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FLOODING MODEL AS THE ANALYSIS OF THE SEA LEVEL INCREASE AS A RESULT OF GLOBAL WARMING IN COASTAL AREA IN LAMPUNG

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ABSTRACT

The melting of ice layers, as a direct impact on global warming, is indicated by a lesser thickness of ice layers is specifically causing an increase in the sea level. Lampung, as a province that has an ecosystem of regional coast, can be estimated to submerge. Flood modelling can be done to know the estimated flood range. The model of the flooded region is taken from Shuttle Radar Topography Mission (SRTM) data, which is normalized to get the visualization of Digital Elevation Model (DEM). The purpose of this research is to know the estimated region of provincial coast of Lampung that is going to be flooded because of the rise the sea surface. This research uses flood inundation technique that uses one of the GIS mapping software. The result can be used as consideration to achieve policy in the building of regional coast. The regions that are flooded based on the scenario of the raising of two and three-meter surface sea level are East Lampung Regency, West Lampung Regency, South Lampung Regency, Tanggamus Regency, Pesawaran Regency, and Bandar Lampung.

Keywords : *Increase On The Sea Surface, Flood Inundation, Flood Range*

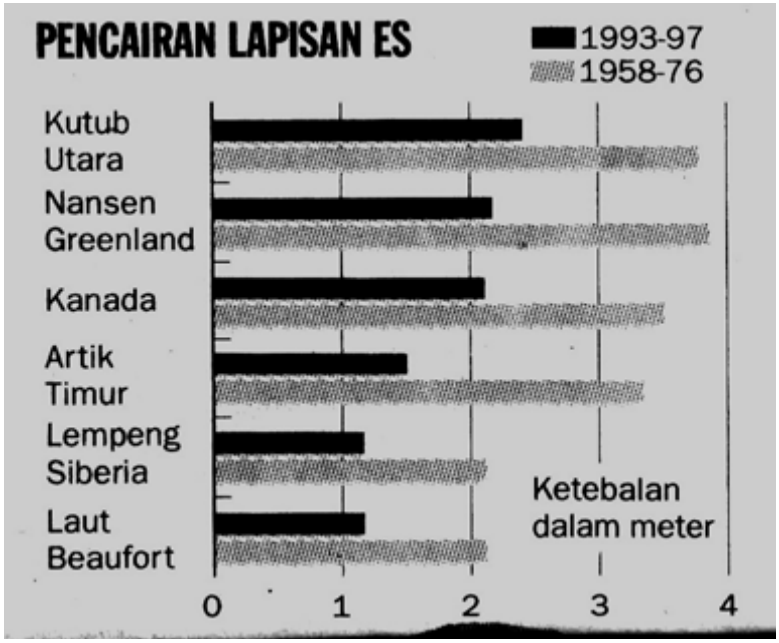
INTRODUCTION

Global warming has become an imprehensive issue for the recent years. The sun's radiation that continually increasing gives direct impact to the earth's increasing temperature. The earth's increasing temperature is caused by "Green House Effect". The rising amount of gasses emission level such as Carbon Dioxide (CO2), the increasing use of air conditioner that cause CFC gas erupts the air, methane (CH4), and the effect of dinitro dioxide (N2O).

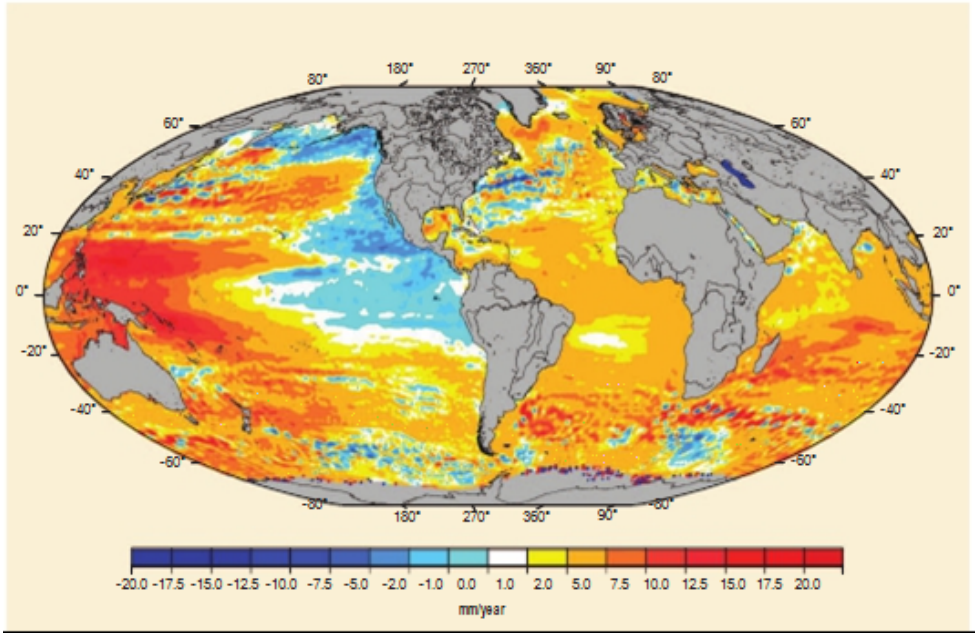
Variations of the sun's radiation that combined with various volcano activities impact the increasing temperature since the pre-industry era until the year 1950 (Hegerl, 2007). These variations of the sun's radiation is also causing the global increasing average temperature between the year 1900 – 2000 with 45% - 50% of earth's temperature escalation and between 1980 – 2000 contributing 25% - 35% of it.

