Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AOS25-P01 Room:Convention Hall Time:May 25 15:30-17:00

Census of Marine Life: Global and Japanese marine biodiversity

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The CoML (Census of Marine Life) was a huge marine biological program, global network of researchers in more than 80 nations engaged in a 10-year scientific initiative to assess and explain the diversity, distribution, and abundance of life in the oceans. The main purpose of the CoML was to assess and explain the diversity, distribution, and abundance of marine organisms in the global ocean. The CoML consisted of four major component programs: the History of Marine Animal Populations (HMAP), the Ocean Realm Field Project including 14 field projects, the Future of Marine Animal Populations (FMAP), and the database of the Ocean Biogeographic Information System (OBIS). The 14 field projects focused on the major habitats and groups of species in the global ocean. Several marine biological activities in Japan contributed to the CoML.

To ascertain the level of marine biodiversity in Japanese waters, Japanese CoML commnumity have compiled information on the marine biota, including the number of described species (species richness), the number of identified but undescribed species, and our current state of knowledge about each taxon. This is the first attempt to estimate species richness for all marine species in Japanese waters. A total of 33,629 species have been reported to occur in Japanese waters. The total number of identified but undescribed species was at least 121,913. The total number of described species combined with the number of identified but undescribed species reached 155,542. This is the best estimate of the total number of species in Japanese waters and indicates that more than 70% of Japanese marine biodiversity remains un-described. Japanese Exclusive Economic Zone (EEZ) extends from approximately 17N to 48N, and from 122E to 158E. The land area of Japan is small at 3.78 x 105 km2, but the EEZ ranks sixth largest in the world, or approximately 12 times the area of the land. The total area of Japanese EEZ is only 1.2% of the area of the global ocean. According to CoML investigations, the total number of marine species described from the global ocean is estimated at about 250,000. A total of 33,629 species approaches 13.5% of all marine species. Thus, Japanese marine species richness is high considering the small area and volume of Japanese waters. The state of knowledge was extremely variable, with taxa containing many inconspicuous, smaller species tending to be less well known. Although Japanese marine biota can be considered relatively well known, at least within the Asian-Pacific region, considering the vast number of different marine environments such as coral reefs, ocean trenches, ice-bound waters, methane seeps, and hydrothermal vents, much work remains to be done. We assume global climate change to have a tremendous impact on marine biodiversity and ecosystems. The present result will be the good baseline to monitor (detect) the impact of environmental change on marine biodiversity

Keywords: Census of Marine Life, marine biodiversity, International project

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Application RS and GIS for Monitoring Presence Mangrove Forest as Function for Decreasing Impact of Salt Water Flood

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Application of Remote Sensing and GIS for Monitoring
the Presence of Mangrove Forest as the Function for Decreasing Impact of Salt Water Flood
In Coastal Area and Swamp Area
(Case Study in North Jakarta)

Abstract

Salt water flood is one of disaster happened in a coastal area or swamp area caused by human or nature. It is kind of flood happened caused by the raising of sea level or tidal wave. But the salt water flood had other factors that influenced. Other factors that influenced the salt water flood are rainfall, watershed relief, watershed morphology, discharge and depth of watershed, the change of land use and presence of natural levee made by Mangrove Forest.

The presence of Mangrove Forest became one of an important thing to decrease area of salt water flood impact, because the presence of Mangrove could hold back the tidal waves of salt water. However, this present age is pruning of the Mangrove Forest and then used the products for development and industry needed, and then that situation would make the presence of Mangrove Forest become decreased.

This research aims is find the relationship between presence of Mangrove Forest with the salt water flood or tidal wave flood. In other hand, these researches also decide the potential area was grown by Mangroves for decreasing the impact of salt water flood. This research used remote sensing method and GIS digital analysis with geomorphological approach. Materials indeed for this research are multi temporal remote sensing image data for indicated Mangroves Forest distribution and monitoring. There are some correlation between area impact of salt water flood with area of Mangroves Forest, that could be indicated by remote sensing.

