The Effect of Storm Surge and Tidal Currents to Sediment Transport in the North Ariake Sea

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INTRODUCTION

Ariake sea is a typical semi-enclosed shallow sea being rich in fishery products. It supports the local economy through fishing and the cultivating grounds of fish and shellfish. The amount of fishery products have decreased in recent years. The reason is clear that the seabed deposit has been deteriorated. While the sea is being degraded, water quality is suffering and soil particles of tidal flats is decreasing. For this reason, the prediction of tidal flow, wind effect and suspended sediment transportation is important in coastal related areas.

The purpose of the research regarding to condition of sediment concentration may have on the aquatic environment of North Ariake Sea caused by tidal current, storm surge and the relative contributions in support of ecosystem restoration .

STUDY AREAS

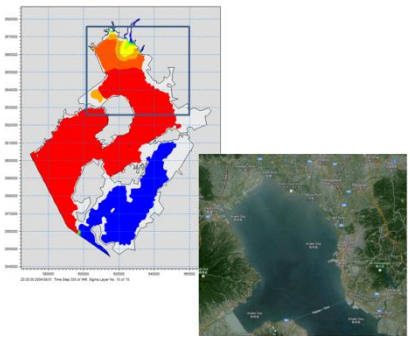


Figure1. Study Area

The North Ariake Sea locates in the west coast of Kyushu Japan. The total area of this sea approximately 1,700km^2. Tidal flats cover 18,840ha in this part, receiving flow of some rivers. Among them Chikugo river is the largest river in which the estuary connects to the North Ariake bay.

METHODOLOGY

As the computational tools the MIKE3 Flow Model HD Hydrodynamic and MT Mud Sediment Transport by DHI are used. The data needed as input are: bathymetric data obtained from the Ariake Sea Project of Saga University, topographic data from 50m DEM of Japan supplied by Geospatial Information Authority of Japan, the other data from Japan Water Information System-Japan Oceanographic Data Center-Japan Meteorological Agency. The tidal current considering is Nagasaki Tide and the Storm Surge is Typhoon Songda 200418 from 28 August to 7 September 2004. During calibration the parameter of hydrodynamic and sediment characteristics of the sea were adjusted until a satisfactory correspondence between the model results and observed field data was obtained. The result obtained can be shown in Fig.2 to Fig.4.

RESULT AND DISCUSSION

Fig.2 indicates that along flooding the highest SSC takes place in the river mouth to seaward and by tidal current from south to the north at spring. The result well reflects the characteristics of SSC distribution in the mouth of river with tidal flat exist. The interface of saline water and fresh water (Fig.3) can be clearly seen around the river mouth. Vertically, the low salinity water moves more offshore at the surface than the bottom in the time of high fresh water conversely at low fresh water the high salinity

water moves more to upstream.

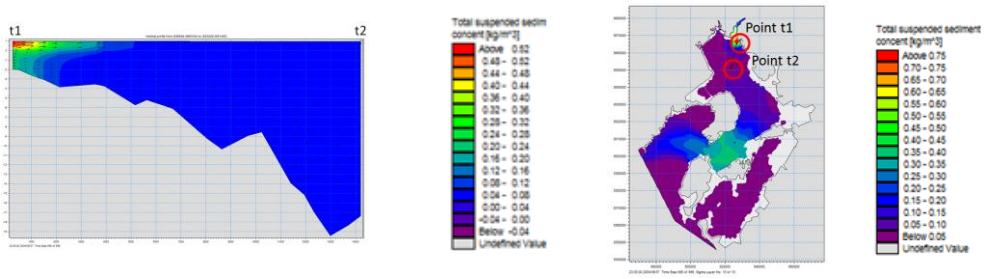


Figure2. SSC vertical profile along t1-t2 line with SSC horizontal distribution in the Ariake Sea

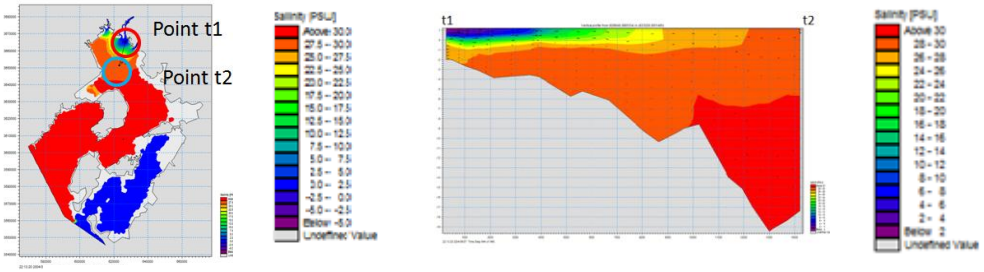
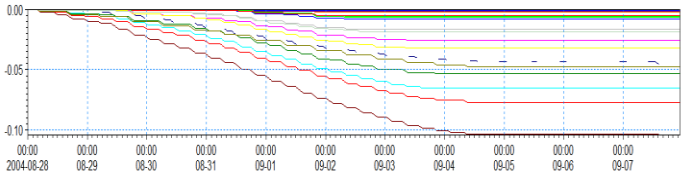


Figure3. Salinity vertical profile along t1-t2 line with salinity horizontal distribution in the Ariake Sea

Fig4.Graph trend of bed thickness decrease effected by tide



Graph trend of bed thickness tend to decrease (graph lines below 0.0m) at south part of North Ariake sea (Fig.4).There are other graphs: a) tend to increase (graph lines above 0.0m) in north part effected by tidal current, b) effected by storm surge. The effect of wind by Songda to Saga denote that erosion took place at almost of the all points in the basin (graph lines below 0.0m), indicate that storm surge generated by typhoon stirs up large quantity of sediment resulting the erosion of tidal flats.

CONCLUSIONS

SSC and salinity changes due to storm surge and tidal current in the North Ariake sea have been presented. 1).The model has been calibrated against water level, salinity and sediment concentration data, as the good agreement.2).The effect of tidal current deposition took place more to the north and almost along nearshore and river mouth, while erosion at more south.3). The highest SSC took place near the river mouth caused by flooding towards the south.4).Wind effected that the erosion took place at almost the all points in basin. 5).The tidal current is on important effect that should be counted to sediment resuspension, while storm surge influenced the most to suspended sediment at strong wind period.

REFERENCES

1)DHI,MIKE3 Flow Model FM, Hydrodynamic Model, Mud Transport Model,2011 2).N.Cao Don et al.,Sediment Transport and Short Term Sediment Process in tidal flats Ariake sea, Journal Coastal Research,2007,3) Y. Sonoda et al.,Distibution Characteristic Of Water Quality,Sediment And Benthos In Ariake Sea,Journal JSCE,2011