

AN OCEAN MONITORING SYSTEM FOR FISHERIES IN WATERS AROUND JAPAN OPERATED BY FISHERIES INSTITUTES AND ITS APPLICATION TO THE FISHERIES RESEARCH

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ABSTRACT

The waters around Japan are known as a dense observation area in the world. Fisheries institutes in Japan are playing an important role in the continuation of the ocean monitoring from the 1910's. This ocean monitoring system, mainly consisting of repeat oceanographic observations in coastal waters, has been maintained by cooperative works of prefectural institutes and the Fisheries Agency of Japan. In this report, we discuss significance of the monitoring system and new aspect of this system combined with numerical simulation.

1. BACKGROUND

In 1910, a fundamental oceanographic survey for fisheries was initiated by the Department of Agriculture and Forestry of Japan based on the recommendation by Tasaku Kitahara, a technical officer of the Department, claiming that it was strongly required to comprehend the ocean condition for fishery promotion. The survey has been recognized as the first systematic ocean monitoring in Japan. Since 1918, the survey was expanded by arranging observation lines and fixed stations over almost whole area around Japanese islands. The observed oceanographic data were mailed to the Imperial Fisheries Institute of the government from each prefectural institute and published as 'Quarterly Report Oceanographic Investigation'. The data were also used in drawing sea surface temperature and density distributions to publish 'The Oceanographic Chart' every month. The most important objective of these activities was to support fishery by providing information of oceanographic conditions. Furthermore, from 1933 to 1941, several long line observations in the western North Pacific Ocean were conducted in summer in order to investigate the oceanographic conditions of distant waters for tuna fishing. The project is called 'Oceanographic Observations along thousand nautical-mile lines in the western North Pacific Ocean'. This exploratory survey brought advances of the oceanography of the western North Pacific Ocean.

After the interruption during World War II, the capabilities of oceanographic observation at each prefectural institute were gradually recovered. In 1963, reconstruction of the systematic oceanographic

monitoring by fisheries institutes was discussed and started in the next year under the Fisheries Agency's project 'Forecast of Fisheries Environment'. The oceanographic monitoring system is maintained to the present. Observed data were compiled in the yearly data report 'The result of Fisheries Oceanographical Observation' and more than 14,000 profiles were registered from fisheries research institutes including prefectural institutes, fisheries high school and Fisheries Agency every year [1]. Fig. 1 shows the stations for repeat oceanographic observations occupied by prefectural institutes and Fisheries Research Agency in the recent years.

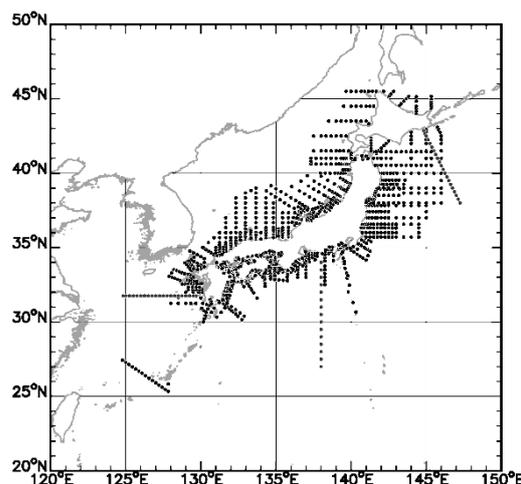


Figure 1. Oceanographic Observation stations routinely occupied by prefectural fisheries institutes and Fisheries Research Agency in the recent years

2. OCEANOGRAPHIC INFORMATION FOR FISHERIES

Major role of the oceanographic observations of prefectural institute is to assess the oceanographic conditions of fishing grounds. The information deduced from the analysis of the observed data is provided to fisheries communities from each prefectural institute. Since the oceanographic data obtained at one-month interval is not adequate for diagnosing the highly variable coastal area, the satellite observed data and

continuously obtained data from fixed coastal stations are utilized now.

The information about ocean interior is also important. For example, subsurface temperature profile data are used for the tuna fishery to detect the suitable layer, temperature data at bottom layer of the continental shelf region are needed for trawl fisheries, and the current field is important for whitebait fisheries in the coastal area and for set net fishery. Moreover the long-term predictions about oceanic condition and fishing condition are another important issue for fisheries.

For the requirement from fisheries, it is necessary to create continuous three-dimensional high-resolution oceanographic nowcast and forecast data by numerical modelling systems integrating various kinds of observation data.

3. UTILIZATION OF NUMERICAL OCEAN MODEL

In Japan, an ocean forecast system, FRA-JCOPE, has been developed under the cooperative study between Fisheries Research Agency and JAMSTEC and is operated together with the monitoring system. FRA is the abbreviation of Fisheries Research Agency. JCOPE is the abbreviation of Japan Coastal Ocean Predictability Experiment by JAMSTEC. FRA-JCOPE is accompanied with a data gathering system in which the oceanographic observation data can be reported via internet from each prefectural institute. The FRA-JCOPE system has advantages that coastal observation data gathered by this system can be assimilated on near real time [2]. While ARGO data and satellite SSH data are very important in the offshore region, these data are less useful for fisheries in coastal region because of the insufficient coverage. This insufficiency is expected to be compensated partly by the oceanographic data obtained by fisheries institutes in the monitoring system.

The operation of the FRA-JCOPE was initiated in April 2007. Now, forecasting calculation toward two month ahead is performed every week and the results are released on the FRA-JCOPE website [3]. The three-dimensional data produced by the FRA-JCOPE system are provided to member institutes for diagnosing the oceanographic conditions and for providing fisheries information. Visual images created from the three dimensional simulated data are effective for diagnosing offshore fishing grounds. So the oceanographic information about the meso and larger scale phenomena deduced from the forecast model has come to be used gradually in forecast of fisheries conditions by local fisheries institutes. However, the present FRA-JCOPE is less suitable for reproducing the small scale phenomena prevailing in the coastal region, because of the limitation by the specification at the developing stage of the present system. It is recognized that the

development of coastal ocean forecast model with higher resolution is the next important step.

The FRA-JCOPE data are utilized not only for the on-site operations but also for the fisheries studies. For example, the appearance of giant jellyfishes in the East China Sea is forecasted by using the calculated surface currents. Transport experiment of bluefin tuna larvae near the continental shelves around Japan is performed in order to investigate the recruitment mechanisms of young bluefin tuna and the oceanographic feature of the spawning ground [4].

4. REFERENCES

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