



## Uncertainty enabled Sensor Observation Services

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Almost all observations of reality are contaminated with errors, which introduce uncertainties into the actual observation result. Such uncertainty is often held to be a data quality issue, and quantification of this uncertainty is essential for the principled exploitation of the observations. Many existing systems treat data quality in a relatively ad-hoc manner, however if the observation uncertainty is a reliable estimate of the error on the observation with respect to reality then knowledge of this uncertainty enables optimal exploitation of the observations in further processes, or decision making. We would argue that the most natural formalism for expressing uncertainty is Bayesian probability theory.

In this work we show how the Open Geospatial Consortium Sensor Observation Service can be implemented to enable the support of explicit uncertainty about observations. We show how the UncertML candidate standard is used to provide a rich and flexible representation of uncertainty in this context. We illustrate this on a data set of user contributed weather data where the INTAMAP interpolation Web Processing Service is used to help estimate the uncertainty on the observations of unknown quality, using observations with known uncertainty properties.

We then go on to discuss the implications of uncertainty for a range of existing Open Geospatial Consortium standards including SWE common and Observations and Measurements. We discuss the difficult decisions in the design of the UncertML schema and its relation and usage within existing standards and show various options. We conclude with some indications of the likely future directions for UncertML in the context of Open Geospatial Consortium services.