

Impact and Countermeasures on Rising Sea Levels in Tokyo

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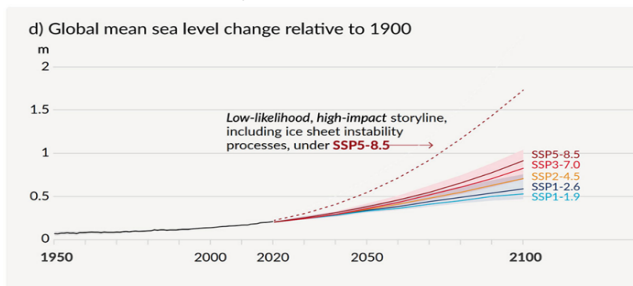
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Introduction

According to the Sixth Assessment Report released by IPCC [Intergovernmental Panel on Climate Change], from 1901 to 2018, the world's average sea level increased by 20 cm.

The IPCC's "1.5°C Special Report" which was published in October 2018 states that it is necessary to limit the global average temperature rise to 1.5°C to resolve climate change. Nevertheless, the sea level rise is expected to rise by 32 to 62cm in 2100 and rise by up to 1m.



[The Sixth Assessment Report, IPCC]

According to JOCCA [Japan Center for Climate Change Actions], there are two main causes of sea level rise.

The first cause is a phenomenon in which the temperature of seawater rises and the volume increases due to global warming. This problem is called "thermal expansion". By thermal expansion, the sea level rises.

The second cause of rising sea levels is melting glaciers and ice sheets. If glaciers covering land such as Greenland and Antarctica melt, ice that used to be on land will be added to seawater when the temperature rises, resulting in a rise in the water level [Center for Global Environmental Research]. If the sea levels actually rise for these reasons, how will Tokyo be affected?

Effects and Present Situation of Tokyo

Simulations of sea level rise and storm surge according to Greenpeace (2021) show that as many as 6 million people throughout Japan could be affected by inundation or flooding in 2030.

First of all, the effect of Tokyo will be an extreme rise in sea level caused by storm surges and other factors associated with the typhoon, which is expected to flood approximately 835,000 people. Moreover, referring to Greenpeace(2021), if the city is exposed to flooding due to extreme sea level rise in 2030, it is estimated to cost about 7.5 trillion yen, or about 7% of the total GDP of the city. Furthermore, based on Matthew H. Nash.The Swiftest(2022), a data analysis and research provider, says rising sea levels and frequent flooding will flood 36 cities, also Tokyo is the most dangerous city.

Comparing with foreign cities

Compared with foreign cities, first we will focus on New York. The solution is "Making barriers around the City". The name of the barrier is "U-shape barrier". After a hurricane in October 2012 caused massive flooding and power outages in New York City, plans were made to build a "Big U" to protect the island's southern coastline in a U-shape. The construction cost is said to be 510 million dollars (about 55.3 billion yen), but "Big U" will not only serve as an embankment, but will also have multi-purpose spaces that can be used for business and entertainment.

Next we will focus on "Restored or constructed wetlands, beaches, barrier islands, and reefs". If these are restored or constructed it can protect economic function, also can serve ecological function. Next, making a soft edge is useful for sea level rise. There are three merit points.

First, it can reduce the speed of waves. When the wave hits the edge the wave will rebound. Second, it reduces long-term maintenance costs. These solutions cause an increasing intertidal zone. The next solution is "Raising the elevation of land". There are two merit points. It can restore eroded beaches. It can depress erosion. Second, we would like to focus on Singapore. Most of Singapore is below 4 meters above sea level, and it is pointed out that there is a danger of submersion due to sea level rise. One of the unique ideas in Singapore is the construction of tetrapods planted with mangroves. The mangroves that have grown in 14 months are intricately intertwined and are expected to prevent land erosion and strengthen the ground. Third, in Venice it has been a huge problem of sea level rise. Since 2003, the Italian government has been working on the "Moses Project" to build a huge floodgate, but due to corruption and the economic crisis, it has not been completed yet. In the Moses system, an operator assisted by a computer system operates movable locks. The entrances of three lagoons in Venice have 78 walls that move independently and can respond to changes in tide level up to 3m. It also takes into account the impact of sea level rise expected over the next 100 years. The tide level was expected to be 125cm during the test, but the activation of the Moses system reduced the rise to about 70cm.

To summarize New York, Singapore and other countries' solutions of how to solve the sea level rise. Each country has a different environment, so they have their own solution. As we think about other countries' solutions, the solution might not fit for the country. So each country's government has to think how to improve the sea level rise.

Suggestion of Solutions

The Tokyo city government should make solutions to adapt to sea level rise.

Pursuant to Mimura. N (2005), people can adapt to sea level rise. In the solution of

adaptation, it can be separated into 3 parts. In the solution of withdrawal, the policy is based on the abandonment of land and facilities in areas vulnerable to sea level rise. Acclimatization, on the other hand, is a measure to avoid impacts based on the assumption of continued use of the affected area. Protection is a measure to protect vulnerable areas where social and economic activities are concentrated, the natural environment, and can be divided into hard and soft protection methods..

Conclusion

All in all, Tokyo is the most dangerous country which will be damaged economically and environmentally by sea level rise. Other foreign cities have already considered and adopted solutions to rising sea level. The solution to rising sea levels can be divided into three categories; withdrawal, acclimatization and barriers.

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