A new procedure of seismic ray tracing for hypocenter location using a 3-D global velocity structure

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In current hypocenter determination procedures, 1-D radial earth models are used to calculate travel times, and lateral heterogeneities are compensated by using station corrections. However, many studies of seismic tomography have revealed relatively detailed velocity structures in the earth, and I think they can be now used for hypocenter location.

Hypocenter determinations for 3-D structures need to calculate travel times by 3-D ray tracing method. So, I have developed a new procedure of ray tracing for this purpose. This procedure has been modified from the 3-D ray tracing method developed by Koketsu and Sekine (1998), and it can calculate travel times of reflected and refracted rays for 3-D heterogeneous earth models.

In order to check the accuracy of the new 3-D ray tracing procedure, I made simple numerical tests. I put imaginary hypocenters at depths of 0, 50, 100, 150, 200, 250, 300 km, and 900 imaginary stations on the earth's surface at an interval of 0.1 degree for the epicentral distance range of 0-90 degrees. Then I calculated travel-times of P, S, PP, SS, pP, sS, PcP, and ScS by the new procedure for the iasp91 radial earth model (Kennett and Engdahl, 1991), and compared calculated travel times with the iasp91 travel-time table. The results have been satisfactory, and I think that the accuracy of the procedure is enough to be used for hypocenter determination.

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