Keywords: Salt water flood/tidal waves flood, Mangroves, Geography Information System and Remote Sensing, North Jakarta

Keywords: Salt water flood/tidal waves flood, Mangroves, GIS and Remote Sensing, North Jakarta

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A study on variability of baroclinic tides in Taiwan Strait

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The Taiwan Strait is a 180x400 km shelf channel located between Taiwan and China. Measurements from four bottom-mounted installations along the central part of the Taiwan Strait from August 29 to December 28, 1999 revealed that the internal tides could be intensified in the presence of horizontal fronts in the northern South Chinese Sea (SCS). The fronts were produced by either the typhoon-induced cold wake or oceanic mesoscale processes. In general, tidal motions are dominated by barotropic tides in Taiwan Strait. However, tidal currents in the Taiwan Strait can be dramatically changed after the fronts appear in the northern SCS. In the general phase, barotropic diurnal and semidiurnal tide magnitudes were ˜0.15 m/s and 0.4 m/s, respectively, while the current magnitude of baroclinic diurnal and semidiurnal tide were ˜0.1 m/s and 0.15 m/s, respectively. After the presence of fronts in northern SCS, the strong mode-1 semidiurnal baroclinic tides were intensified, with a maximum velocity of ˜0.25 m/s. The magnitude and the depth-integrated kinetic energy of semidiurnal baroclinic tides after the time of the thermal fronts impact were, respectively, ˜3 times and ˜4 times of those in the general phase, while the diurnal baroclinic tides were not significantly affected. Subsequently, the strong mode-1 semidiurnal baroclinic tides weakened in the next 2-4 days. The variability of internal tide corresponding to the presence of fronts and the correlation between magnitude of fronts and internal tides were the most remarkable in the west of strait (Mainland China side), and eastward decrease.

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New challenge of integrated fisheries information system and links to future large-scale research plan in marine ecology

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Oceanography is moving toward the construction of operational observing systems in coastal regions. This issue is of global interest for sustainable use of fisheries and aquaculture resources. In particular, satellite remote sensing and marine-GIS for fisheries and aquaculture has been developing rapidly, and an operational use is required for sustainable development and management. We started Hakodate Marine Bio Cluster Project in the Regional Innovation Cluster Program (Global Type) from 2009 supported by the Grant-in-Aid for University and Society Collaboration from the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. Through this project, we develop an integrated coastal fisheries information system that combines satellite remote sensing, observations from a buoy network, 4-D VAR data assimilation system, ecosystem modeling, and marine-GIS spatial modeling to delineate the potential fishing zone for coastal squid fisheries, and to predict suitable sites for scallop and kelp aquaculture in southern Hokkaido coastal region, Japan. New challenges in the field of fisheries information systems now include developing systems capable of analyzing the marine environment in 3D, prediction and validation of oceanographic parameters, and dissemination of new information products to the user community in real or near-real time. We will present the overview of this on-going project and discuss on expanding those activities to future large-scale research plan in marine ecology.

Keywords: integrated fisheries information system, satellite remote sensing, marine-GIS, Hakodate Marine Bio Cluster, marine ecology

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Shipboard physical oceanographic observation in the Argo era

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Physical oceanography has almost changed its morphology from a pure science to a practical one that aims more quantitative assessment of the ocean circulation's role in climate and fishery resources variations. The modern physical oceanography is supported by high-resolution numerical models and global observation systems. As for observations, satellite altimeter enabled us to monitor vertically-integrated current structures since early 1990s, which has grew understanding of large-scale ocean circulation variability as well as the influence of mesoscale variability of ˜100 km scale to large-scale one. Furthermore, a global observation network by autonomous Argo profiling floats has been built since 2000, which made it possible to monitor three dimensional structures of temperature and salinity down to 2000-m depth with a horizontal resolution of ˜300 km. Further accumulation of data in the future will lead to clarifying long-term variability of ocean interior and its effect on climate and fishery resources.

On the other hand, the current Argo network cannot monitor phenomena of mesoscale and smaller scales (including sub-mesoscale, turbulence) nor deep layers below 2000-m depth. Also, the float sensors other than temperature and salinity ones are still in the test phase, and the Argo network has not yet exercise its power in investigating the relation of physical oceanography to biogeochemistry or meteorology. In these research fields, shipboard observation still has a crucial role. As an example, I would like to introduce our ongoing research. In recent years, analyses of satellite altimeter data have demonstrated that the Kuroshio Extension current flowing east of Japan has two states alternately on decadal timescales: an unstable state accompanied by high mesoscale eddy activity and a stable state with low eddy activity. This eddy activity variability is expected to influence structures of temperature, nutrients, etc. in broad areas through the formation of winter oceanic mixed layer in the Kuroshio Extension region, but specific influences and the associated processes have not been clarified yet. To clarify eddies' role in the water mass and nutrient distributions in areas north of the Kuroshio Extension, we plan to conduct two high-resolution physical and biogeochemical observations using *R/V Hakuho-maru* in FY2013 and FY2015.

Further development of physical oceanography requires both monitoring type observations represented by ones performed by the Japan Meteorological Agency and bottom-up type observations for process studies such as ones planned by us. As for bottom-up type observations, two research vessels *Hakuho-maru* and *Tansei-maru*, which are currently handled by the Japan Agency for Marine-Earth Science and Technology for operations and the Atmosphere and Ocean Research Institute, the University of Tokyo for cooperative research, have played an important role in conducting observations proposed by scientists across the country for nearly 50 years. The current two vessels are both old. The currnet *Tansei-maru*, which has performed coastal observations for 30 years, stops its operation in FY2012, and turns over its role to the incoming vessel from FY2013. The currnet *Hakuho-maru* is also close to the end of its durable period. For further clarification of ocean's role in global environment, another incoming vessel for *Hakuho-maru* and the adherence of cooperative research system are strongly desired.

Keywords: physical oceanography, research vessel, Argo

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Importance of research vessels from the viewpoint of air-sea interaction studies

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The atmosphere and the ocean always exchange heat and momentum and affect each other. Air-sea interaction is especially active in the tropics, where the air is warm and humid. It has been well known that the coupling of the atmosphere and the ocean is essentially important for the El Nino phenomena. Recently researchers have also recognized that the oceans have an important role in controlling the atmospheric circulation even in the mid and high latitudes. We cannot predict atmospheric variations accurately without knowing oceanic ones in all the latitudes, not only in the tropics. Research vessels and buoys are indispensable research facilities even for meteorology and climatology because 70% of the earth surface is the oceans. Air-sea coupled model is a powerful tool for the interaction studies. However, there is always imperfectness in numerical models, and we have to do in situ observations to complement model research. We have a presentation on the importance of research vessels from the viewpoint of air-sea interaction studies.

Maritime clouds:
Cloud is one of the important factors that affect heat, saline, and momentum budget in the upper ocean. It is also important for the understanding of the warming in the polar regions, and one of the factors of the largest uncertainty. Radar/lidar of high performance on a research vessel will enable us to do wide-ranging research activities: the structure of maritime precipitable clouds in the tropics, the difference in cloud system between sea-ice and open-water areas, etc. When we operate remote sensing instruments, such as radar, on a vessel, specialized vessel-use ones will be necessary. Such instruments are still rare in the world.

Polar regions:
The warming in the Arctic is twice as fast as the mid and low latitudes, and the decrease in sea-ice area is notable. The change in atmospheric pressure pattern largely contributes to the sea-ice decrease, and the course of low pressure is also affected by the change in sea-ice area (Inoue et al., 2012). The air-sea interaction in the Arctic significantly affects the climate in the mid latitudes, including Japan, and it is very important socially. The Antarctic Ocean is one of the main regions where deep water is formed. Hence the changes in surface heat and momentum fluxes there affect the ocean circulation and the carbon cycle. An enormous amount of heat and brine are released from the upper ocean in the cold season. Baroclinicity increases at the edge of sea ice, which contributes to development of low pressures. However, it is impossible to calculate air-sea heat flux over the region where sea ice exists by using satellite data only. The reliability of reanalysis data is also lower over such regions. We need to continue in situ meteorological observations over the marginal ice zone by large research vessels predominantly. For this purpose, ice strengthening construction as well as full meteorological observation facilities is required.

