UNIVERSITY OF GENOVA

Department of Earth, Environment and Life Sciences

Master's degree course in
Hydrography and Oceanography

Sea level rise evaluation by remotely sensed data and its impacts on urban areas

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Summary

The coastline is a dynamic environment. Coastal change can be extremely slow or extremely rapid. Most coastal areas lack continuous data collection or monitoring, making the development of appropriate coastal morphological models difficult. Coastal cities, as an intersection of land and sea, play a crucial role in the national and global economy. Sea level is a very sensitive index of climate change and variability and, responds to change in several components of the climate system. The number of residents living in low-elevation coastal zones (areas less than 10 m above mean sea level) has also been growing. This trend is estimated to continue faster than in inland areas. Similarly, the population of major ports exposed to 100-year coastal floods is predicted to increase due to socioeconomic development in the coming decades. According to the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC), by 2100 the coastal cities will experience both sea-level rises (ranging from 0.28 m to 0.98 m) and much more intense storm surges. Such storm flooding occasionally causes significant physical damage, loss of life, and economic losses. Examples of such incidents include Hurricane and Typhoon events. Even life inland is threatened because rising seas can contaminate soil and groundwater with salt. Predicting how high the sea levels will rise is difficult. However, it is an issue that must be carefully monitored so coastal areas can be prepared for the consequences. In the following, the reasons and future developments for the probabilistic sea-level rise hazard and its impacts are discussed in depth. The thesis aimed to increase public awareness about the phenomenon and make choices wisely. It is interesting how the physical event evaluates.

The availability of remotely sensed data helps to monitor the desired areas and create prediction maps. Furthermore, open data sources and software availability plaid a big role. Digital elevation models are used to create inundation models of study areas. Open-source software such as ESA SNAP and QGIS play a crucial role in the examination of data and results.

Throughout the analysis, has been done for these study areas as New York City and Iloilo city shown that the steepness and slope degrees differ. NYC and its surroundings have slope levels from 0 to 31 %, and the same analysis shows that Iloilo city and its surrounding slope levels are goes from 0-21 %. But, in the urbanized areas, cities itself has way more flat slope levels. The steepness of the area shows the predicted flood event possibility of the water inundation levels on land. The exposure and hazard layer combination analysis by the Qgis InaSAFE plugin represented the amount of possible affected population, road, and buildings within the regions. The analysis of the impact of sea-level rise(1-10 meters) layers and exposure of the population layers were combined. There are some interesting findings, accordingly in a future sea-level rise of 1 meter, Iloilo city will be the cause of population displacement more than New York City. More in detail, 1.2 times more affected people are expected. This can be very significant for poor countries. The reconstruction and relocation actions should take place now, not only in the examined areas but also in other countries. Some projects are taking place now, or others are planned to be done in near future in study areas. The Climate change actions in the Philippines are aims to develop the resilience of natural resource management. The USA is involved in climate change actions and sea-level rise events through flood barriers for New York City and building restorative reconstructions in many other cities.

Adaptation measures range from physical structures such as sea walls where they still are cost-effective to the development/revision of land use plans using risk maps as the basis, to early warning systems for severe weather, including advisories on storm surge probabilities, as well as planning for and developing resilient livelihoods where traditional fishing/ agriculture are no longer viable.