

Measurement Uncertainty and GOA-ON

Introduction

A key goal for any *observing network* is to ensure that the measurements made are of appropriate quality for their intended purpose, and that they are comparable one with another; though made at different times, in different places, and in many cases by different instruments, maintained by different groups.

It is thus essential to ascertain (and report) the *uncertainty* of measurements made as part of the GOA-ON, and to characterize the GOA-ON measurement quality goals in terms of such uncertainties. The definition of the term *uncertainty* (of measurement) is:⁽¹⁾

“A parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand.”

NOTE 1 The parameter may be, for example, a standard deviation (or a given multiple of it), or the width of a confidence interval.

NOTE 2 Uncertainty of measurement comprises, in general, many components. Some of these components may be evaluated from the statistical distribution of the results of a series of measurements and can be characterised by experimental standard deviations. The other components, which can also be characterised by standard deviations, are evaluated from assumed probability distributions based on experience or other information.

NOTE 3 It is understood that the result of the measurement is the best estimate of the value of the measurand and that all components of uncertainty, including those arising from systematic effects, such as components associated with corrections and reference standards, contribute to the dispersion.

Thus measurement uncertainty is not a synonym for measurement repeatability or even reproducibility.⁽²⁾ Its evaluation requires a significant investment of effort,⁽³⁾ and has, as yet, rarely been done for any oceanographic measurement procedures, let alone for measurements made remotely using autonomous instrumentation. Nevertheless it is essential that the GOA-ON incorporate this approach from the beginning, and thus measurement quality goals are articulated in this document in terms of the standard uncertainty of the result of a measurement (*i.e.* with the associated confidence interval being equivalent to that for a standard deviation).

It still remains for the GOA-ON effort to develop clear guidelines for estimating this standard uncertainty for each of the separate measurement procedures to be used in the Network. These, in turn, will require the introduction of more formal quality assurance procedures into the various participating laboratories that are responsible for the instruments comprising GOA-ON.

¹ Guide To The Expression Of Uncertainty In Measurement. ISO, Geneva (1993). (ISBN 92-67-10188-9) (Reprinted 1995: Reissued as ISO Guide 98-3 (2008), also available from <http://www.bipm.org> as JCGM 100:2008)

² P de Bièvre, Measurement uncertainty is not a synonym of measurement repeatability or measurement reproducibility . . . *Accred. Qual. Assur.* 13:61–62 (2008).

³ S L R Ellison and A Williams (Eds). Eurachem/CITAC guide: Quantifying Uncertainty in Analytical Measurement, Third edition, (2012) ISBN 978-0-948926-30-3. Available from www.eurachem.org.