

Estimation of the garbage volume flowing into the Tokyo Bay

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1. Background and purpose of the research

A floating dock has drifted down to the west coast of America, 90 or more found foreign types, it costed eighty thousands dollars to dispose of them - Problems of the sea garbage that was come up after the Great East Japan Earthquake. Such is the environmental problem of the crossing border type that is becoming serious mainly in the East China Sea and Sea of Japan in our country. In general, first step to resolve the environmental problem is to recognize the actual state through the monitoring (quantification). As for the sea garbage, the most typical monitoring method still being used is garbage collection by human hands, and that is the significant bottleneck to implement the problem solution (reduction). If you want to know the density of the dissolved oxygen (DO), just use a DO meter. But there exists no "Sea garbage meter" to measure the sea garbage so far.

Under such a background we are proceeding to develop the sea garbage monitoring (quantification) technology. There are several methods such as the one to calculate dimensions covered with drifted garbage based on a image shot by Web camera¹⁾, another is to estimate the sea garbage generation volume (flow-in volume) based on the Drifting garbage collection data issued by the national and local public agencies² and so on. Here, we would like to introduce the estimated result of the volume of garbage - of reeds having the largest collection volume when classified by type - drifted into the Tokyo bay in FY2008.

2. Method

For the estimation, we have used the Drifting garbage collection data by the Environment improvement ship "Bay clean" (Kanto Local Management Division) and Inside bay surface current speed yard measured by the Ocean radar. It is possible to estimate the volume and type of the garbage that Bay Clean has collected by referring to the Daily Report and collected points and time based on the ship route data. We have used the Inside bay surface current speed yard by inverting it to backtrack the garbage drifting route from the collected point to find the flow-in source (river mouth) and flow-in time. As for the flow-in volume, we have calculated the green coefficient (to know the percentage of the unit garbage flow-in volume that has arrived at the collected point at collection time) beforehand and determine the flow-in volume by using the least square method so that it becomes equal to the actual collection volume. It is the same method as the Tsunami wave source inversion.

3. Application of the estimation result and outcome

There is a distinct relation between the garbage flow in volume and river water flow-in volume (Fig.). It suggests that it is applicable to estimate the garbage flow-in volume from the river water flow-in volume. Flood from the August end to September beginning (10 days) has produced garbage corresponding to 32% of the year total that has flown in. On the other hand, there found almost no flow in garbage in a normal period that has no rain.

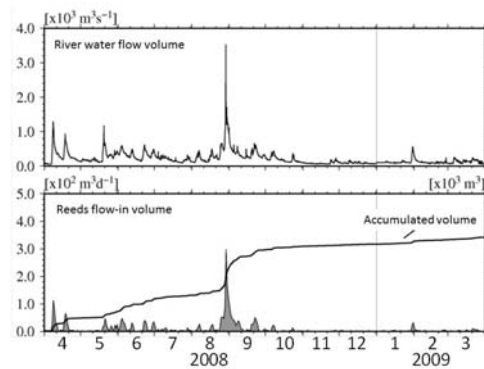


Fig. Estimation result of the river water (upper) and volume of flow-in garbage

If we suppose the accumulated time of the surface current water as some days to ten days, the density of the sea garbage shall be the order of 10^1 L/km² in normal period and around 100 times in the flood period. At the time of the flood, the garbage shall accumulate around the current rip between the plain water and seawater. On the contrary, in normal time there is garbage of small volume and further they are dispersed as there found no distinct current rip. If we talk about the annual collection volume, the point is how we can collect effectively at the time of flood. However, another discussion shall be required whether or not to put only the annual garbage collection volume as the management target of the Environment improvement ship.

If applied the technology introduced here, it becomes possible to estimate the garbage flow in volume and drifting position from the current "river water" flow in volume and Surface current speed yard (Ocean radar). It becomes possible to do simulation to know how many garbage shall be (or was) collected on what timing and where.

【Reference】

- 1) Kataoka et al., MPB, No.64, 1829-1836, 2012.
- 2) KATAOKA et al, Coastal ocean research, No.49, 113-126, 2012.