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Optimization of hybrid maximum likelihood earthquake location method

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Rapid and accurate determination of earthquake location is one of the most fundamental processes of earthquake early warning systems (EEWSs). However, tradeoffs between speed and accuracy are often observed. For rapid warning, the location should be reliably determined from a limited number of data obtained within much shorter time than traditional methods, while the location accuracy is generally proportional to the number of data. Earthquake location of most EEWSs depends on arrival times of P waves. Therefore it could be helpful for improving the location reliability of the EEWS to be able to utilize other information that could be obtained from P waves. In this study, multiple characteristics of P waves, such as epicenteral distances and back-azimuths, are introduced to the maximum likelihood earthquake location method based on the equal differential time of P arrivals, and optimization of parameters is verified using the Monte Carlo test. The results show that they can contribute greatly to improve the robustness of earthquake location even with a small number of observations.