UTILIZATION OF SEAWATCH DATA FOR RESEARCH IN OCEANOLOGY BY RDCO-LIPI

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Abstract

The Research and Development Centre for Oceanology of the Indonesian Institute of Sciences (RDCO-LIPI) was established in the beginning of the 20th century. Most of its work is conducting research on the physical, chemical, biology, geology, and ecology aspects. These studies were made mostly by conventional methods, i.e., sending out research vessels to gather oceanological information of the water mass, coastal areas, and marine biota. Later on remotely sensed data was used to study certain properties of the coastal area and coastal waters.

All collected data are usually obtained from a certain point, called station, which comprises data from the bottom to the surface of the sea. Remotely sensed data could cover a wide area, but is limited to the surface and shallow waters. SEAWATCH data may add valuable information to data collected conventionally or remotely. Data gathered by SEAWATCH System could provide information on a continuous and near real time basis.

This paper discusses possible uses of SEAWATCH System to oceanological research conducted by RDCO-LIPI.

I. INTRO[)UCTION

The Research and Development Centre for Oceanology of the Indonesian Institute of Sciences (RDCO-LIPI) is an Governmental Agency in charge of conducting research activities in the field of Oceanology. The Centre focused its work on physical, chemical, marine biology, marine geology, ecology and mariculture. The Centre was established in 191 0 as a Fishery Station, which later on developed into one of the leading Institution on marine research in Indonesia.

The Centre has three Divisions, namely the Oceanography Division, Marine Biology Division, and Division for Environmental Studies, located in Jakarta, while in Ambon, Maluku, eastern Indonesia, a fourth Division was established, the Division for Marine Natural Resources. The Oceanography Division focuses its work on the physical and chemical properties of sea water and geology of coastal zone and coastal waters. The Marine Biology Division focuses its work on taxonomy, physiology, reproduction, and other aspects of biology. The Division for Environmental Studies conducts research on ecology, pollution monitoring, red tides and mariculture. While the Division for Marine Natural Resources focuses its work on marine ecosystems and the optimal exploitation of marine natural resources, mainly for the eastern part of Indonesia.

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In the beginning conventional methods are applied to gather oceanological information. Then in the early 70's remotely sensed data was also employed for certain programs, such as mapping of natural resources, coastal zone dynamics, and pollution monitoring (Praseno, 1975; Praseno & Sukarno, 1 976; Praseno et al. 1978; Praseno, 1983, Sobur et al., 1981). Some data are collected using continuous data collectors moored at the bottom of the sea or using drifting buoys equipped with various sensors. Continuous data are also obtained from tide gauges to study tidal characteristics.

Now that SEAWATCH Indonesia buoys are deployed and in operation, it is hoped that valuable information could be used from the 5 locations (Selawan, Batam, Jakarta Bay, Jepara, and Masalembo) for work carried out by RDCO-LIPI. This paper summarized some of the research activities conducted by RDCO-LIPI where SEAWATCH data could be used as supporting information. These data should be valuable, because of its continuity and near real time basis, but should be calibrated for its quality.

II. UTILIZATION OF BUOY DATA FROM JAKARTA BAY.

Water circulation in coastal areas may play an important role to coastal ecosystems, the distribution of land base pollutants, as well as to human activities. The Jakarta Bay is a good example where the type of current system is important. Around 2,000 industries in Jakarta and surrounding discharged effluents into the bay through rivers and canals. Concentrations of up to 136 ppm Pb, 3.93 ppm Cd, up 93 ppm Cu, 222 ppm Zn, 535 ppm Mn, and 38.9 ppm Ni were recorded in surface sediments of the Jakarta Bay (Hutagalung, 1995). Although Rochyatun (1997) obtained lower concentration of Pb (68.83 ppm) and Cd (2.87 ppm). The polluted water cause problems to existing ecosystems, fisheries, sea transportation, recreation, and human health. So far, the most damaging affects occurred to marine ecosystems and marine life. Coral reefs near the coast disappeared due to sedimentation, while some islands also dissapeared due to coral and sand mining. The cockle, Anadara granosa, usually found abundantly are now very rare. Some blamed the disappearance to pollution and some to over fishing. Fishing is truly carried out very intensely to meet the ever growing demand. Result of Dissolved Oxygen monitoring in front of Cisadane River and Cengkareng Drain Jakarta Bay, was still favorable for marine live (Rochyatun & Susana, 1998). They concluded that the flushing mechanism of estuarine water was still working well through the circulation pattern in the bay.

