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Portable sensor technology for rotational ground motions

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In this contribution we present performance characteristics of a single component interferometric fiber-optic gyroscope (IFOG). The prototype sensor is provided by iXBlue, France. It is tested in the framework of the European Research Council Project, ROMY (Rotational motions – a new observable for seismology), on its applicability as a portable and field-deployable sensor for rotational ground motions. To fully explore the benefits of this new seismic observable especially in the fields of vulcanology, ocean generated noise and geophysical exploration, such a sensor has to fulfill certain requirements regarding portability, power consumption, time stamping stability and dynamic range. With GPS-synchronized time stamping and miniseed output format, data acquisition is customized for the use in seismology. Testing time stamping accuracy yields a time shift of less than 0.0001 s and a correlation coefficient of 0.99 in comparison to a commonly used data acquisition system, Reftek 120. Sensor self-noise is below $5.0 \cdot 10^{-8}$ rads^{-1}Hz$^{-1/2}$ for a frequency band from 0.001 Hz to 5.0 Hz. Analysis of Allan deviation shows an angle random walk of $3.5 \cdot 10^{-8}$ rads^{-1}Hz$^{-1/2}$. Additionally, the operating range diagram is shown and ambient noise analysis is performed. The sensitivity of sensor self-noise to variations in surrounding temperature and magnetic field is tested in laboratory experiments. With a power consumption of less than 10 W, the whole system (single component sensor + data acquisition) is appropriate for field use with autonomous power supply.