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uncertainty propagation: ensuring traceability from the laboratory to the field

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Confidence in the quality of infrasound measurements is at the heart of the operational requirements linked to the detection and assessment of geophysical and industrial events. The entire measurement process, from laboratory calibration to the field, must be considered to estimate the confidence level of the measurement through the associated uncertainty. As part of the European Infra-AUV (metrology for low-frequency sound and vibration) project, a field calibration campaign was performed to complete the calibration chain to the sensors in the field. This paper presents a methodology to obtain traceable measurements of the infrasound wave parameters, taking into account the entire calibration traceability chain and other uncertainty sources arising from a thorough analysis of the measurement process. We present an in-situ calibration method of infrasound sensors to be used in conjunction with the Gabrielson on-site calibration to provide field traceability of measurements under varying environmental conditions. In the context of this application, the resulting uncertainties in the back azimuth, between 0.05 and 7°, and trace velocity between 0.2 and 60 m/s (from high to low frequency), were predominantly due to the Gabrielson phase uncertainty. The amplitude uncertainty of approximately 0.2 dB also had significant contributions from the temperature and pressure susceptibilities.

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