It was found very difficult to study the water circulatory system of the bay. Too many factors are involved, such as the main current of the Jawa Sea, earth rotation, tides, wind force and direction, discharge of river water, the shape and bathymetry of the bay, and other minor factors. Research conducted by RDCO-LIPI so far has not come to a satisfactory conclusion of the circulatory pattern. The availability of buoy data from 3 sites (Pluit, Tanjung Karawang and Pulau Kelapa) could help improve result of this study. Knowledge on the circulatory pattern of the bay may be useful for further development of the city Jakarta, future activities, and management of the coastal area.

One other aspect of research where buoy data could be useful is the monitoring of Harmful Algal Blooms in the Jakarta Bay. So far 28 potentially harmful

species have been identified from the bay and surrounding waters, of which 6 are epibenthi forms. Vegetative forms and cysts of PSP producing species are among those identified (Praseno et aL, 1998-1 Matsuoka et al., 1998). Among them are Pyrodinium bahamense var. compressum (both vegetative and cyst forms) and Gymnodinium catenatum. Other toxin producing species identified from the bay are Chattonella subsalsa (a fish killer), 6 species of the genus Dinophysis (D. acuminata, D. acuta, D. caudata, D. miles, D. ovum, and D. rotundata), Gymnodinium pulchellum (shrimp killer?), Noctiluca scintillans (once thought to be the cause of mass mortality of fish), the epibenthic forms Gambierdiscus toxicus, Ostreopsis lenticularis, O.ovata, Prorocentrum lima (both benthic and planktonic), the diatoms Pseudonitzschia pungens (ASP) and Thalassiosira mala (ichthyotoxin), and the cyanobacterium Trichodesmium thiebautii. So far, only Noctiluca scintillans and Gymnodinium pulchellum have cause problems to fish kills in the bay (Praseno, 1995), and Tdcho.desmium thiebautii (Praseno et al., 1998) to fish kill in the Seribu Island waters, off the coast of Jakarta Bay.

With 3 buoys deployed at and near the Jakarta Bay light attenuation data, obtained by sensors attached to the buoys, increase in seston concentration could be monitored. Studies should be conducted to determine the link between light attenuation data and chlorophyll concentration of phytoplankton. Steidinger & Baden (1984) suggested that all toxin producing phytoplankters are photosynthetic species. It is, therefore, possible to relate light attenuation data to chlorophyll concentration and thus monitor phytoplankton fluctuation. Studies should be conducted to figure out connection between increase in seston concentration and blooming of HAB organisms. Data of the 3 buoys could also be used to track the distribution of phytoplankters, which, in case of harmless blooms, could be used as valuable information to establish suitable sites for mariculture.

III. UTILIZATION OF BUOY DATA FROM BATAM ISLAND.

In 1992 PT. PENGERUKAN INDONESIA (P.T. RUKINDO) conducted a survey in Batam Island waters, to collect data on the physico-chemical conditions of an area around Nipa Island (PT. Rukindo, 1992). Results among others show that the Zn concentration at that time was 0.01 ppm. Six years after soil from Singapore was dumped at Nipa Island Zn concentration at the same place showed a very steep increase reaching an average value of 22,402 ppm (PT. Asinusa Putra Sekawan, 1998). This is not surprising since sediment from Singapore show high values for Cu, Zn, Pb, and Sn (Tang et aL, 1997). The Zn value for sediment samples were as high as 833 ppm with an average of 88 ppm. From marine sediment samples of 50 different locations in Singapore coastal waters Zn reached a value of 758 ppm in the port of Singapore (Orlic et aL, 1997). Other concentrations of heavy metal also increases, which show that the dumped Singapore soil had cause negative impacts to the marine environment and may affect marine life in the future.

RDCO-LIPI is planning to conduct a survey to measure the present condition at Nipa Island. Data on current velocity and direction'could be very u@(Ul in deciding location of stations. It is hoped that currnet data from SEAWATCH-Indonesia buoys deployed in the vicinity of Batam Island be used for this purpose. Other historical data is available at RDCO-LIPI.