The intensive temperature increase is even occuring in the polar region, which is famous as the coldest area, more than any place on earth. The direct impact felt by the society is the increase of sea level that makes some mainland sink.

The estimation of the increasing amount of water as the result of global warming, added by the wind system that is not spreading as expected and the season's movement that is improper cause the extreme climate changes. (Mangunjaya, 2008).



Picture 1. Data of ice sheet thickness shrinkage, from several locations
Source : Suwedi, 2005

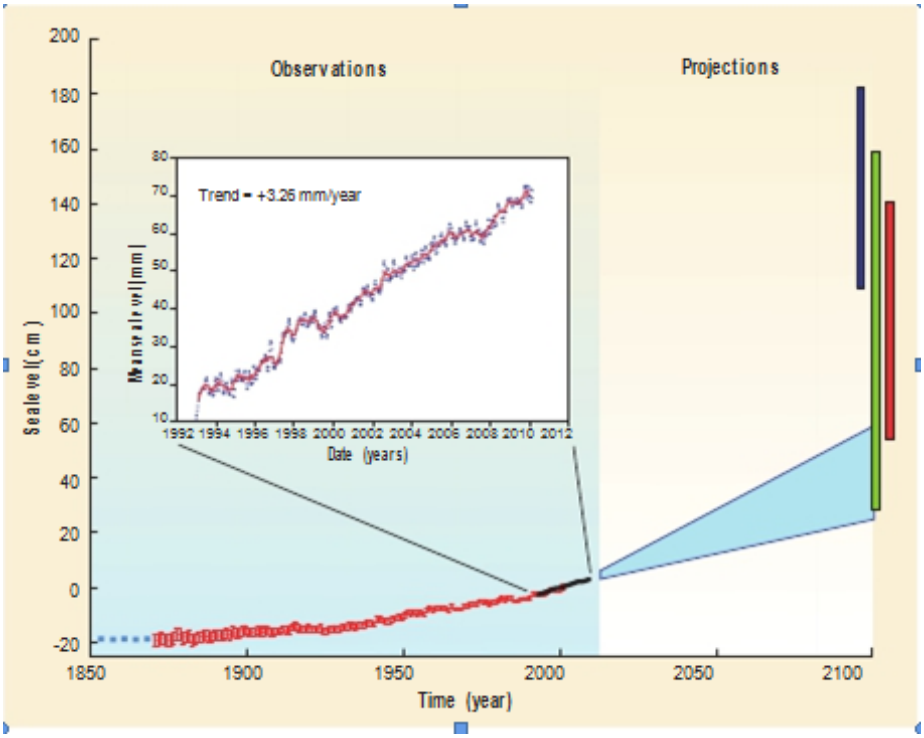


Picture 2. Sea level changing based on the altimetry satellite data

Another impact of the global warming is the changes of pattern/cycle and precipitation intensity in many areas. This aspect will influence the clean water supplies, ground water, surface water, and capacitor reservoir. (Suhedi, 2005). Some regions will have over water supplies, and the other will experience drought.

According to the IPCC (*Intergovernmental Panel on Climate Change)* (2007), the earth's temperature will increase for about 2.2°C up to 4.9°C in the year 2100

or are in 3.3°C rising in a state of under the *business as usual*. This globally increasing temperature will trigger the increase of sea level for about 0.09 meters until 0.88 meters at approximately 4.9mm/year increase within 100 years. (IPCC, 2001).



