Development of simple CTD calibration method for Argo float.

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The global Argo array produces huge accurate data which can be used for climate and oceanic changes by a lot of deployed Argo float. The Argo float is equipped with a CTD (SBE41; Conductivity (salinity), Temperature, Pressure) sensor, which is made from an US manufacturer: Sea Bird Electronics (SBE). Since long-term stability and accuracy of the CTD sensor are the most important point to detect the climate and oceanic change signals, checking and screening of the SBE41 before deployment is crucial. Therefore, JAMSTEC developed a simple CTD calibration method for SBE41 in a laboratory.

The international Argo program is a global project to monitor temperature and salinity changes of the upper 2000 m ocean by over 3000 Argo floats. The floats can automatically measure them for 3-4 years, sending variable kind of data via satellite in real time. The target accuracies of the SBE41 are within ± 0.005°C for temperature and ±0.01psu for salinity, which had been decided by Argo Data Management Team. To maintain the accuracies of the sensors is a key to be better understanding mechanisms of global oceanic changes.

Up to now we has been deployed over 1100 floats with SBE41 since 2000. Although all the CTD sensors are fully checked and passed for the accuracies before shipping from the manufacturer (SBE), the sensors are not accidentally satisfied with the target accuracy due to sipping trouble etc.. To detect the failure sensors and avoid the fault floats, we had operated JAMSTEC’ s CTD calibration system which was the same type system as SBE’ s and checked the sensors as much as possible. From 2000, we had checked over 500 sensors and found 30 unhealthy ones. The reasons why the number of checked CTD is about a half of all deployed floats are mainly complexity of the system and too much time to check for each sensors (over 12 hours). Difficulty of the operation, such as to open a float and separate a sensor, requires higher skills of technicians. Therefore, we developed new and simple CTD calibration method without opening the float, separating CTD sensor and any special skills for technicians, to be able to check all sensors efficiently within shorter time.

The mechanism of the new CTD calibration method is very simple. Artificial sea water (35 within ±0.1psu, 23 within ±0.3degC), is made by NaCl, degassing in advance, is flown at a constant speed in reference temperature and conductivity sensors and some CTD on floats through a thin pipe, being driven by a high efficiency pump. Within a fixed time (30 minutes), the reference sensors and float sensors automatically measure temperature and conductivity frequently. The checked float sensor is evaluated for healthy or unhealthy by calculation of the difference of temperature and conductivity between the float sensors and reference ones. The important point to get accurate calibration result is to keep uniform air and the artificial salt water. Based on a lot of try and error to maintain temperature environment, we succeeded to reduce temperature gaps in between the laboratory room and checking sensor within ±0.3degC during a

calibration, which makes us the same calibration quality of the simple calibration method as SBE’s calibration system.

Keywords: Argo float, CTD sensor, Sensor calibration

