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In-situ calibration of seismic sensors recording differential motion to determine rotational ground motion components

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We present an effective in situ calibration of paired sensor records used to determine differential seismic motions. The calibration is of extreme importance when small differential motions are to be recorded, which requires the paired sensors to be 'identical' in terms of their frequency characteristics. These differential motions are subsequently used to derive finite differences approximating spatial derivatives appearing in the expressions for seismic rotations. The calibration method is applicable only when the differential motions are over-determined, i.e. the same difference is measured by more than one pair of sensors of the same type. We demonstrate the calibration method on three illustrative examples: a synthetic test, a series of laboratory tests using a special rotational shaking table, and a measurement of vertical rotation rate due to a small earthquake of M_L=2.7, which occurred within the earthquake swarm in Western Bohemia in autumn 2008. We found good agreement of the calibrated rotation record with the transverse acceleration as predicted by theory.