References:


Introduction on Delayed Mode QC:

Recalibration is generally not possible due to the no recoverable nature of floats, so float datasets are usually check to an indirect way. Here we present the application of a method based on mapping a set of calibrated data by objective analyzing to the float profile position. The method applied at the Coriolis Data Center is the method of Annie Wong et al (2003) [1] adapted to North Atlantic environment by Lars Böhme [2] to produce the delayed mode data for Gyroscope project in a first time.

Recalibration is set up to correct sensor drifts by using historical hydrographic data. The used objective mapping method takes into account the high spatial and temporal variabilities of the North Atlantic [2]. Assuming that a conductivity offset changes slowly over time, the float measurements are fitted linearly to the mapped salinities in potential conductivity space by weighted least-squares. The result is a set of calibrated salinity data with corresponding uncertainties.

Overview of the Delayed Mode QC method:

The method uses the two main state variables temperature $\theta$ and salinity $S$. Mean $\theta$-$S$ relationships can be used to estimate salinity from measurements of temperature and pressure. The CTD measurements (WOD01 and others) are interpolated on 2 dbar levels to store all information but reducing the amount of data. To provide an acceptable vertical coverage the deepest measurement of each station must be below 1000db.

The horizontal data selection is based on a spatial distance $D$ and a fractional distance in potential vorticity $F$. The vertical data selection selects $T$ float measurements for each profile (top and bottom measurements (525-2000 dbar), minimum and maximum of $T$ and $S$, two with tightest $P-T$ definition and two with highest $P-S$ definition). A temporal distance $t$ is also taken into account.

The final objective estimate at the float profile location is the sum of two stages of mapping: the first calculates the basin-wide mean, in the second the residuals are mapped to the float profile location using a covariance function of the temporal and small spatial separation. All measurements are converted to potential conductivity to eliminate differences in pressures between historical and float data. Then the potential conductivities of the float are fitted to the mapped potential conductivities.

DMQC - Analysis on ARGO float:

Some diagnostic plots allow to follow the behavior of the float and to understand the correction computed from the DMQC method for the calibration.

Corrections applied to the floats of the North Atlantic Ocean

Conclusions

Due to the drift and offset observed on the salinity sensor, it is necessary to recalibrate float data in delayed mode. Offsets and drifts are detectable in the floats of the North Atlantic and a corresponding correction is supplied using objective mapping method.

The results have shown that Seabird sensors were more stable than FSI sensors. Historical hydrographic dataset using to select ‘best’ profiles for the mapping to the float profile is sometimes insufficient in some oceanic areas and need to be updated with the recent cruise data.

To help to determine the correction, complementary tools have been developed, using the residuals and fields of an objective analysis taken into account all type of data available in the Coriolis database (profilers, xbt, ctd, moorings).

References:
