Global deployment of Deep Argo floats toward accurate prediction of future climate and ecosystem changes

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Long-term assessment and conservation of marine bio-resources are crucial in securing the global food supply. Given the present very rapid warming of global climate, however, marine environmental changes could be a very serious threat to humanity. Acidification of surface seawater and decrease of dissolved oxygen in subsurface layers have been detected recently; if these trends are significant, irreversible global/oceanic change on a longer time scale is a realistic possibility. Deep oceanic circulation plays a key role in marine environmental change. A recent numerical model suggests a global temperature change of more than 4^{o}C and a decrease of marine biological production by 20% under conditions of weakened deep oceanic circulation. The actual features and mechanism of deep oceanic circulation are still largely unknown; comprehensive observation of the deep ocean is important in order to accurately assess the oceanic ecosystem.

The Oceanographic Society of Japan submitted a research proposal in association with 16 academic societies belonging to the Fisheries/Oceanography Research Liaison Council and the Paleontological Society of Japan. The proposal focuses on observation of turbulence in the deep sea with a turbulence sensor attached to a deep-sea Argo float (at a target depth of greater than 4000 meters) called “Deep NINJA.” More than 10 floats of this type with conventional temperature and salinity sensors are currently in operation in the Southern Ocean. By deploying approximately 1000 floats, observation of temperature, salinity and turbulence will be conducted globally from the ocean surface to seafloor. The obtained data will be incorporated into a coupled atmosphere-ocean global climate model and simulation will be conducted using the leading Japanese supercomputer facility. Responses of the biological community to the reproduced paleo-environmental changes can be validated by paleontological data such as the microfossil record in sediment cores; such validation can be used to further refine the model. It is expected that far more accurate prediction of future climate, marine biological production and marine bio-resources can be achieved through the proposed research.

Keywords: Deep-sea Argo Float, Deep Ocean Mixing, Global Overturning Circulation, Climate Change Prediction, Paleo-environmental Change, Marine Bio-resources

