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Dynamic tilt correction with direct measurements of rotation

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Sensitivity of classical seismic sensors to tilt (rotation around horizontal axes) is a well known and up to now unsolved problem. Especially for long periods ($> 10\,\mathrm{s}$) and strong ground motions, tilt causes a base line drift, that is hard to quantify and introduces huge errors in data analysis, e.g. double integration from acceleration to displacement. With the development of commercial rotational ground motion sensors (e.g. BlueSeis3A by iXblue, France in collaboration with researchers from Ludwig-Maximilians University of Munich, Germany, within the framework of the European Research Council Project, ROMY) field experiments with co-located measurements of 3 components of translational motion and 3 components of rotational motion (6C - measurements) can be carried out. With such a setup, it is possible to directly measure the tilt motion with high sensitivity ($\sim 20\,\mathrm{nrads}^{-1}\mathrm{Hz}^{-1/2}$) in a broad frequency range (0.001 Hz to 50 Hz) and correct translational acceleration recordings for tilt contribution. Here, we describe and discuss new methods for dynamic tilt correction with directly measured rotational motions. Time domain and frequency domain methods are compared and applied on the one hand side to well controllable laboratory tests using a tilt calibration table, and on the other hand side to synthetic data from simulated near-field recordings of volcanic long period events.