

Stochastic Premium Calculation for Lightning Damage Insurance Based on Long-term Revenue Prediction

Bilge TUTAK¹

INTRODUCTION

In this study, the main objective is to determine the optimum insurance premium, related to the damage of the lightning strike. Probability of lightning strike associated with elevation is the key parameter for determination of this premium. Also a Monte Carlo simulation with 1000 houses and 1000 year interval is conducted for long-term cost-profit analysis of insurance companies.

METHODOLOGY

As first part, for ease of use and better understanding of insurance customers, aGUI(Graphical user interface) is implemented. After selecting the appropriate dataset for customer, user has to load the limits of the region in order to enter a valid (lat,lon) pair. By this valid (lat,lon) pair, which represents the house location of the customer, the elevation of that (lat,lon) pair is calculated by interpolation with the closest 4 points. As the elevation of the house is calculated, assuming a constant height of 10m for every house, the probability of lightning strike between these elevations is computed from the initial dataset. By means of this probability obtained from elevation a very important parameter is being obtained. Also the customer has to choose a range for his/her house value, in order to compute the appropriate premium. At the final step of GUI, premiums associated with damage stages are computed and shown to the customer as 5 damage type of insurances. (0-20), (20-40), (40-60), (60-80), (80-100) % damage coverages occur in the table shown to the customer.

As for the Monte Carlo simulation, random (lat,lon) pairs for 1000 houses are generated and every house is assumed to be insured at time $t=0$. Also a random price for every house is generated. 202 lightning per year for 1000 year, with random (lat,lon) pair is generated for strike location. The elevation of each house with the same interpolation method as in the first part is calculated. Using the elevations probabilities of lightning strike for each house is also

determined. Using the generated house prices, a premium is calculated for each house. As the final part of MC simulation, we look for a lightning strike at a house location. For the financial analysis of if a lightning hits a house, we subtract the amount paid to that customer from the budget of the insurance company. All the insurance paid by ths customers is added to the budget of the insurance company.

RESULTS

The random parameters included in the model are the lightning strike location and the damage of the lightning. By using the previously recorded datasets, the elevation for a given location is found by interpolation. Teh premiums for different damage stages due to a lightning can be seen by the customer for choosing the economically best fitting insurance premium and type. Also by using the monte carlo simulation, insurance companies can determine the long-term costs and profits stochastically.

CONCLUSION

The Monte Carlo simulation and the premium calculator are depend on a previously records. If the national lightning detection system in US is considered, the long-term analysis according to this detection system and the available record, insurance companies can concentrate on and determine the optimum profit based on the optimum insurance premiums. Also by using the premium calculator, a customer can easily understand why he/she pays that amount of money.

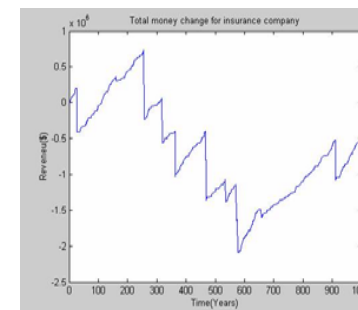


Figure 1 Long-term analysis results

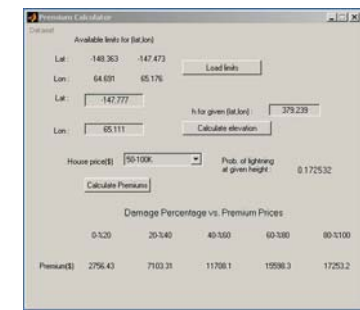


Figure 2 Premium Calculator GUI

¹ Stud. Asst., Bogazici Univ., Civ. Engg., Istanbul, Turkey. tutak@boun.edu.tr