

Demonstration experiment of Marine Plastic waste Monitoring System

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Background

It is estimated that 150 million tons of plastic waste exists in the world's oceans. It is difficult to collect marine plastic waste because the outflow route is complicated, the distribution range is wide, and it moves due to ocean currents and winds. It has been reported that the spilled plastic waste accumulates without being decomposed and has an adverse effect on the marine ecosystem due to accidental ingestion and entanglement in fishing nets. In addition, about 8 million tons of plastic waste are discharged every year, and it is estimated that about 30% of this is discharged from Southeast Asian countries.

At the ASEAN Summit held in Thailand in June 2019, the "Bangkok Declaration" was adopted, which included expanding cooperation on the reduction of marine plastic waste, and stipulated the areas that each country should focus on and the activities recommended.

Purpose

The purpose of this demonstration project is to understand the Inflow route, Drifting, Drifted to the coast, and abundance of marine plastic waste in Thailand, Indonesia, and the Philippines, which are major waste generators of marine waste and are actively working to solve the problems. And to research and develop a marine plastic waste Monitoring system.



Innovation

Currently, the outflow route of plastic waste originating from the land area and the behavior of plastic waste at sea have not been reported.

This marine plastic waste monitoring system applies a physical oceanographic process, and the tracking device flows out of the land area and joins the offshore plastic waste accumulation group. The behavior is monitored by this system, and drifting and drifting areas are predicted.

This system is novel and advanced in the following points.

(1) Develop a marine plastic waste tracking device that uses the latest satellite positioning and IoT technology to monitor the outflow route, drifting and drifting area of plastic waste.

(2) Develop a monitoring system using big data / AI analysis technology to improve the efficiency of marine plastic waste collection, and predict the position, drift, and drifting area of marine plastic waste.

System configuration of this project

The monitoring system of this project has the following configuration.

(1) Tracking device:

(a)Plastic bottle, (b)GNSS receiver, (c)LPWA (Low Power, Wide Area) unit, (d)Battery, (e)Antenna

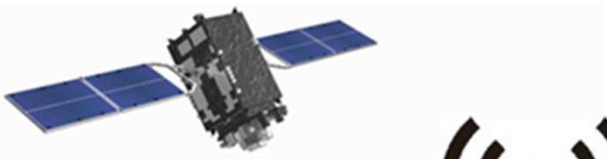
(2) Tracking device reception gateway:

Installed along the coastal area

(3) Monitoring system:

The tracking device reception gateway collects the position information from the tracking device. This system monitors the behavior and predicts the drifting position using integrated analysis with other data such as satellite, ocean, atmosphere.

Marine Plastic waste Monitoring System



Ground Data

- Tracking
- Ocean
- Atmosphere

Satellite Data

- Ocean
- Atmosphere



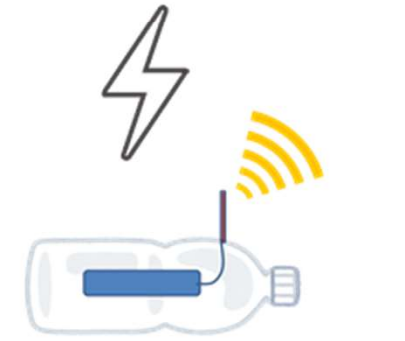
Cloud DB



Analysis



Monitoring System



Drift bottle

Expected results

1. The results of this project will enable us to efficiently and simultaneously grasp the distribution and existing amount of marine debris drifting and drifting plastic waste, which was previously difficult to track.
2. By deploying the same scheme in Japan and other countries, it will be possible to grasp the global distribution and existing amount.
3. Continuous analysis makes it possible to model and predict the inflow and movement paths of marine plastic waste.

Expected results

4. Efficient survey and collection of marine plastic waste can be realized by providing monitoring data to international organizations, governments / local governments, NGOs, and the private sector. It also contributes to the promotion of effective measures for marine plastic waste (outflow control, collection/disposal/recycling, etc.).
5. By visualizing and quantifying the actual condition of marine debris drifting and drifting plastic waste, the public's interest in the marine plastic waste problem will be raised. Also, it can contribute to educational activities such as littering, illegal dumping, and separated collection.

Demonstration experiment outline (1/3)

This demonstration experiment will go through the stages of (1) the development of a tracking system and (2) the tracking demonstration experiment in each country.

