane damage prediction using Hurricane Ike in Texas's coastal counties as a case study"*
p3815, ln 26, "Hurricane Ike was a critical disaster which began on 1 September 2008 and ended on 14 September 2008; the storm struck the Bahamas, Cuba, and the Gulf Coast of the US (i.e. Florida, Louisiana, and Texas), in that order."	"…the storm struck the Bahamas, Cuba, and the Gulf Coast of the US (i.e. Florida, Louisiana, and Texas), in ~~that~~ this order…."
p3815, ln 26, "…After that, the storm arrived at Cuba and the Bahamas as…"	"…After that, the storm arrived ~~at~~ in Cuba and the Bahamas as…"
p3816, ln 1-3, "By the time Ike hit the coastlines of Louisiana and Texas, it had become a Category 2 storm with a central pressure of 950mb and a maximum wind speed of 95 knots (Berg, 2009)."	"…By the time Ike hit the coastlines of Louisiana and Texas, it had ~~become~~ became a Category 2 storm with a central pressure of 950mb and a maximum wind speed of 95 knots (Berg, 2009)…"
p3816, ln 13-19, "The Texas Windstorm Insurance Association (TWIA) was established in 1971 to shield insurance policy holders in Texas coastal counties from unexpected meteorological catastrophes. This association is made up of a group of windstorm insurance companies that cover direct loss of property, indirect loss of property or income, and casualties suffered in the Texas coastal counties. TWIA not only provides hurricane protection and training for agents and policy holders, but also receives insurance premiums and makes payments for acceptable claims."	As the reviewer points out, this part was inserted in 1.1 Escalating demand for natural disaster damage prediction. Reference （TWIA, 2012) Texas Windstorm Insurance Association Board of Directors′ Biennial Report to the Commissioner of Insurance House Committee on Insurance Senate Committee on Business and Commerce and Sunset Advisory Commission http://www.twia.org/Portals/0/Documents/TWIA%20Biennial%20Report%20December%202012.pdf, 2012

reference is missing. I would better connect this part to the rest of the text.	
p3816, ln 21-28, "The objectives of this research are: (1) to identify the relationships among hurricane damage loss, vulnerability indicators, and hurricane indicators for commercial buildings, (2) to predict hurricane damage by vulnerability factors and hurricane indicators, based on insured loss payments for the Texas coastal counties, (3) to decide the magnitude and significance of the indicators, and (4) to create a methodical process using Geographical Information Systems (GIS) to assess other times and states in order to predict hurricane damage. These factors provide the framework necessary to identifying the spatial distribution of financial hurricane loss." Did you fulfill all this goals?	The preliminary objective of this research is to predict hurricane damage by vulnerability factors and hurricane indicators, based on insured loss payments for the Texas coastal counties. To achieve the objective, we identified the relationships among hurricane damage loss, vulnerability indicators, and hurricane indicators for commercial buildings, and decided the magnitude and significance of the indicators. We believe that all goals are achieved in this research.
p3816, ln 27-28, "These factors provide the framework necessary to identifying the spatial distribution of financial hurricane loss."	"These factors provide the framework necessary to identify~~ing~~ the spatial distribution of financial hurricane loss."
p3817, ln 3-6, "Third, geographical vulnerabilities, building environment vulnerabilities, and hurricane indicators were combined…" do you means built areas?	The mean of the building environment vulnerabilities is that the vulnerability refers to a building that has itself. For instance, a building's age and floor area are might be related to the vulnerability of the hurricane damage.
p3816, ln 6-7, "Finally, regression models were generated and analyzed." one model? how many models?	As reviewer points out, we revised the sentence as follows: *"Finally, a regression model were generated and analyzed."* .
p3817, ln 8-9, "…After the creation of the data, a multiple linear regression method was applied to analyze the data, which resulted in two global equations that allowed for an understanding of the relationship between the dependent and independent variables…"	"…After the creation of the data, a multiple linear regression ~~method~~ was applied to analyze the data, which resulted in two global equations that allowed ~~for~~ an understanding of the relationship between the dependent and independent variables…"
p3818, ln 8-9, "The financial damages suffered by Texas coastal counties are shown in Fig. 3." Claims payout (Fig. 3) do not represent the total damage. moreover, fig. 3 describes properties. do they include only	We revised the sentence as follows: *"The claim payouts are as shown in Fig. 3."* The damages include only commercial properties. We added to the word in the picture description of Fig.3. *"Distribution of TWIA commercial property claim payouts"*

