

Scenario Analysis on the Susceptibility of Cantilan DepEd Elementary Schools to Storm Surge

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Abstract

This study used geographic information systems (GIS) and remote sensing as a tool in simulating the storm surge in Cantilan, Surigao del Sur. Storm surge shapefile were downloaded at the website of Nationwide Operational Assessment of Hazards (Project NOAH) which is the flagship disaster mitigation program of the Department of Science and Technology (DOST) of the Philippine government. Digital elevation mapping, image processing, and overlaying of schools geographic coordinates were conducted in QGIS 3.16 Software. Results of the study revealed that at SSA 1 or 2 meters height of possible storm surge, five (5) elementary schools of Cantilan are susceptible. At SSA 2, with a height of 3 meters, there are four (4) schools susceptible at 3 meters height. When it comes to SSA 3, ten (10) schools are susceptible to 4 meters height of water level. Moreover, all the elementary schools located at the coastal area are susceptible to storm surge SSA 4 with a height of 5 meters..

1. Introduction

Disasters set back the investments made by the education sector. The most terrible consequences are deaths and injuries in schools. There are schools that are unusable because of damages, their prolonged use as shelters, having unsafe access, the loss of equipment and materials, or lack of teachers are some effects of hazards which can hinder children to achieve their goals (Victoria, 2016). From SY 2009-2010 to 2013-2014, top three hazard exposures of schools are tropical cyclones, flood and earthquake. In some cases, schools experience more than one hazard at one point in time. It should also be noted that schools are as well exposed to human-induced hazards like armed conflict and fire at 7% and 2%, respectively (DepEd EBEIS; 2009 – 2013).

In 2013, typhoon Haiyan hit the Philippines and extensively damaged the Eastern Visayas region where about 50%, or 840 of 1,665 schools were affected; 6,018 classrooms were partially damaged; and 1,567 classrooms were totally destroyed. Furthermore, the recent tropical storm, Basyang, that hit Surigao del Sur last February 13, 2018, drew urgent concern especially in the areas of Cantilan and Carrascal where a flash flood swept a few houses, destroyed several hundred of hectares of rice land and caused death, the initial count of 5 people including children and injured many others. When the typhoon landed in Cortes, Surigao del Sur, Cantilan-Parang Road was no longer passable and classes were suspended. On July 13, 2019 a magnitude 5.5 earthquake about 7-km away from Carrascal, Surigao del Sur, caused 25 persons reported to have been injured due to the earthquake. Several houses and ten (10) infrastructures and Government facilities were reported to have sustained slight to major damages. In addition, the Municipalities of Carmen, Lanuza, Madrid, Cantilan and Carrascal has the highest reported of damage infrastructures including school facilities (NDRMMC, 2019).

These natural hazards does not only hinder school operations but threaten the lives of students, teachers and personnel. Shaw, Ronan, et.al., (2011) maintain that education and awareness inoculates a “culture of disaster

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preparedness” in students and empowers them to make the right decisions should they encounter such situations in the future. Muttarak and Pothisiri (2014) found that formal education can increase an individual’s preparedness for disasters and thus, reduce vulnerability to natural hazards. Hence, this paper, aims to shed light to help school administrators in the early planning and safety measures in their respective schools.

1.1. Study Area

The Municipality of Cantilan is located in a coastal area on the eastern part of Mindanao. Cantilan is a 2nd class municipality in the province of Surigao del Sur, Philippines. According to the 2015 census, it has a population of 31,492 people. The municipality is politically subdivided into 17 barangays. The municipality has a history of its first natural hazard which affects the whole “Daan-Lungsod”, the old town which was the settlement in the early 1700's. On October 15, 1856, a "hurricane from the North which turned over west and south at 4:00 and 10:00 am, increased to such intensity that tidal waves changed the whole town into a sea.