① Thailand:

Test site: Gulf of Thailand

Executing agency: Chulalongkorn University, Asia Technology Industry

② Indonesia:

Test site: Bali Island

Executing agency: Udayana University, Ministry of Marine Fisheries

③ Philippines:

Test site: TBD

Executing agency: University of the Philippines

Demonstration experiment outline (2/3)

1. Development of a monitoring system

(1) Tracking device:

(a) Plastic bottle, (b) GNSS receiver, (c) LPWA (Low Power, Wide Area) unit (ELTRES © SONY), (d) Lithium battery

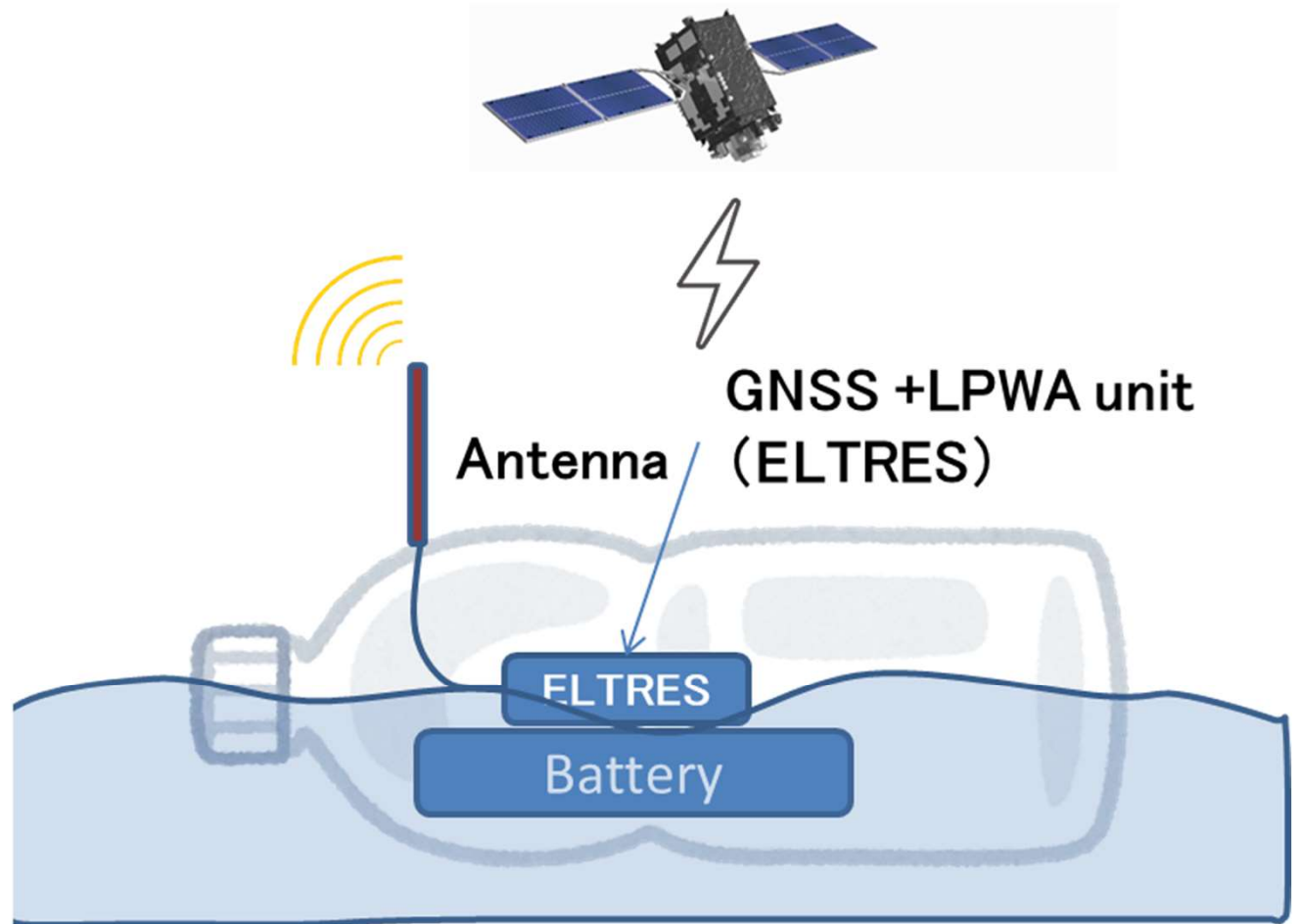
(2) Tracking device reception gateway:

