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

*Toshiyuki Hibiya[1]

1. Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo

Long-term assessment and conservation of marine bio-resources are crucial in securing the global food supply. Given the very rapid warming of global climate at present, however, marine environmental changes could be a very serious threat to human beings. Actually, acidification of surface seawater and decrease of dissolved oxygen in subsurface layers have been detected recently; if these trends are significant, an irreversible global/oceanic change in a longer time scale would be realistic. The deep oceanic circulation plays a key role in the marine environmental change. A recent numerical model suggests a global temperature change of more than 4°C and a decrease of marine biological production by 20% under a condition of weakened deep oceanic circulation. The actual feature and mechanism of the deep oceanic circulation are still largely unknown, and the comprehensive observation of deep sea would be also important in the assessment of oceanic ecosystem.

The Oceanographic Society of Japan submitted a research proposal in association with the 16 academic societies in the Fisheries/Oceanography Research Liaison Council and the Paleontological Society of Japan. The proposal aims to unveil the deep oceanic circulation, which is currently acting as the bottleneck in reproducing past and future climate variability and global environmental changes in numerical models. More specifically, the proposal focuses on observation of turbulence in the deep sea with a turbulence sensor attached to the deep-sea Argo float (target depth more than 4000 meters) or "Deep NINJA". More than 10 floats of this type with conventional temperature and salinity sensors are in actual 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 the simulation conducted using the leading Japanese supercomputer facility would yield an accurate reproduction and prediction of the past and future climate. Responses of biological community to the reproduced paleo-environmental changes can be validated by paleontological data such as microfossil record in sediment core, and the validation further refine the model prediction. A far more accurate prediction of future climate, marine biological production and marine bio-resources will be achieved through the proposed research project.

Keywords: Deep Argo Floats, Turbulence in the deep ocean, Deep oceanic circulation, Prediction of future climate changes, Prediction of future ecosystem changes