Picture 3. The globally sea level increase in the 20 and 21 century
Source : Robert J.(2010)

As one of the surrounded-by-coast province, and directly adjacent to the Indian ocean and Laut Jawa, Lampung has the potentials that are submerged by the rising sea level. Lampung is the first gate to enter many districts in Sumatera, thus, if the access to Sunda Strait is hampered, it can turn down all of the economic sectors in Sumatera. These turned-down economic sectors is caused by the submerging area, and can impact the hampered delivery of goods and services from Java and vice versa.

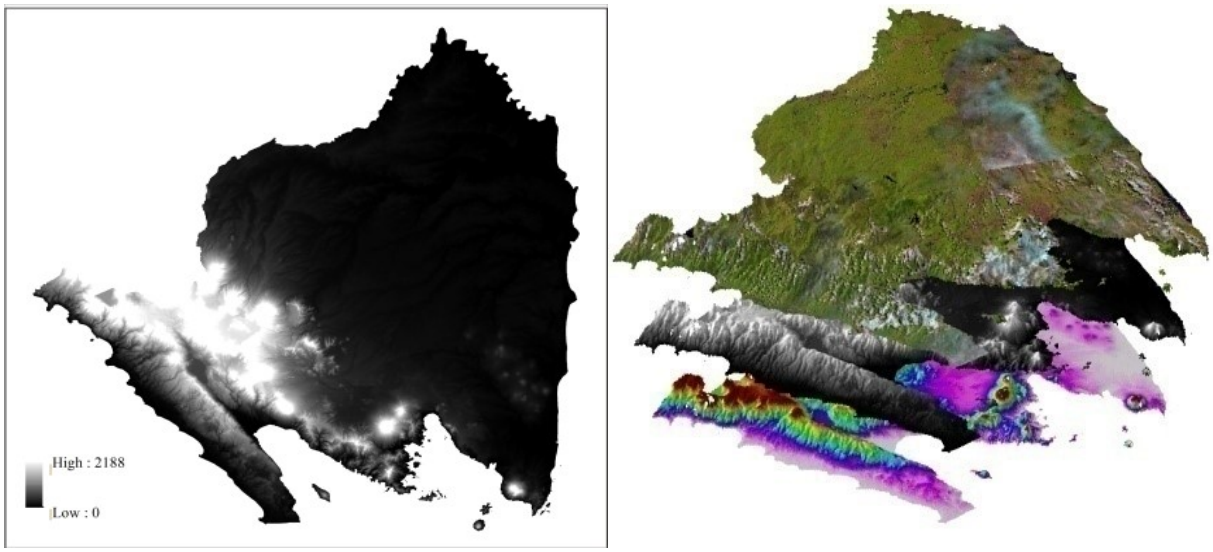
MATERIAL AND METHODS

The estimated areas that are affected by the flood, that caused by the rising sea level are identified with experimental method, where it is possible to manipulate the variables then observe the cause and effect. This method controls the variables, so that the external variables can be omitted. Models are done using the *GIS mapping software* to estimate the regions that might submerged by the flood. The data used is the secondary data.

This research will observe the entire Lampung's coast areas. The floodwater mapping is using the digital data in raster format from *Shuttle Radar Topography Mission* (SRTM) that will be converted to *Digital Elevation Model* (DEM) data. The *flood inundation animation* method in *GIS mapping software* is used to estimate the submerged areas

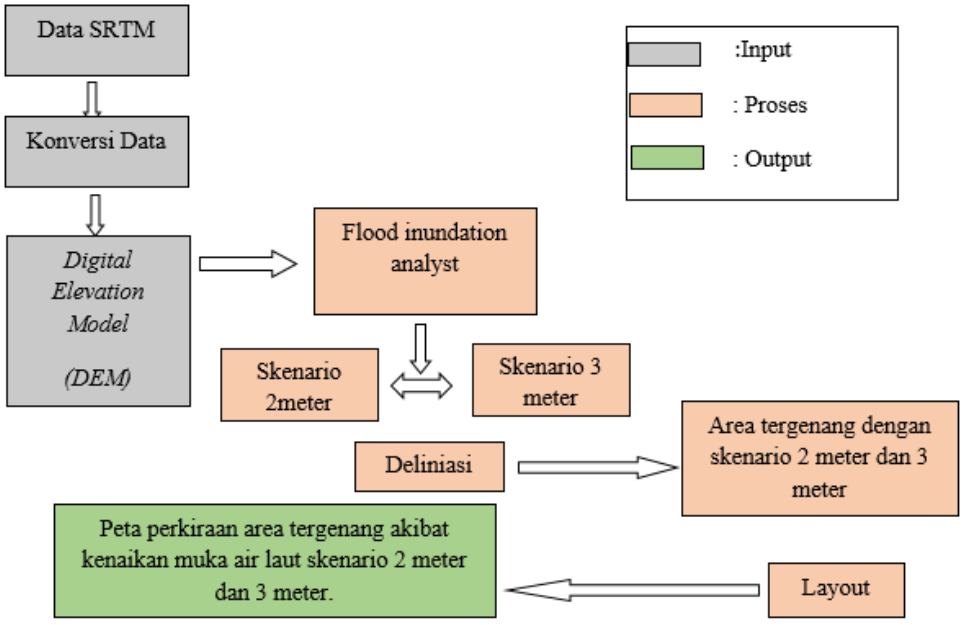
The *Shuttle Radar Topography Mission* (SRTM) data is given the visualization of the earth's topography according to the

