A Non-linear Quality Control Procedure for Representativeness errors in Ocean Historical Datasets

Kanwal Shahzadi, University of Bologna (Italy), kanwal.shahzadi@unibo.it
Nadia Pinardi, University of Bologna (Italy), nadia.pinardi@unibo.it
Vladyslav Lyubartsev, CMCC (Italy), vladyslav.lyubartsev@cmcc.it

In order to compute world ocean climatologies representing the low frequency variability of ocean essential variables, such as temperature and salinity, there is a need to consider the concept of uncertainty in the input profiles. Uncertainty in the input data arises from different kinds of errors, mainly categorised into gross and representativeness errors (Janjic et., 2017). Systematic errors, parts of the gross error are attributed to incorrectly calibrated instruments, incorrect archiving or technical problems in data transmission, instrument sensitivity and accuracy. Representativeness errors instead represent the inadequate resolution of the space and time scales of variability of the ocean fields. In particular for ocean climatologies, the representativeness error is given by the inability of the input data to represent the low frequency signals.

A non-linear Quality Control (NQC) procedure is developed (Shahzadi et al., 2020) similar to Jia et al. (JAOT, 2016) in order to eliminate non-representative or high frequency signals of the World Ocean Database 18 (WOD18) ARGO profiling floats Temperature and Salinity profiles. The procedure requires the subdivision of the domain of interest into regime oriented regions in order to make the statistical estimates of the mean and standard deviation as reliable as possible, i.e. representative of the climatology of that sub region. In addition, mean and standard deviations will be computed in the sub regions by gridding the intermediate results of the NQC procedure with an objective analysis (OA) algorithm developed by Carter and Robinson (1987). At each iteration of the NQC procedure, data are compared to standard deviations calculated from the gridded field in the sub regions and rejected if their value exceeds 2-3 standard deviations. The procedure flags the rejected data until a convergence is obtained, i.e. no more data is rejected by comparison with the standard deviations in the sub regions (Fig.1).

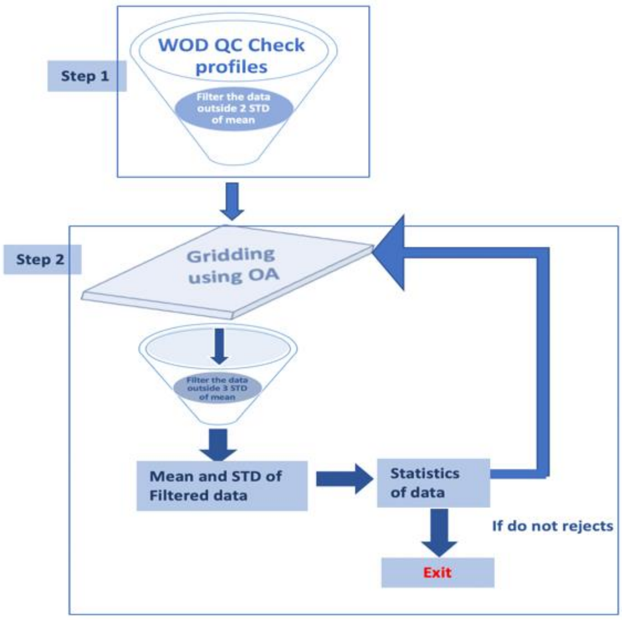
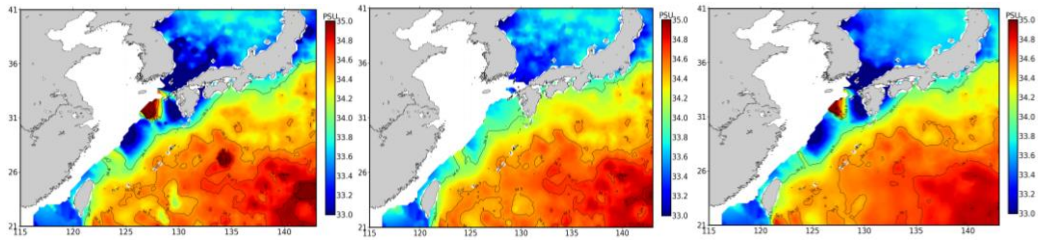


Figure. 1: Nonlinear Quality Control Schematics

The procedure is applied in the North West Pacific (NWP), North Atlantic (NA) and South Atlantic (SA) as different test areas using ARGO profiling floats for the period 2003-2017. Here, we show the results for NWP and for August at 10m, along with the sensitivity of the NQC to the regional subdivisions, i.e., a dynamical and a regular, 5x5 degrees subdivision. In Fig. 2, we show the results of the NQC as compared with the simple standard deviation quality control as defined in WOD18. It is clear that the NQC subtracts the high frequency signals from the climatological estimate more efficiently. Furthermore, it is found that dividing the area in dynamical sub regions makes the NQC procedure converge, rejecting a relatively low number of profiles as compared to regular subdivisions.



(i) (ii) (iii)

Fig. 2: Salinity Field at 10m, (i) only WOD statistical check and (ii) NQC check (regime oriented division) and (iii) NQC check (regular division) after 3rd iteration

References

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