WAVEFIELD EXTRAPOLATION TECHNIQUES FOR INHOMOGENEOUS MEDIA WHICH INCLUDE CRITICAL ANGLE EVENTS. I. ONE-WAY EXTRAPOLATION OPERATORS (325)

C. P. A. WAPENAAR AND A. J. BERKHOUT

In modelling as well as in migration schemes the assumption is generally made that the seismic wavefield may be split into downgoing and upgoing waves which propagate without interaction. This assumption is only justified for multiple-free and sub-critical angle events, which are governed by the one-way wave equations. In seismic literature much attention has been paid to the behaviour of the seismic wavefield in the vicinity of turning planes. At a turning plane the propagation direction of a wave is changed from downgoing into upgoing or vice versa, due to a vertical gradient in the propagation velocity. Generally, this phenomenon is referred to as critical angle event. Modelling and migration schemes cannot simply be extended for the incorporation of critical angle events if the coupling near the turning plane of propagating downgoing and upgoing waves is neglected. Several alternative modelling approaches have been proposed, based on the WKBJ technique, which properly include critical angle events. Unfortunately, these approaches are not suitable for migration and inversion applications.

In this part of the paper the one-way wave equations will be reviewed and an alternative decomposition near the turning plane into downgoing and upgoing waves will be presented. Based on this approach, forward and inverse wavefield extrapolation operators are defined which include critical angle events. Applications of these operators in modelling, migration and inversion schemes will be discussed in part II.

Delft University of Technology, Delft, The Netherlands.