increasing amount in each pixel. The sea level's increasing scenario that is used is two and three meter. The estimation of submerged-areas is known using the previous data analysis.



Picture 5. SRTM Data(Left) Digital Elevation Model(Right)

There are two steps in this spatial analysis research which are floodwater visualization in the area and the submerged area estimation using certain variables. Further research flow can be seen in the flowing diagram below.



Picture 6. Research flowing diagram

RESULTS

The digital elevation model is the visualization from topographic or the surface level of land according to the relief in each pixel. This research is using the *Shuttle Radar Topography Mission* (SRTM) data that is converted to the digital elevation model with 30 meters for each pixel. The digital elevation model for Lampung shows in five classes. The color black indicates lower regions and white represents highlands.

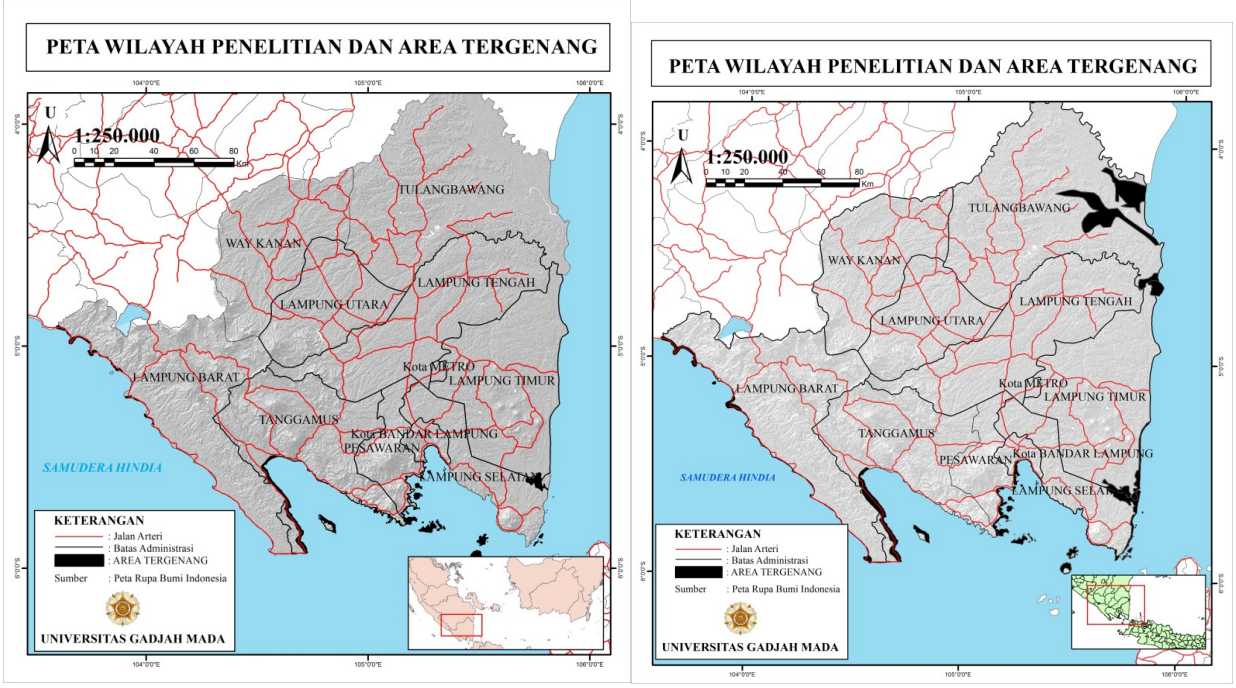
The digital elevation model from Lampung coast area that is visually consists of various topography. The east coast area shows flat relief, while the south and west coast show weaving relief, dominated by hills.

