Uncertainty quantification in rotational seismology.

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Ground motions generated by earthquakes have for a long time been addressed by measuring the translational ground motions and used to determine earthquakes source characteristics. In the last decade, rotational seismology became increasingly important, and thus portable sensors were developed and have begun to be sensitive enough to directly measure seismic rotations. Nevertheless, seismic rotations remain computable using the spatial finite differences of the local ground motions that will henceforth be named the rotational measurement method. Analytical cases of a planar wave impacting a network of a chosen geometry were generated in order to determine the limits of this rotational measurement method as well as the major parameters influencing these limits and as such a precision on the determination of the 3-components of rotation was established. This was done for a 2D as well as a 3D array. In the first case, this signifies that a free surface hypothesis was taken into account. The chosen array was located in a model that is relevant to the characteristics of the LSBB (Low background noise underground research Laboratory, France, https://lsbb.eu). A precision on the rotational measurements when using the dense broadband seismic array of the LSBB is thus inferred. From there, this rotational measurement method was applied to a seismic database recorded at the LSBB. Some seismic events on which this method was applied will be shown as well as the uncertainties' quantification on the rotational measurements.

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Exploration of the relations between seismic source moment tensor and seismic rotations.

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Ground motions generated by earthquakes have for a long time been addressed by measuring the translational ground motions and used to determine earthquakes source characteristics. Rotational seismology is a relatively new field of studies and recently, portable sensors have begun to be sensitive enough to directly measure seismic rotations. Nevertheless, seismic rotations remain computable using the spatial finite differences of the local ground motions. Synthetic signals were generated from sources with full moment tensors in order to assess the impacts of the source mechanism on rotational motions. Then a database of rotational motions was created using the dense broadband seismic array of the LSBB (Low background noise underground research Laboratory, France, http://lsbb.eu). This database was built upon seismic events that occurred over a period of 4 years, from 2015-2018. Only seismic events with the following characteristics were selected from the GCMT (Global Centroid Moment Tensor) catalog for this database: a magnitude ≥5, an epicentral distance ≤ 9000 km, a depth <150 km, and the useful frequency band being defined by a Signal-to-Noise Ratio (SNR) > 3. Quantification and analysis of the rotational motion relatively to the seismic events source's properties were inferred and discussed.

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