commercial properties? this has to be specify also in the picture descriptions.	
p3818, ln 13-16, "The total claim payout was $450 518 330 and the total number of claims was 4150. Galveston County received the most damage from Hurricane Ike in terms of both dollar amount of damage ($255 333 818; 56.68%) and the number of claims (1807; 43.54 %)." these values refers only to commercial buildings?	As reviewer points out, the values perfectly refer only to commercial buildings.
p3818, ln 21-24, In this study, 500 of the total damage reports (4150) were randomly selected as samples. The sample size needed to be larger than 370, which is determined when the size of a population is 5000 with a 95% confidence level and a ±5% precision level (Israel, 1992). how did you selected them? absolutely randomly? what is the distribution in space of the selected samples?	We selected them absolutely randomly. There are no any criteria for the sampling. The descriptive statistics for the samples are that Min : 850 Max : 97,500 Mean : 11,761 Std. Deviation : 12,247
p3819, ln 3-5, Geographical vulnerability is defined as a substantial exposure to peril (Cutter, 1996). Since vulnerability is an essential feature of natural disasters, it can be explained by biophysical risks such as elevation and other geographical impacts (Cutter et al., 2003)." vulnerability and exposure are not the same. *Exposure*: the values (in this case buildings) that are present at the location involved; – *Vulnerability*: the lack or loss of resistance to damaging/destructive forces. please find a better reference.	As reviewer points out, we revised the sentence as follows: *"…Geographical vulnerability is defined as a substantial <u>risk</u> to peril. Since vulnerability is an essential feature of natural disasters, it can be explained by biophysical risks such as elevation and other geographical impacts (Cutter,2003)…"*
p3819, ln 6-9, "In general, geographical features differ depending on the location, and the level and amount of exposure to natural hazards can also be diverse." how did you consider elevation in your analysis?	We considered the elevation as an indicator. However, the Hurricane Surge Zone and the elevation were highly correlated each other. Hence, we choose one which is better statistically significant with the damage.
p3819, ln 7-11,	

"For instance, the Federal Emergency Management Agency (FEMA) created the FEMA Q3 Flood Data study in an effort to understand the risks of hurricanes and floods." reference?	Reference Q3 flood data specifications https://msc.fema.gov/webapp/wcs/stores/mapstore/docs/q3spec.pdf
p3819, ln 10-13, "The zones show the potential risk of flood in each defined area. As shown in Table 2, there are three types of flood zones. Zone A is an area anticipated to have a 1 %, or larger chance to flood in any given year." how are these levels calculated? are water levels and elevations considered? when considering coastal flood risk they are needed (see for example Slosh model).	They decided the level depending on the annual chance of flooding; Zone A : An area inundated by 100-year flooding Zone X : An area that is determined to be outside the 100- and 500-year floodplains. Zone X500 : An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1square mile (Reference:https://msc.fema.gov/webapp/wcs/stores/mapstore/docs/q3spec.pdf) FEMA created the map for identifying floodplain areas. They are not considered water level and elevation, but we believe that the two things are highly correlated with the annual chance of flooding.
p3819, ln 15-16, "Although floods can occur anywhere, flood prone areas exist. Based on historical flood data, geographical vulnerability presents flood prone areas." what does it mean?	We revised the sentence as follows: "Although floods can occur anywhere. However, we can define flood prone areas based on historical flood data, geographical vulnerability."
p3819, ln 15-16, "Each scaled area is predicted to be influenced by a defined category called the Hurricane Surge Zone. This scale not only presents hurricane risks in scaled areas, but also compares the geographical vulnerability of each area." when using surge height, it is necessary to define a damage function, since the buildings are not completely destroyed. The damage depends on water level. it would not calculate wind speed and surge height in the same table, since they are related to different parameters.	The damage records from TWIA were mixed the storm and flood damages. The reason is that TWIA counted the damages as one. Although, the wind speed and surge height are different parameters, we considered in a damage model. Hurricane Surge Zones are defined based on sustained wind speeds and surge heights. The number of each scaled area predicts the influence of the sustained wind speed and the surge height at that location. The water level is highly correlated with Hurricane Surge Zones in the correlation test, and we decided to Hurricane Surge Zones. The reason is that Hurricane Surge Zones are more statically significant than water level. Because, the purpose of this study is to make a statistic damage function to predict the TWIA claim payout.
p3820, ln 1-4, "Accordingly, geographical vulnerability indicators should be considered in hurricane damage prediction. FEMA Flood	The purpose of this study is to predict hurricane damage. Hence, it is important that identify vulnerability indicators which are related to the damage.