Picture 6. Research Area (Lampung's coast area)

Flood formulation scenario as the analysis of sea level increase is simulated according to data from *Shuttle Radar Topography Mission* (SRTM) that already processed and become the *Digital Elevation Model* (DEM). Data processing that is done with *flood inundation animation* method gives the various floodwater estimation in each scenarios.

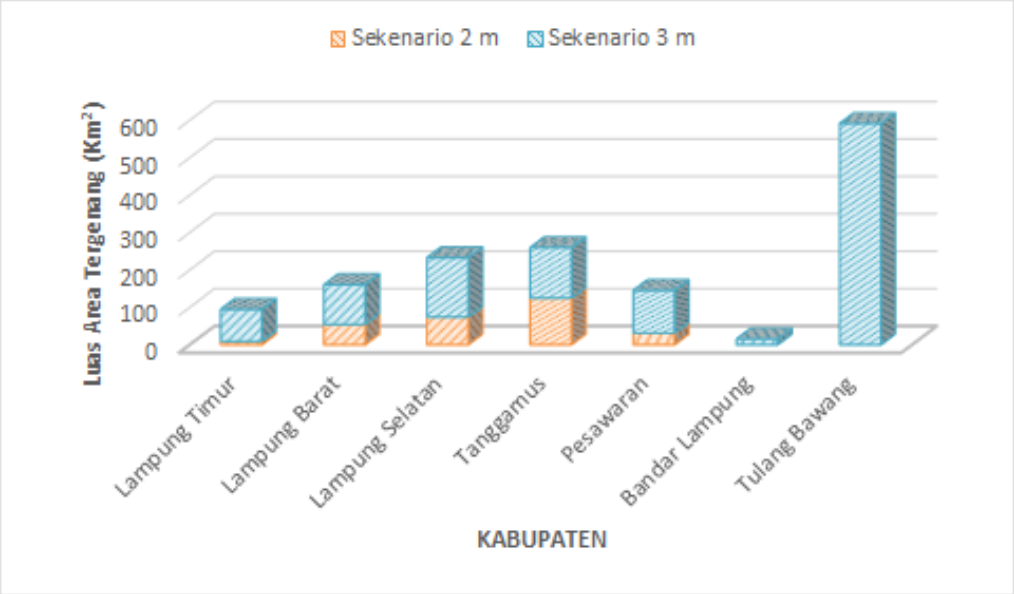
Floodwater scenario model is made using the assumption that flood will occur in some coastal regions in Lampung if the sea level is between two and three meter increase. This scenario causes some regions in some islets submerged. The areas in Lampung Selatan (South Lampung) that are submerged mostly at some islets in Sunda Strait. In the Lampung Timur (East Lampung) district, there are some small areas submerged, while according to the 2 meter increasing sea levels, Tanggamus is the widest submerged area. The submerged area is shown in black.

The 3 meter increase sea levels occurred in flooded areas. According to the preceding scenario, there are five districts that are submerged which are West Lampung, Pesawaran, South Lampung, East Lampung, and Tanggamus. However, there are two other districts that is submerged by using the three meter scenario which are Tulang Bawang and Bandar Lampung. The widest submerged area according to those two scenarios that had been done is Tulang Bawang district. It is estimated that ± 8% of its area is submerged.



Picture 7. The 2 meter scenario of the sea level increase (left) and three meter (right) submerged area

Coast area is the inundated area, one of which is Bakauheni Harbor. Some Bakauheni areas that are submerged will give direct impact to the economic activities because of the hampered goods and services delivery. The delayed supplies can trigger the inflation in Sumatera, since the supplies are limited and opposite to the demand. The inundated area in every regions have different area because they have different relief. The difference of each inundated area can be seen in this diagram.



Picture 8. Graphic of the areas which sea level increases

CONCLUSION

The flood model in the area researched is using the two and three meter sea level increase scenario. There inundated areas that uses the two meter scenario are East Lampung Regency, West Lampung Regency, South Lampung Regency, Tanggamus Regency, Pesawaran Regency, and Bandar Lampung. Meanwhile, the inundated areas that uses the three-meter scenario are East Lampung, South Lampung, West Lampung, Tanggamus, Pesawaran, Tulang Bawang, and Bandar Lampung. The district with the widest floodwater is Tulang Bawang district with ±8% of the area is submerged.

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