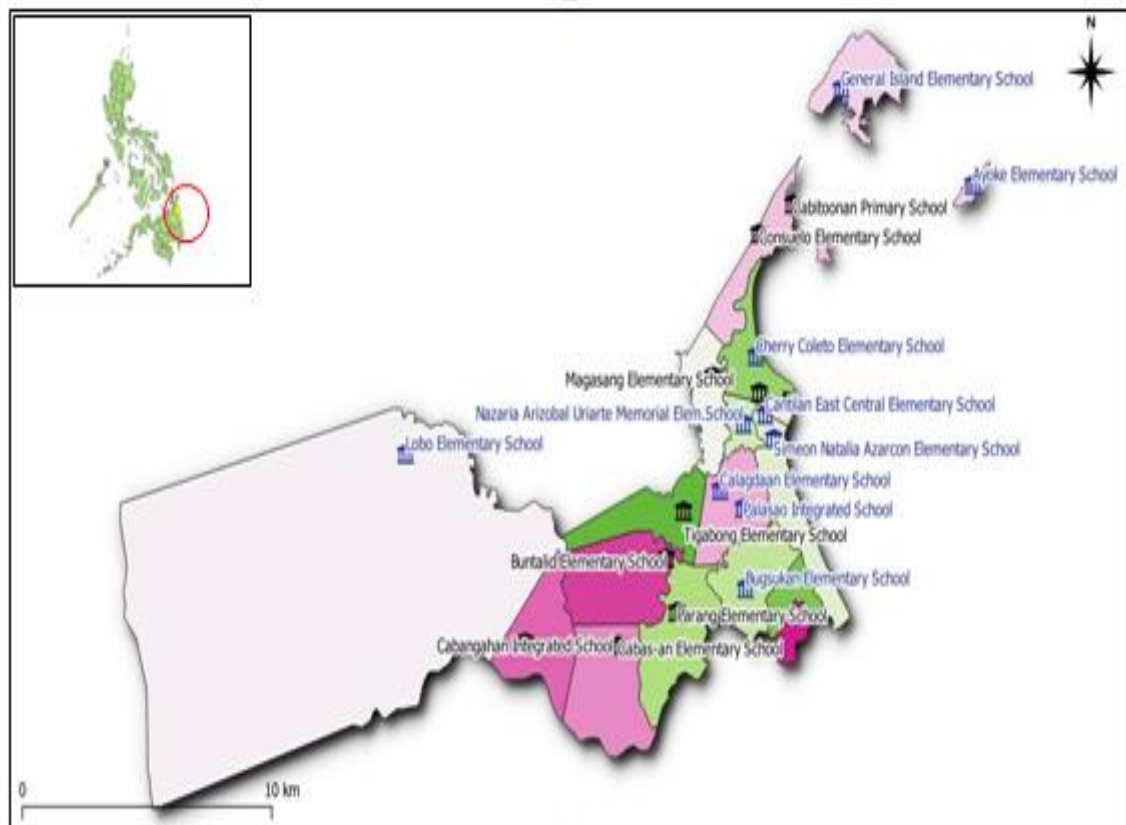


Figure 1. Geographic Distribution of Respondent School

As seen from Figure 1, a total of nineteen (19) public elementary schools were respondents of the study. In Cantilan 1 District, a total of nine (9) elementary schools were included as research respondents, while in Cantilan 2, a total of ten (10) elementary schools were included as research respondents respectively.

2. Materials and Methods

Storm surge shapefile were downloaded at the website of Nationwide Operational Assessment of Hazards (Project NOAH) which is the flagship disaster mitigation program of the Department of Science and Technology (DOST) of the Philippine government. Digital elevation mapping, image processing, and overlaying of schools geographic coordinates were conducted in QGIS 3.16 Software. Figure 2. shows the process of computing the distance and azimuth of each DepEd schools to the nearest potential storm surge level that the school is prone to. Azimuth (A) is the angle of the line measured from the vertical line (0 degree) to the direction of the school to the nearest storm surge, measuring azimuth is shown in Figure 2.

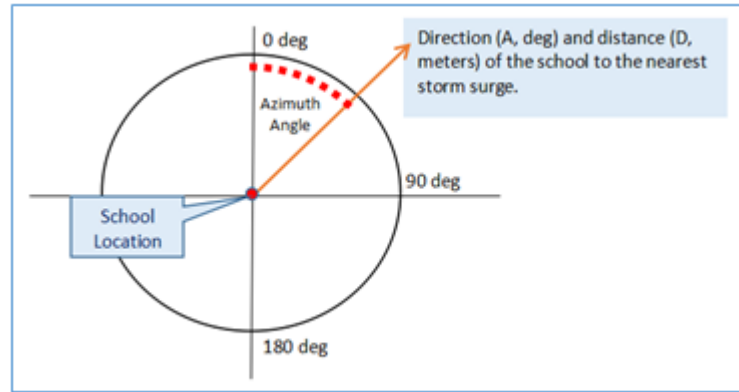


Figure 2. Azimuth and Distance Measurement

3. Results and Discussion

A storm surge is a rise in sea level that occurs during tropical cyclones, intense storms also known as typhoons or hurricanes. The storms produce strong winds that push the water into shore, which can lead to flooding. This makes storm surges very dangerous for coastal regions (Japan Meteorological Agency, 2014). A storm surge is primarily caused by the relationship between the winds and the ocean's surface. The water level rises where the winds are strongest. In addition, water is pushed in the direction the winds are blowing (National Oceanic and Atmospheric Administration, 2014). The specific factors affecting the height of the generated surge are the following: the storm's central pressure, wind intensity, translational forward speed, storm radius, storm approach angle, coastline geometry, and the local bathymetry (National Oceanic and Atmospheric Administration, National Weather Service, National Hurricane Center, 2014).