Installed along the coast of each country's test site

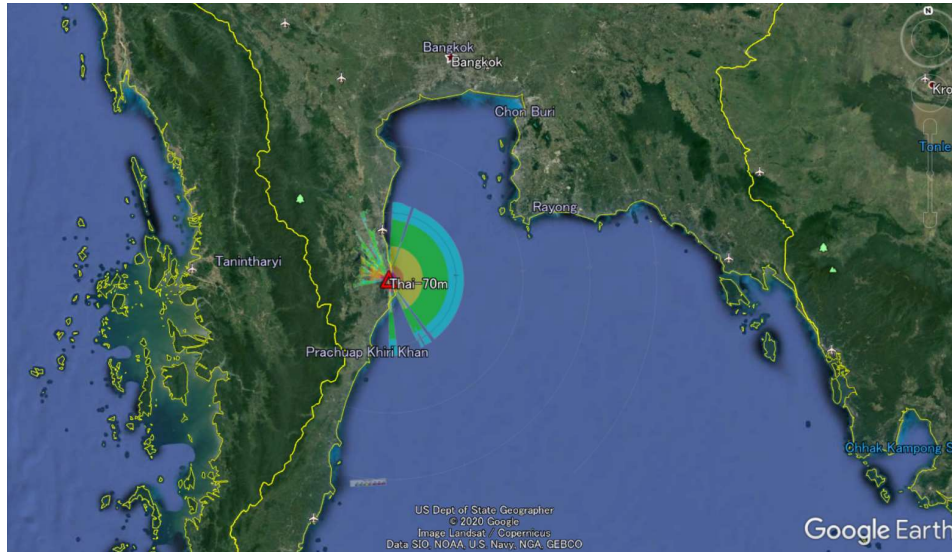
(3) Monitoring system:

- a. Collect the location information of the tracking device from the location tracking device reception gateway,
- b. Integrated analysis of marine conditions and meteorological information obtained from ground and satellite data,
- c. Monitor the behavior of marine plastic waste and predict the drifting and drifting areas.

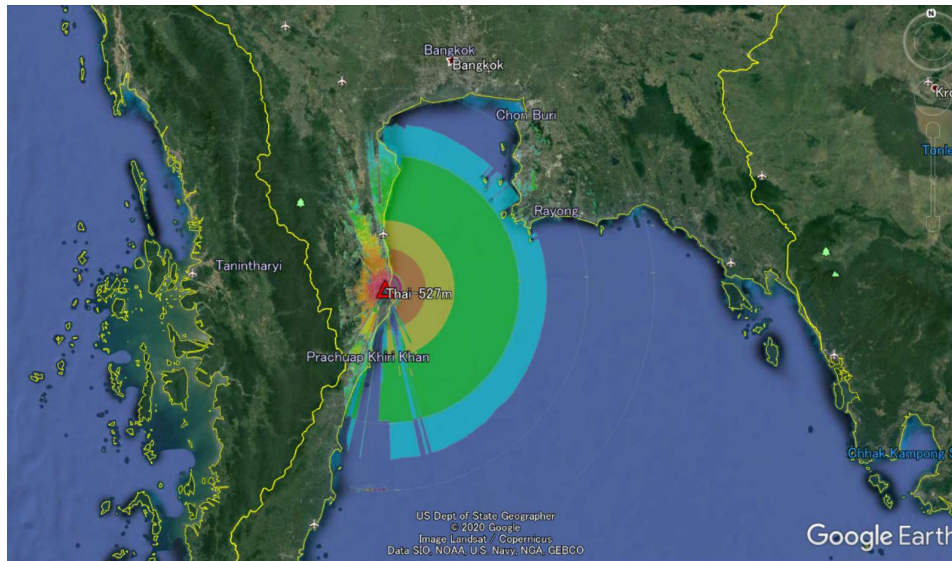
Tracking device and Reception Gateway



Gateway communication distance



Transmitter height: 50 cm
Transmission output: 13dBm
Receiver height: 70m
Communication distance: 50Km



Transmitter height: 50 cm
Transmission output: 13dBm
Receiver height: 527m
Communication distance: 100Km

Gulf of Thailand

Demonstration experiment outline (3/3)

2. Monitoring system demonstration experiment

(1) Release:

The tracking device will be released to the following two locations.

(a) Estuary area of major rivers, (b) Marine plastic drifted beach

(2) Tracking:

The location information is collected by the tracking device reception gateway along the coast of each country and displayed on the monitoring system.

(3) Collect:

The monitoring system grasps the point where it was washed ashore and collects the tracking device. At the same time, the drifting status of the local marine plastic waste accumulation group will be confirmed by drone observation and visual observation.

Future potential and Economic spillover effect (1/2)

1. Plastic products are indispensable products for humankind, and they will continue to be used in the future, their wastes will not disappear, and they will be continuously discharged in the future.
2. This system can visualize and quantify the actual condition of marine plastic waste drifting and drifting in the ocean.
3. This will raise public interest in the plastic waste problem and contribute to educational activities such as separate collection and prevention of illegal dumping.
4. Efficient reuse and recycling of waste collected by this system can contribute to a resource-recycling society.

Future potential and Economic spillover effect (2/2)

5. It can contribute to the development of a society that uses the ocean properly by raising awareness of problem solving in society as a whole.
6. Waste has traditionally been a negative entity due to the high costs of collection, transportation, and waste disposal.
7. Efficient collection by this system reduces waste collection costs. It will be a positive value-added product through waste reuse and recycling technology.
8. This shift in the idea of using waste as a resource will expand the market due to the diversification of value-added products, which can be expected to have an economic ripple effect.

Thank you for your attention!

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