Improvement in air-sea flux estimation:
Accurate estimation of the amount of air-sea heat, momentum, and water vapor exchange is the most fundamental and important for air-sea interaction studies in any latitudes. Bulk parameterization has been improved mainly by using tropical in situ observations, such as TOGA COARE (e.g., Fairall et al., 2003). However, the estimated surface heat flux value on a basin scale still has quite large uncertainty (e.g., Kawai et al., 2008). We need furthermore international, long-term efforts to improve the flux estimation.

The Above-mentioned subjects are just a part of important air-sea interaction studies. Meteorological instruments of high performance on research vessels are indispensable for such studies. At least, a set of instruments that can derive surface heat and momentum fluxes is required. We must consider installing an automated radiosonde launcher and radar/lidar for large research vessels of more than a few thousand tons.

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Details and Perspective of Large Facilities and Research Projects Collected at the Science Council of Japan

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In March 17 2010, the Science Council of Japan (SCJ) announced the ”Japanese Master Plan for Large Research Projects” to the public. The aim of this report is to show the direction of science and to promote cutting-edge science, and to strengthen and broaden the Japanese sciences. In September 2011, SCJ released the revised version of the first report entitled ”Japanese Master Plan of Large Research Projects 2011 -A Table of 46 Selected Projects-. In my talk, I will present the details of this master plan and its revised version, and the future perspective, especially focusing on the research fields of earth science as well as ocean science.

Keywords: Science Council of Japan, Large projects

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Air-sea CO2 exchange estimation by reconstructing pCO2 distribution in the North Pacific using a neural network

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The North Pacific plays an important role for the anthropogenic CO_2 uptake due to biogeochemical effect. In order to estimate air-sea CO_2 flux in the North Pacific, National Institute for Environmental Studies (NIES) has operated comprehensive surface ocean CO_2 measurement in the mid-/high-latitude of North Pacific since 1995 utilizing volunteer observing ships, as well as in the western Pacific Ocean since 2006. In this study, we hypothesize that pCO_2 can be estimated through Self Organizing Map (SOM) with 4 parameters of SST, MLD, CHL and SSS datasets. SOM is a kind of Neural Network technique and it offers a kind of function which can express non linear and discontinuous relationships. As for applying to pCO_2 mapping, Telszewski et al. (2009) first applied to reconstruct monthly pCO_2 distribution in the North Atlantic for 3 years using with SST, MLD and CHL dataset as well as their observed pCO_2 dataset. In this study, over 73000 in situ pCO_2 data are used for reconstructing pCO_2 distribution from 2002 to 2008 using SOM technique. The values of reconstructed pCO_2 agree well with those of in situ measurements especially in the low/mid latitude area of the North Pacific. After the estimation, monthly air-sea CO_2 flux is calculated in each grid by using the equation that Sweeney et al. (2006) proposed. The averaged amount of annual air-sea CO_2 exchange for 7 years is estimated to be about -0.46 PgC yr^{-1} which is close to that of Takahashi et al. (2009) and the amplitude of its interannual variation is about 0.04 PgC yr^{-1}.

Now, we plan to apply this technique to pCO_2 mapping not only in the Equatorial/South Pacific but also in the coastal region around Japan to reduce the uncertainty of the air-sea CO_2 exchange estimation. Therefore, some of the results concened with interannual variation of pCO_2 in these areas will be presented in this session.

Keywords: pCO2, air-sea CO2 flux, North Pacific, interannual variation, Self Organizing Map