Improvement of Epicentral Direction Estimation by P-wave Polarization Analysis

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Polarization analysis has been used to analyze the polarization characteristics of waves and developed in various spheres, for example, electromagnetics, optics, and seismology. As for seismology, polarization analysis is used to discriminate seismic phases or to enhance specific phase (e.g., Flinn, 1965)[1], by taking advantage of the difference in polarization characteristics of seismic phases.
In earthquake early warning, polarization analysis is used to estimate the epicentral direction using single station, based on the polarization direction of P-wave portion in seismic records (e.g., Smart and Sproules(1981) [2], Noda et al.,(2012) [3]). Therefore, improvement of the Estimation of Epicentral Direction by Polarization Analysis (EEDPA) directly leads to enhance the accuracy and promptness of earthquake early warning.
In this study, the author tried to improve EEDPA by using seismic records of events occurred around Japan from 2003 to 2013. The author selected the events that satisfy following conditions.
1) MJMA larger than 6.5 (JMA: Japan Meteorological Agency).
2) Seismic records are available at least 3 stations within 300km in epicentral distance.
Seismic records obtained at stations with no information on seismometer orientation were excluded, so that precise and quantitative evaluation of accuracy of EEDPA becomes possible. In the analysis, polarization has calculated by Vidale(1986) [4] that extended the method proposed by Montalbetti and Kanasewich(1970)[5] to use analytical signal.
As a result of the analysis, the author found that accuracy of EEDPA improves by about 15% if velocity records, not displacement records, are used contrary to the author's expectation. Use of velocity records enables reduction of CPU time in integration of seismic records and improvement in promptness of EEDPA, although this analysis is still rough and further scrutiny is essential.
At this moment, the author used seismic records that obtained by simply integrating acceleration records and applied no filtering. Further study on optimal type of filter and its application frequency band is necessary.
In the presentation, the results of aforementioned study shall be shown.
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