

Influence of Kiso rivers discharge on surface residual currents and distribution of Chlorophyll a in Ise Bay

Hajime Naganuma¹, Masataka Hayashi¹, Hidenori Aiki², *Joji Ishizaka²

1. Graduate School of Environmental Studies, Nagoya University, 2. Institute for Space-Earth Environmental Research, Nagoya University

Ise Bay is a semi-enclosed bay located in the center of Honshu island of Japan, and it is coastal area where the rate of fresh water flows is greater than that in Tokyo Bay and Osaka Bay of the similar size. In such a bay, estuary circulation induced by the inflows of fresh water would be prominent. However, it has not been known how fresh water inflows influence the variability of horizontal circulations in the bay. This study is, thus, aimed at understanding the surface residual currents by using High Frequency radar (HF radar) in Ise Bay, which allows us to investigate the influence of Kiso rivers to the surface residual currents. In summer in Ise Bay, red tides occur frequently owing to the excessive increase of phytoplankton. However, as there have been no study on the relationship between flow fields and phytoplankton of Ise Bay, we also studied the influence of the surface residual currents to the distribution of chlorophyll a.

Surface residual currents were calculated by the harmonic analysis of hourly data of HF radar from January 1, 2010 to December 31, 2013. We used the data of the daily mean discharge rate of the Kiso rivers (Kiso River, Nagara River and Ibi River). For wind directions and speeds, we used hourly data of the vane anemometers installed at Ise-Wan Sea Berth (Bay head), Chubu International Airport, and No.4 lighted buoy (Mid-bay). The distribution of chlorophyll a was calculated from the data of MODIS –the ocean color sensor mounted on the satellite Aqua. In this study, we focused on the variability in summer (June –August) when red tides frequently occur, after having understood the seasonal variability. The monthly mean discharge of Kiso rivers was low in winter, and high in summer with the highest discharge of $1015.6 \text{ m}^3 \text{ s}^{-1}$ in July. As river discharge reflected the seasonal variability of precipitation, the increase of the discharge in summer suggested the influences of the rainy season and typhoons. The monthly mean surface residual currents in Ise Bay generally flowed from the north to the south during January to May, and during September to December, and the current was stronger at the eastern part than at the western part. On the other hand, in July, the current speed was faster at the western part than at the eastern part, and in August, a cyclonic circulation appeared at mid-bay. The monthly mean concentration of chlorophyll a was low in winter when the river discharge was low, but it became high when the discharge rate increased in summer. In July, when the highest concentration of 10 mg m^{-3} was observed, chlorophyll a was distributed from bay head to the coast of Mie prefecture. From these seasonal variability, the change of characteristic in the surface residual currents and in the chlorophyll a distributions in summer were identified, and it was thought that they were largely influenced by Kiso rivers discharge.

Then, in order to identify the factors that influences the directions of the surface residual currents in summer, we compared the daily mean direction of the surface residual currents in bay head at 34.823° N , 136.724° E with the daily mean of the river discharge. As a result, when the river discharge became three times as much of the annual mean ($1500 \text{ m}^3 \text{ s}^{-1}$) or more, the surface residual currents flowed to west. On the other hand, when the discharge was less than $1500 \text{ m}^3 \text{ s}^{-1}$, direction of the residual currents was varied. It is thought that, when the river discharge was high, they were turned to west due to the Coriolis force. Furthermore, as we compared the flow and the wind direction and speed, it was revealed that the residual currents were greatly affected by the wind of mean speed 5.7 m s^{-1} and higher.

Then, in order to study the changes in chlorophyll a distributions and advection, we compared the daily

distribution of chlorophyll a, the daily mean of the residual currents and that of the river discharge. After the discharge of $1500 \text{ m}^3 \text{ s}^{-1}$ or more, water with high chlorophyll a of 10 mg m^{-3} or higher was distributed from bay head to the coast of Mie prefecture, and after the discharge of less than $1500 \text{ m}^3 \text{ s}^{-1}$, high chlorophyll a water was distributed in bay head, or from bay head to the coast of Chita Peninsula. It was suggested that the high chlorophyll a water was probably drifted from the bay head to the coast of Mie prefecture when the river discharge rate was high, and it stayed in the bay head or drifted to the coast of Chita Peninsula when the river discharge was low.

Keywords: Ise Bay, surface residual current, HF radar, river discharge, Chlorophyll a

Re-evaluate particulate organic carbon flux in the East China Sea

*Chin-chang Hung¹

1. National Sun Yat Sen University

Fluxes of particulate organic carbon (POC) in the East China Sea (ECS) have been reported to decrease from the inner continental shelf towards the outer continental shelf. Recent research has shown that POC fluxes in the ECS may be overestimated due to active sediment resuspension. To better characterize the effect of sediment resuspension on particle fluxes in the ECS, rare earth elements (REEs) and organic carbon (OC) were used in separate two-member mixing models to evaluate trap-collected POC fluxes. The ratio of resuspended particles from sediments to total trap-collected particles in the ECS ranged from 82-94% using the OC mixing model, and 30-80% using the REEs mixing model, respectively. These results indicate that REEs may be better proxies for sediment resuspension than OC in high turbidity marginal seas because REEs do not appear to undergo degradation during particle sinking as compared to organic carbon. Our results reveal that REEs can be used as tracers to provide quantitative estimates of POC fluxes in marginal seas.

Keywords: carbon cycle, POC, East China Sea, sediment trap

Sea Turtle-Friendly Zonation Area, Case Studies Goa Cemara Beach, Yogyakarta, Indonesia

*Sry Handini Puteri¹, Intan Elvira¹, Adhera Sukmawijaya¹

1. UGM

Sea turtle is one of the ocean - creature that has a specific habitat, which is coastal ecosystem. The suitable coastal ecosystem for sea turtles are consisting of some specific geomorphic characteristics. Geomorphic characteristics consists of several parameters, ie slope, wind, climate, waves, currents, and grain size of sand.

One of the Sea turtle habitat is located in Goa Cemara Beach. The beach has been converted into a tourist area by now. Rapid changes are not equipped with an insight of local wisdom and environmental assessment, thus it threatened the habitat of sea turtle. This study aims to determine the appropriate geomorphic conditions for sea turtle nesting habitat. The second objective is to recommend the spatial zoning that is friendly to the sea turtle' s habitat. The data used in this research are primary data and aerial photo interpretation. Primary data conducted by observation and direct measurement in the field. The expected output of this research are map of the spatial zoning that is turtle-friendly and map of the former turtle' s nest.

Keywords: Sea Turtle, Coastal Zonation, Aerial Photography

Occurrence of fishes around area with submarine groundwater seepage in the central Seto Inland Sea, with special emphasis on flatfishes

*Jun Shoji¹, Ryo Sugimoto², Hisami Honda³, Makoto Taniguchi³

1. Hiroshima University, 2. Fukui Prefectural University, 3. Research Institute for Humanity and Nature

In order to examine the effects of submarine groundwater discharge (SGD) on fish community structure and production, physical and biological surveys were conducted at a tidal flat in Seto Inland Sea, Japan. Flatfish species were dominant among fish community in and around the area with high SGD detected by monitoring survey by the use of radon concentration as a SGD tracer. Stomach content and stable isotope analyses indicated dependence of the fish species on nutrients derived from terrestrial sources through SGD. Marbled sole juveniles > 40 mm showed a higher dependence on the land-originated nutrients than other species.

Keywords: water-food NEXUS, fishery resources, submarine ground water, flatfish, Seto Inland Sea, Hiroshima