3.1. Storm Surge SSA -1 (2 meters) Simulation in Cantilan and DepEd Elementary Schools

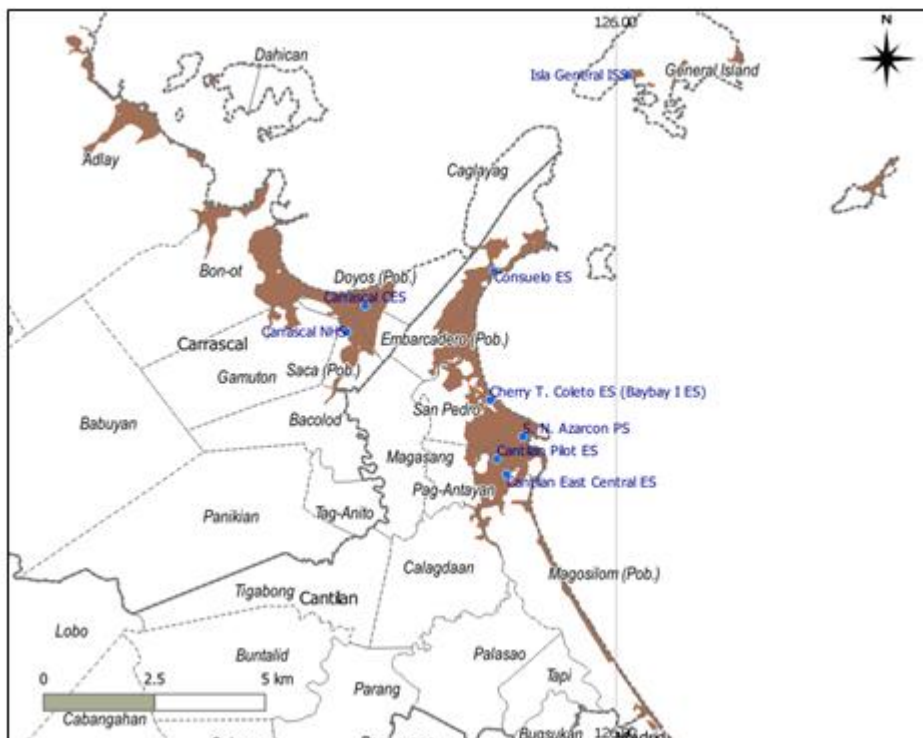


Figure 3. Simulation of Storm Surge at SSA 1 (2 meters height) in Cantilan Elementary Schools

As seen in Figure 3 above, results of the study revealed that at SSA 1 or 2 meters height of possible storm surge, five (5) elementary schools of Cantilan (2 for district 1 and 3 for district 2) are susceptible. These schools are; (1) Consuelo Elementary School, (2) Cherry T. Coletto Elementary School, (3) Simeon Natalia Azarcon Primary School, (4) Cantilan Pilot Elementary School, and (5) Cantilan East Central Elementary School. These

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schools, are located in low-lying areas and proximate to bodies of water. They are highly susceptible to SSA-1 of possible storm surge.

3.2. Storm Surge SSA -2 (3 meters) Simulation in Cantilan and DepEd Elementary Schools

Figure 4 below, reveals that all the schools susceptible to SSA 1 at a height of 2 meters storm surge are covered in SSA 2, with a height of 3 meters. Schools susceptible at 3 meters height includes; (1) Magasang Elementary School, (2) Nazaria Arizobal Uriarte Memorial Elementary School, (3) Bugsukan Elementary School and (4) General Island Elementary School. Among the identified schools, one (1) for district 1 and three (3) for district 2 are covered in SSA-2 (with 3 meters height).

