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What is the impact of errors on LCS data information content?

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The measurement of air pollutants is essential for decision-making in order to improve air quality and reduce human health risks. Low-cost sensor (LCS) technologies offer a unique opportunity to expand measurements of key air pollutants, but end users need to consider the capability of a measurement device in relation to the questions being asked of the data. End-users must a priori identify the data requirements and design quantifiable and transparent criteria by which to assess the measurement data. Having a reliable estimate of the measurement uncertainty is thus key to assessing and openly communicating the fitness for purpose of a particular measurement technique for a particular task. Despite their limitations (expensive and time-consuming), and as long as the uncertainties of the reference instrument are stationary and well-characterized, the best way up to now to characterize the LCS error structure is through colocation studies. Despite the complexity of colocation studies, global performance metrics (R2, RMSE, MAE, etc.) are often deemed convenient when assessing the performance and suitability of LCS. However, these simple metrics are limited and sometimes misleading, restricting our understanding of the error structure and therefore the information content of the measurements. In this work we used a selection of instruments -LCSs and reference- to investigate the nature of common air pollution measurement errors and the effect over traditional metrics and other -potentially more insightful- empirical approaches to transparently assess measurement uncertainty, discussing the implications of this on the end-use of LCS.