Zones, Hurricane Surge Zones, and distance from water should all be integrated into the hurricane damage prediction model as geographical vulnerability indicators." I do not understand what is included in these indicators. Do FEMA flood zones already consider distance from water? Are they based on a hydrological model? Is a damage function included?	We believe the three indicators are independent each other and are highly related to the damage. However, three indicators are not highly correlated each other. FEMA flood zones level depending on the annual chance of flooding. Hurricane surge zones are decided based on sustained wind speed and surge height. The distance from water is measured by the distance from property centroid to closest shoreline. Hence, we believe that each variable is a good indicator to predict the hurricanes damages.
p3820, ln 9-17, On a large scale, for instance, water-related infrastructure systems such as dams, seawalls, and dikes are constructed in flood and hurricane-prone areas, and play a prominent role in preventing damage from natural disasters (Brody et al., 2008). On a smaller scale, the building features of each building such as building age, building floor area, and appraised value of the building are important components of natural exposure (Chock, 2005; Dehring and Halek, 2006; Highfield et al., 2010; Khanduri and Morrow, 2003). reducing vulnerability?	We believe that dams, seawalls, and dikes would reduce damages from hurricanes and floods. The building features of each building such as building age, building floor area, and appraised value of the building would be good indicators to measure the vulnerability of the building.
p3821, ln 1-5, "Every year, hurricanes impact large areas and frequently affect both people and property. Numerous parameters of hurricanes can act as key factors contributing to the amount of damage sustained, such as frequency, magnitude, and others. For example, wind parameters play a key role in hurricane damage and cause related disasters such as floods, hurricane surges, and landslides." I would better formulate this sentence and add a reference.	We revised the sentence as follows: *"Every year, hurricanes impact large areas and frequently affect both people and property. Numerous parameters of hurricanes can act as key factors contributing to the amount of damage sustained, such as frequency, magnitude, and others (Hamid 2010; Huang 2001). For example, Max. sustained winds play a key role in hurricane damage and cause related disasters such as floods, hurricane surges, and landslides (Burton 2010).* <u>Reference</u> Burton, C. G. (2010). "Social vulnerability and hurricane impact modeling." Natural Hazards Review, 11, 58. Huang, Z., D. V. Rosowsky, and P. R. Sparks. (2001) "Hurricane simulation techniques for the evaluation of wind-speeds and expected insurance losses." Journal of wind engineering and industrial aerodynamics 89(7), 605-617.
p3822, ln 19-22, "PDL = β_0 + $\beta_1 \cdot$ Wind_Speed + $\beta_2 \cdot$	The damage records from TWIA were recorded the storm and flood damages. The reason is that TWIA considered same damage. That is the reason we considered in a damage

Side_Right + $\beta_3 \cdot$ Age + $\beta_4 \cdot$ Area + $\beta_5 \cdot$ Imp_Value + $\beta_6 \cdot$ FEMA_Zones + $\beta_7 \cdot$ Surge_Zones+ $\beta_9 \cdot$ Dist_Shore." I am not sure that these are all independent variables. The formula has to better explicate. Wind and flood related variables has to be separated. Since the study considers coastal zones, I would like to understand how water levels are included and if a damage function has been calculated. Moreover you should refer to other models in literature.	model, even if, the wind speed and surge height are different parameters. The purpose of this study is to predict hurricane damages. Therefore, it is important to identify vulnerability indicators which are related to the damage. We believe the all indicators are independent each other and are highly related to the damages. The results of correlation analysis show that the all indicators are not highly correlated each other. Hence, we believe that each variable is a good indicator to predict the hurricanes damages. The sentence added in p3815, 18 line. *"Burton explored the relationships among hurricane losses, social factors, and hurricane parameters in the Mississippi coastal counties of Jackson, Harrison, and Hancock (Burton 2010). Highfield et al. identified the relationship between vulnerability variables and hurricane damage on Galveston Island and the Bolivar Peninsula (Highfield et al. 2010). Huang et al. surveyed hurricane and insurance losses in South Carolina using wind speeds (Highfield et al. 2001)."* Reference Sparks, P. R., Schiff, S., and Reinhold, T. (1994). "Wind damage to envelopes of houses and consequent insurance losses." Journal of Wind Engineering and Industrial Aerodynamics, 53(2), 145-155. Huang, Z., D. V. Rosowsky, and P. R. Sparks. (2001) "Hurricane simulation techniques for the evaluation of wind-speeds and expected insurance losses." Journal of wind engineering and industrial aerodynamics 89(7), 605-617.
p3822, ln 23-24, p3823, ln 1-8, "This study utilized GIS to combine, manage, and create spatial information for a statistical examination. As a computerized database management system, GIS facilitates spatial data to store, capture, control, make, analyze, and present geographically referenced data (Bill, 1994). Generally, spatial data presents the figure and position of the data	~~This study utilized GIS to combine, manage, and create spatial information for a statistical examination. As a computerized database management system, GIS facilitates spatial data to store, capture, control, make, analyze, and present geographically referenced data (Bill, 1994). Generally, spatial data presents the figure and position of the data by layers using raster data, digitally imaged grid data, and vector data, based on polygons, points, and lines, respectively (Hellawell et al., 2001). The primary benefit of using this application is in creating a new layer of data by~~

