Application of optical angular rate sensors for rotational measurements in seismology

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Abstract. The development of large ring lasers allowed for accurate detection of rotational seismic waves over a wide range of amplitudes and frequencies. Due to their insensitivity to translational motion the optical angular rate sensors are very attractive for application in seismology, geodesy and even fundamental physics. However the operation of the large ring lasers in the near-field is difficult due to their mass, size and environmental requirements. Hence the fiber-optic gyros may be used for seismic applications where the mobility is more important and where the high rotation rates are expected. This kind of sensors also can be utilized for correction of standard seismometers subjected to tilt. In this paper we present the current state of experimental research dedicated to application of fiber-optic gyros for seismology. The test results demonstrate that the tactical grade optical sensors are capable of measuring small rotation fluctuations down to 10^{-5} rad/s successfully. However the seismometer correction seems only feasible in the range of rotation rates about 10^{-3} rad/s and higher. This limitation caused by the excessive noise in the output of fiber-optic gyro. The possible measures to overcome this problem are discussed as well as advantages of optical gyros for strong motion seismology.

Keywords: seismic rotation, seismometers, fiber optic gyroscopes.