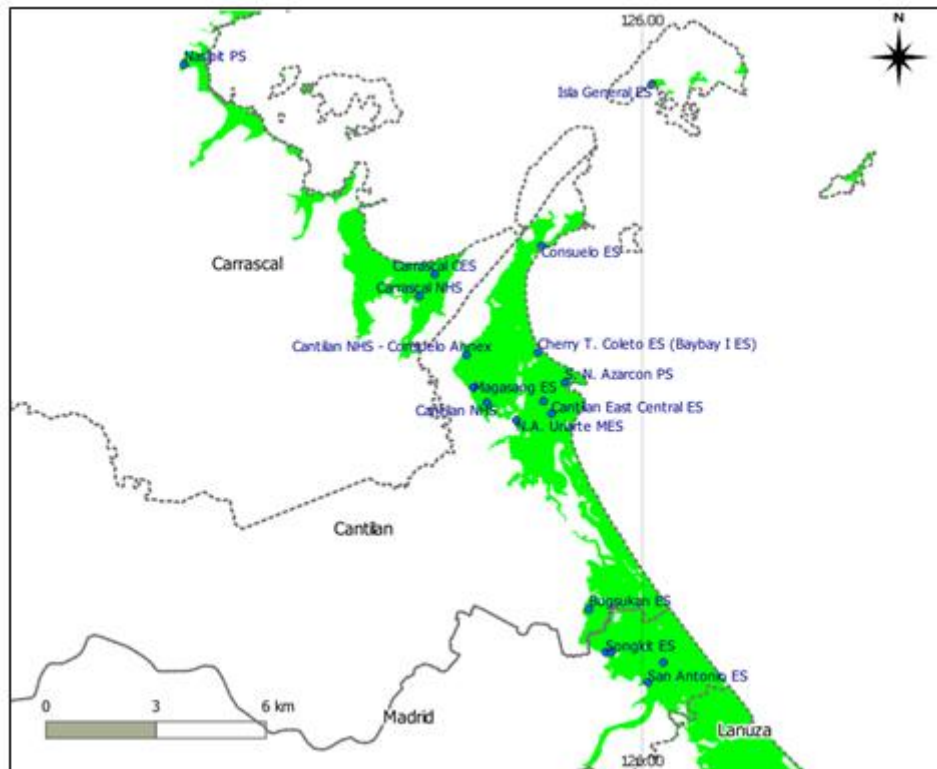


Figure 4. Simulation of Storm Surge at SSA 2 (3 meters height) in Cantilan Elementary Schools

3.3. Storm Surge SSA -3 (4 meters) Simulation in Cantilan and DepEd Elementary Schools

Figure 4 below, shows all the schools susceptible to SSA 3 or storm surge at 4 meters height. Elementary schools in Cantilan susceptible to SSA 3 includes; (1) Consuelo Elementary School, (2) Cherry T. Coletto Elementary School, (3) Simeon Natalia Azarcon Primary School, (4) Cantilan Pilot Elementary School, and (5) Cantilan East Central Elementary School, (6) Magasang Elementary School, (7) Nazaria Arizobal Uriarte Memorial Elementary School, (8) Bugsukan Elementary School (9) General Island Elementary School and (10) Ayoke Elementary School. Among the two (2) Districts in Cantilan Elementary School, seven (7) schools in district 2 are susceptible to SSA 3 (4 meters height) and three (3) schools in district 1. Based in the result on topography and elevation, most of the schools identified are situated in low-lying areas near the shore.

3.4 Storm Surge SSA -4 (5 meters) Simulation in Cantilan and DepEd Elementary Schools

Figure 6 below, shows that all the elementary schools located at the coastal area are susceptible to storm surge SSA 4 with a height of 5 meters.

