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Measurement uncertainty quantification: comparison of time-varying uncertainty with error BERNHARD WIENEKE, LaVision GmbH, BARTON SMITH, Utah State University — In fluids measurements, the uncertainty of an instrument is typically fixed or a percentage of the measured value. One expects that the usually unknown true error in the measurement is within the 2-sigma uncertainty 95% of the time. In the present work, the relevance and statistical properties of uncertainties are explored with PIV data but this equally applies to other measured quantities In PIV the measurement error is a function of several image and flow quantities that vary in time and space. Therefore the uncertainty also varies in time and space and is not necessarily a function of the measured velocity. This makes comparison of error and uncertainty much less straight forward. We present several statistical methods of comparing uncertainties with the true errors including coverage factors, histograms, profiles and 2D-plots to assess the quality of uncertainty quantification methods. It can be shown that for the simpler case of no bias errors, the standard deviation of the error should be compared to the standard deviation of the uncertainty. We also compare conditional averages according to seeding density or out-of-plane motion to validate the sensitivity of the methods to different error sources. Results are shown for recently developed PIV uncertainty methods.

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