Comparability of oceanic nutrient data:

Use of CRM/RMNS in R/V Mirai cruises to ensure comparability

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1, Introduction

CLIVAR cruises by the R/V Mirai belongs to Japan Agency for Marine-Earth Science and Technology (JAMSTEC) were carried out to study the decadal change of ocean. To study the change, it is important to keep the comparability of measurements among the cruises. To get more accurate and high quality nutrients data, the reference material of nutrients in seawater (RMNS) were produced and used in the 8 CLIVAR cruises during the period from 2003 to 2014. Since 2005, we have assigned RMNSs by ourselves and have been keeping internal comparability among the cruises. In 2014, there were three providers of Certified Reference Material (CRM) of nutrients in seawater. National Meteorology Institute, Japan (NMIJ) certified three levels of CRMs in June 2014. KANSO Technos and JAMSTEC also started to certify RM produced by KANSO since 2015. National Research Council, Canada (NRC) is providing MOOS-3, but nutrients concentration of MOOS-3 was found unstable and significantly lower rather than certified values for nitrate and phosphate when we measured MOOS-3 in 2015. We show the result of our measurements from 2003 to 2015 and introduce the advantages of using CRM in this presentation.

2, Results

CRMs/RMNSs can be used to ensure that the measurement is traceable to the SI and to keep comparability of measurement. The summary of average concentration of CRMs/RMNSs and the summary of measured concentration of NMIJ CRMs show that we have been keeping excellent comparability among the cruises since 2005. In MR15-05 cruise, measured concentrations of CRMs were consistent with certified concentrations within the range of uncertainty, which means that the nutrient determination were traceable to the SI. The analytical precision calculated from the results of repeated measurements of CRMs (n=49) were 0.10% for nitrate at 43.45 μmol/kg, 0.23% for phosphate at 3.071μmol/kg and 0.11% for silicate at 161.20 μmol/kg, respectively. A set of CRMs/RMNSs were used as working standards to obtain calibration curve. We could also estimate uncertainty which depends on nutrients concentrations based on the results of repeated measurement of CRMs/RMNSs, eg. Uncertainty (%) = 0.11 + 0.96 * (1/Csil) + 3.74 * (1/Csil) * (1/Csil) where Csil is silicate concentration. The uncertainty of the measurements in the past CLIVAR cruises was laid within the range of standard deviations calculated from the values of CRMs/RMNSs measured in all the cruises from 2005 to 2015.

Profiles of nutrient concentration at the crossing stations of 6 CLIVAR cruses using-CRMs/RMSs, carried out by three laboratories (JAMCTEC, Scripps Institution of Oceanography and Japan Meteorological Agency) show good agreement in general. The differences in silicate concentration at the crossing stations of P13-P02 and P13-P03 are considered to be caused by the difference in factor of Silicon standard. These profiles show that the use of CRMs/RMNSs can keep the consistency of measurements within and between laboratories.

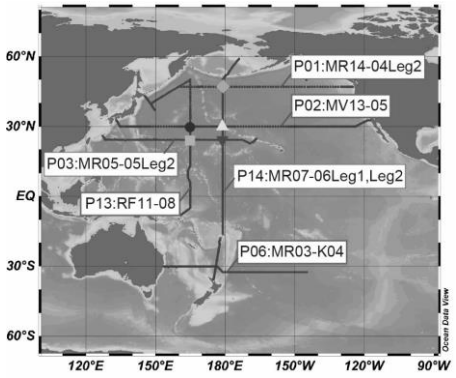
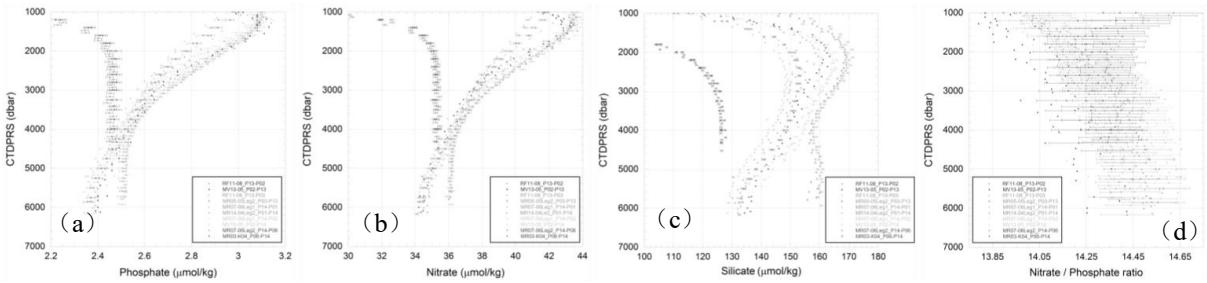


Figure 1. Cruise tracks of 6 CLIVAR cruises carried out by JAMSTEC (MR03-K04, MR05-05Leg2, MR07-06Leg1, Leg2 and MR14-04Leg2), Scripps Institution of Oceanography (MV13-05) and Japan Meteorological Agency (RF11-08).

Figure 2. Profiles of nitrate (a), phosphate (b), silicate (c) and N/P ratio (d) at the crossing stations of P13-P02, P13-P03, P14-P01, P14-P02 and P14-P06 (r=250km).



3. Conclusions

The use of CRMs/RMNSs enabled excellent comparability of measurement and traceability to the SI and we also used CRMs/RMNSs as working standards. We could estimate equations of uncertainty depending on nutrients concentrations and give uncertainty to the measured concentration of samples. The comparisons of profiles of nutrients among three laboratories show the use of CRMs/RMNSs is effective to keep both internal and external comparability.

References

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