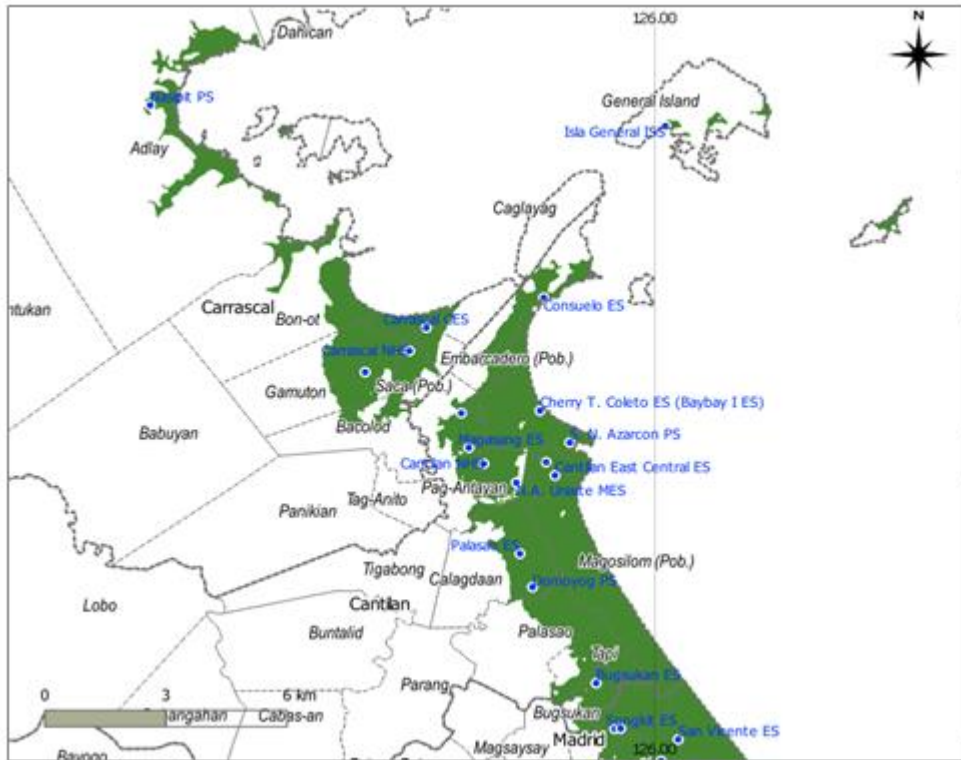


Figure 5. Simulation of Storm Surge at SSA 3 (4 meters height) in Cantilan Elementary Schools

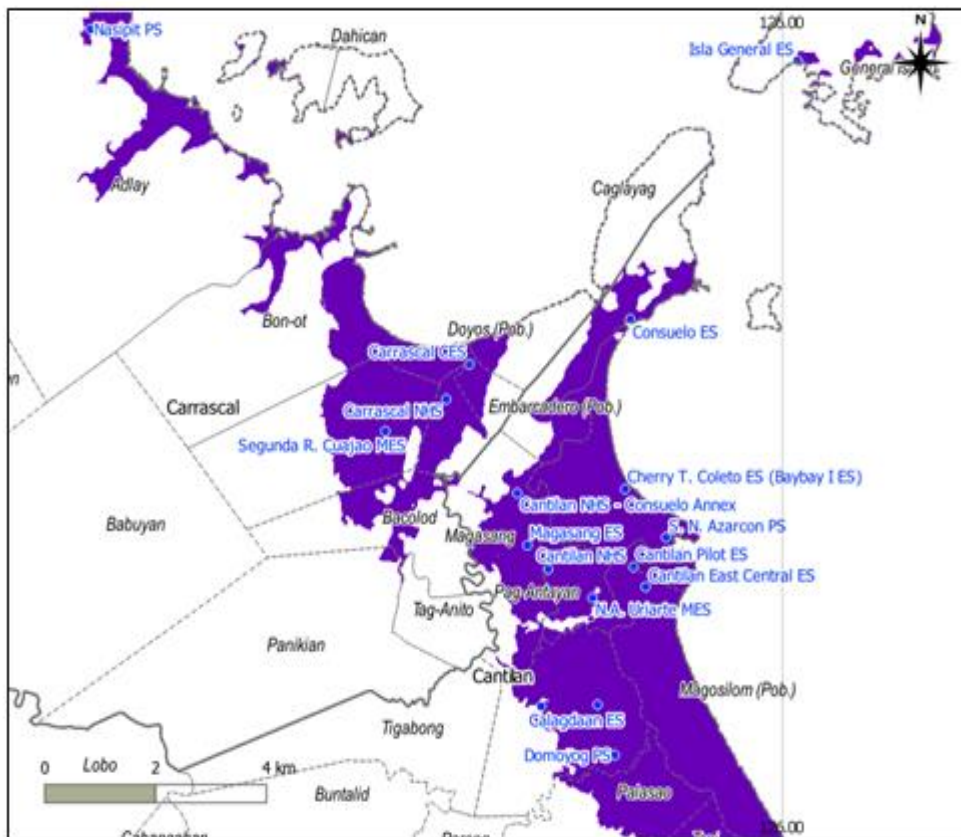


Figure 6. Simulation of Storm Surge at SSA 4 (5 meters height) in Cantilan Elementary Schools

4. Conclusion

In the context of school disaster management, natural hazards does not only hinder school operations but threaten the lives of students, teachers and personnel. Surigao del Sur, being a coastal province is prone to flooding, storm surge and typhoon which challenges the DepEd school administrators ,policy and decision makers to create a “culture of disaster preparedness”. The susceptibility of DepEd schools to storm surge is not merely a geographic issue, but it is a call for a a localized and contextualized risk assessment for schools to identify potential hazards, and improved coordination among LGU’s to response and mitigate disasters.

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