Conclusions This thesis focuses on using novel generalized wavefields, the image-space generalized wavefields, to increase the computational efficiency and improve flexibility of ISWET specially in 3D. The computational efficiency is achieved by the data reduction and the use of a target-oriented strategy enabled by image-space generalized wavefields. The flexibility comes from the fact that key horizons are selected to initiate the wavefields, which naturally incorporates a horizon based strategy into ISWET and enables to lateraly limit the velocity updates. Although the thesis concentrates on migration-velocity analysis by wavefield methods, the images obtained with image-space generalized wavefields can also be used in migration-velocity analysis by ray-based methods.

Chapter **??** addresses the modeling of image-space generalized wavefields using the pre-stack exploding-reflector model. Pre-stack migrated images computed by wave-extrapolation methods are used as the initial conditions for the modeling. I describe all the necessary steps to generate kinematically correct wavefields, so that the moveout information for migration-velocity analysis is maintained. I show that in 3D data size reduction is significant, specially when using common-azimuth migrated images as the initial conditions. In this case, the number of wavefields is decreased by an order of magnitude when compared to that modeled with multi-azimuth migrated images.

Chapter **??** takes further data reduction obtained in Chapter **??** by increasing the number of wavefields simultaneously modeled combined with phase-encoding techniques to mitigate crosstalk. I describe how crosstalk is created and propose different strategies for attenuating it.

Chapter **??** extends ISWET from the shot-profile domain to the image-space generalized-sources domain. I describe how the gradient of the DVSA objective function is obtained with wavefields defined in this new domain and give examples on the velocity optimization using the Marmousi model. ISWET was solved in a target-oriented way and the optimized migration-velocity models adequately describe the long-wavelength components of the true velocity models. The migrated images using these optimized models show remarkably good quality.

Chapter **??** applies the theory developed in the previous chapters to a 3D-field data from the North Sea. The challenges this dataset introduces are the amplitude variation due to acquisition footprints, the insufficient illumination due to the narrow azimuth distribution in the presence of an irregular salt body, and the short offsets. Moreover, the lack of geological information to define the salt body shape represents the main uncertainty for the velocity model definition; nevertheless, the final optimized velocity model yields a migrated image of superior quality compared to that obtained with the initial model. The final image also presents superior quality when compared to the image computed with the velocity model available in SEP's database, showing better-focused and continuous sub-salt reflectors and better fault imaging.

The computational efficiency and flexibility achieved with image-space generalized wavefields enables the use of ISWET as a routine procedure to define the 3Dmigration-velocity model in areas of complex geology.