Focal mechanisms of the aftershocks of the 2000 Western Tottori Earthquake inferred from P wave first-motion data and spatial stress pattern

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A Bayesian approach to estimating a spatial stress pattern was developed [Iwata, 2018, JGR] (hereafter IW2018), and as an extension of this approach Iwata [2018, SSJ fall meeting] has proposed a method to infer focal mechanisms from P wave first-motion data and stress pattern estimated with the Bayesian approach. In this study, this method was applied to a real dataset taken from aftershocks of the 2000 Western Tottori earthquake.

The analyzed P wave first-motion dataset was retrieved from Kawanishi et al. [2009, JGR], which complied records from October 15 to November 30 in 2000. This dataset contains 47,570 P wave first-motions of 3592 events (for details see IW2018). The spatial pattern of stress field was taken from the result of IW2018 that also analyzed the same P wave first-motion dataset. The inferred focal mechanisms show rotation of the azimuth of P-axis around the main fault in the southern area; this feature has been seen in Yukutake and Iio [2017, EPS] and will be the reflection of the stress rotation found in the same area revealed by IW2018.

From the inferred focal mechanisms and spatial stress pattern, the normal and shear stress exerted on the fault plane was evaluated. Then, following the method of Terakawa [2010, Geology], fluid pressure for each of the events was estimated. Two datasets of the fluid pressure in the northern and southern areas of the aftershock areas were constructed and examined whether the two datasets follow the same distribution with the Kolmogorov-Smirnov test. Consequently, the test revealed that the fluid pressure in the southern area is significantly larger than that in the northern area, with a P-value of 1.6e-3.

Keywords: focal mechanism, stress field, stress rotation, P wave first-motion, spatial statistics, fluid pressure

