CLAIMS

1. A method, comprising:

storing, in a computer storage device, geophysical seismic data that has been separated into a multiple-free component and a multiple contaminated component;

performing, with a processor, a first full wavefield inversion process on the multiple-free component of the seismic data, wherein a first subsurface physical property model is generated;

determining, with a processor, an extended target reflectivity, wherein the extended target reflectivity includes a reflectivity for each of a plurality of shots;

separately performing, with a processor, a second full wavefield inversion process with the multiple contaminated component of the seismic data for each of the plurality of shots using the reflectivity corresponding to each of the plurality of shots, wherein a second subsurface physical property model is generated;

generating, with a processor, multiple-free final subsurface physical property model by combining the first subsurface physical property model and the second subsurface physical property model; and

creating, with a processor, an image of the subsurface region from the multiple-free final subsurface physical property model.

2. The method of any preceeding claim, further comprising:

using the multiple-free final subsurface physical property model in interpreting a subsurface region for hydrocarbon exploration or production.

3. The method of any preceeding claim, wherein the extended target reflectivity is used as a starting model in the second full wavefield inversion process in order to minimize reflections from the target reflector.

4. The method of any preceeding claim, wherein the target reflector is a water bottom.

5. The method of any preceeding claim, wherein the target reflector is a salt body.

6. The method of any preceeding claim, wherein the determining includes determining the unique reflectivity of the target reflector for each of the plurality of shots from an iterative inversion of the multiple contaminated component of the seismic data, wherein reflectivity is the only inversion variable.

7. The method of claim 6, wherein the inversion parameter is muted everywhere in the iterative inversion but at the target reflector in order to obtain the reflectivity of the target reflector for each shot separately.

8. The method of claim 6 or 7, wherein the extended target reflectivity is used as a starting model in the second full wavefield inversion process, and the second full wavefield inversion process is applied to the multiple contaminated component.

9. The method of any preceeding claim, wherein the extended target reflectivity includes a unique reflectivity of the target reflector for each shot.