IV. UTILIZATION OF BUOY DATA FROM MALACA STRAIT.

The eastern part of Sumatera coastal water is a prime spot for fishing and mariculture of cockles. Many private companies are exploiting cockles (Anadara squamosa) and export the product to Japan and European Countries. In 1998 all marine products, especially cockles should pass a certain quality standard before it can be exported to those countries. The quality standards employed to this particular product is that the product does not contain heavy metals exceeding the allowed standards limit, that it is not contaminated by pathogenic bacteria, and that the product does not contain phycotoxins. The source of heavy metals and pathogenic bacteria are human activities on land and ship dumping. Phycotoxins, on the other hanc, comes from the blooming of HAB organisms.

RDCO-LIPI plans to survey the eastern coast of Sumatra, to map environmental conditions, focusing on heavy metal and hydrocarbon concentration in sea water, the presence of pathogenic bacteria, and HAB organisms. For mapping of HAB organisms, efforts will be made to identify potential HAB organisms (both vegetative and cysts), with special focus on PSP producing organisms. SEAWATCH data should be able to provide important information on currents, light attenuation, and ironmental factors of the area. These data can be used as supporting data for this mapping program.

V. UTILIZATION OF BUOY DATA FROM MASALEMBO.

The Indonesian seas play an important role in effecting local and large scale ocean phenomena. Through Indonesian seas, mainly in the eastern region, water mass flow from the Pacific into the Indian oceans. The throughfiow is believed to be a key element in the thermohaline balance of the Pacific and Indian Oceans and to global climate system (liahude & Gordon, 1996). This phenomenon influence ENSO by controlling warm water mass seepage from the Pacific into the Indian Oceans supplying a link of tropical warm water between the two oceans. In addition tidal mixing may more or less administer sea surface temperature and sea-air coupling, with feed back on ENSO (Ffield, 1996). RDCO-LIPI is still involved in research on the ENSO/El-Nino phenomenon and the throughfiow of water mass from the Pacific to the Indian Ocean. RDCO-LIPI is also interested in studying the current system of the area, where different current systems meet. The outcome of this research will be valuable for shipping activities and rescue operations.

SEAWATCH data obtained from buoys near Masalembo Island may provide valuable data over a length period of time, to better understand the ENSO phenomenon. Current, salinity, temperature and meteorological data may be used, not only for studying the ENSO phenomenon, but also to study the water circulatory Pattern in this area.

VI. SEAWATCH DATA.

Five locations in the western part of Indonesia has been chosen as sites for buoy deployment. These locations are Belawan in North Sumatra, around Batam Island in Riau, Jakarta Bay and vicinity, Bawean in Central Jawa, and Masalembo Island in the eastern part of the Jawa Sea (Anonyme, 1998). Each site was chosen for

a certain purpose. The buoy in Belawan will collect data for monitoring pollution caused by ship traffic in the Strait of Malaca, shipping, fishing, and maritime meteorology. The buoys at Batam Island will provide information for pollution monitoring, oil spills, fisheries and tourism. The buoys deployed in Jakarta Bay and Kelapa Island, Jakarta, will provide data for land base pollution monitoring, mariculture, algal bloom studies, tourism and maritime meteorology. While buoys deployed at Masalembo and Bawean provide data for shipping safety fisheries and maritime meteorology.

RDCO-LIPI received a terminal linked to the Processing Central at BPPT. Transfer of needed buoy data is made on a weekly basis. So the data is really not received on a real time basis. For monitoring of red tides this type of transfer system would not work, when we have to set up an early warning system. Red tide blooms usually only last for a few days. This type of arrangements (on a weekly basis) does not meet the requirement for establishing an early warning system for red tides. Since the Government of Indonesia increased telephone fare, it would be more efficient to collect data at BPPT instead of through computer link.

Data collected by buoys should be routinely calibrated, because all sensors attached to the buoys are exposed to fouling organisms or experienced physical damage. So far the light attenuation data suffered from growth of fouling organism which in tropical waters could be very intens. It is, therefore, premature to judge the suitability of SEAWATCH data to establish a red tide early warning system.

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