by layers using raster data, digitally imaged grid data, and vector data, based on polygons, points, and lines, respectively (Hellawell et al., 2001). The primary benefit of using this application is in creating a new layer of data by using various useful functions such as merge, clip, union, intersection, join, buffer, overlay, and dissolve. Particularly, this research produced a new layer of data by using the overlay function to combine diverse sorts of obtained data from the related organizations, based on their locations." A general definition of GIS is not needed.	~~using various useful functions such as merge, clip, union, intersection, join, buffer, overlay, and dissolve. Particularly, this research produced a new layer of data by using the overlay function to combine diverse sorts of obtained data from the related organizations, based on their locations.~~
p3823, ln 15-17, "Geographical vulnerability indicators, building environment vulnerability indicators, and hurricane indicators were joined with the TWIA claim payouts by joining the data of with ArcGIS." where is the final indicators list?	The sentence revised as follows: *"Geographical vulnerability indicators (max. sustained wind speed; right side of the hurricane track), building environment vulnerability indicators (building age; building floor area; appraised value of building), and hurricane indicators (FEMA flood zones; Hurricane surge zones; distance from shoreline) were joined with the TWIA claim payouts by joining the data of with ArcGIS."*
p3823, ln 16-17, "Table 6 displays the summary of the correlation results with the TWIA claim payout and the ordinal variables." I am not sure this is a linear relationship.	As the reviewer points out, the nonlinear regression can be more powerful alternative to linear regression but there are a few drawbacks. 1) The effect each predictor has on the response can be less intuitive to understand. 2) P-values are impossible to calculate for the predictors 3) Confidence interval may or may not be calculable. In this respect, the linear regression is used in this study. In addition, the purpose of this study is to identify the interrelationships among the indicators and TWIA claim payouts using a statistical method. Hence, we adopted the linear regression to analyze the data, which resulted in a global equation that allowed for an understanding of the relationship between dependent and independent variables. Reference Zim Frost (2011), http://blog.minitab.com/blog/adventures-in-statistics/linear-or-nonlinear-regression-that-is-the-question
p3826, ln 11-15, "The seven significant predictors include: (1) max. sustained wind speed, (2) the right side of the hurricane track, (3) building age, (4) building floor area, (5) appraised	In this sentence, we would like to explain what the indicators are significant to predict the claim payout. Hence, we did not list the damage function.

value of the building, (6) hurricane surge zone, and (7) distance from the property centroid to the shoreline; each were identified as able to predict the transformed claim payout." damage function is missing.	The detailed damage function is explained by the equation 1 and 2.
p3826, ln 15-18, "The FEMA flood zones, however, were eliminated because the *P* value was higher than 0.10. The Variance Inflation Factor (VIF) ranged from 1.130 to 2.208. <u>These values verify that the individual predictors have no multicollinearity, which means that the predictors are not correlated with each other.</u>" therefore how did you considered surge zones?	The FEMA flood zones are represented by ordinal variables ranging from 0 to 3. The variable 1 signifies that the area is categorized in the FEMA flood zone X. The variable 2 signifies that the area is categorized in the FEMA flood zone X500. The variable 3 signifies that the area is categorized in the FEMA flood zone A. We revised the sentence as follows: *"…These values verify that the individual predictors are not highly correlated with each other…"*
p3829, ln 20-22, "Therefore, we recognized from the distribution of the damages that Galveston county is the most hurricane-prone area in the Texas coastal counties." this is not one of your conclusion.	As reviewer points out, we revised the sentence as follows: *"From the records, we recognized from the distribution of the damages that Galveston county is the most damaged county by Hurricane Ike in the Texas coastal counties."*
p3831, ln 5-8, "Hurricane surge zone has a negative relationship with the TWIA claim payout, which means that if the hurricane surge zone number increases, the claim payout decreases. This result verifies that the hurricane surge zone is a useful indicator for predicting hurricane damage." how it is calculated?	We revised the sentence as follows: *"The hurricane surge zones are represented by ordinal variables ranging from 0 to 5. We conducted Spearman's Correlation Analysis to exam the relationship between the claim payout and the hurricane surge zone. The results showed that hurricane surge zones have significant relationships with the claim payout. The sign of the coefficients was negative."*
p3844, Fig.1., hazard indicators	Hazard indicator → Hazard indicator<u>s</u>