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Assembly of optical fiber sensors for rotational seismology - data coherence and comparability issues in field application

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Nowadays rotational seismology has become rapidly developing field of study which can deliver completely new perspectives for earthquakes analysis or torsional effects in engineering structures. Rotational seismology as a scientific field has been clarified in 2009 as a field for researching all aspects of rotational ground movements generated by earthquakes, explosions, and ambient vibrations. Nevertheless, technical requirements for sensors in this field are very strict and rigorous, especially taking into account measuring range from 10^{-7} rad/s event up to few rad/s. In order to fulfill all technical requirements for sensors which can be applied in rotational seismology measurements we designed and constructed device based on an optical fiber gyroscope (FOG). Fibre-Optic System for Rotational Events&phenomena Monitoring (FOSREM) is a an interferometric optical fiber sensor designed to continuously observe rotational effects. It uses closed-loop configuration which is based on the compensatory phase measurement method as well as specific electronic system. It should be noticed, that the coupling of the FOSREM's optical part which detects critical low value of signal with specialized electronic system which requires precise analog to digital conversion as well as data transfer with different sampling rate is the source of differences between constructed devices even in the same technology. In this paper we present laboratory investigation of FOSREMs including Allan variance analysis indicating that Angle Random Walk is equal to 10^{-7} rad/s. Expect laboratory verification of proper FOSREMs' operation we carried out field tests taking into account that validity and reliability of the research instruments are crucial during field application. The quality of data utilised in any research determines the outcome of the research and its importance for further research work and relevance to scientific community and knowledge. The data reliability can be determined by comparison between records from several sensors. We present first data from international field research which was focused on efforts to achieve uniformity in collecting and data processing. This experiment involved more than 40 rotational and strain sensors and took place in Geophysical Observatory Fürstenfeldbruck, LMU Munich, Germany. Authors applied four FOSREMs in this

experiment and the presented analysis was focused on their data comparability as well as consistency.