

CLAIMS

What is claimed is:

1. A method, comprising:
 - 5 receiving seismic data inclusive of data that corresponds to reflections from a target below a distorting velocity feature in a subsurface, wherein the presence of the distorting velocity feature results in distortion to a seismic image;
adding a velocity perturbation to a current velocity model that represents a portion of the subsurface responsible for the distortion to the seismic image, in order to generate a
10 perturbed velocity model;
generating an image via seismic migration of the seismic data and the perturbed velocity model;
generating and assigning a measure of quality to the image;
determining whether the measure of quality assigned to the image is an optimal
15 measure of quality at a particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image; and
updating the current velocity model utilized to generate the seismic image to generate a revised velocity model utilizing the measure of quality assigned to the image when the measure of quality assigned to the image is determined to be the optimal measure of quality
20 at the particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.
2. The method of claim 1, comprising determining whether an additional velocity perturbation is to be added to the current velocity model that represents the portion of the

subsurface responsible for the distortion to the seismic image to generate a second perturbed velocity model.

3. The method of claim 2, comprising adding a second velocity perturbation to the
5 current velocity model that represents the portion of the subsurface responsible for the distortion to the seismic image to generate the second perturbed velocity model when it is determined that the additional velocity perturbation is to be added to the current velocity model.

10 4. The method of claim 3, comprising:
generating a second image utilizing the second perturbed velocity model; and
generating and assigning a second measure of quality to the second image.

5. The method of claim 4, comprising determining whether the second measure of
15 quality assigned to the second image is the optimal measure of quality at the particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.

6. The method of claim 5, comprising updating the current velocity model utilized to
20 generate the seismic image to generate the revised velocity model utilizing the second measure of quality assigned to the second image when the second measure of quality assigned to the second image is determined to be the optimal measure of quality at the particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.

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7. The method of claim 1, comprising determining whether an additional velocity perturbation is to be added to the current velocity model at a second location of the current velocity model.

5 8. The method of claim 7, comprising adding a second velocity perturbation to the current velocity model at the second location to generate a second perturbed velocity model when it is determined that the additional velocity perturbation is to be added to the current velocity model at the second location of the current velocity model.

10 9. The method of claim 8, comprising:
generating a second image utilizing the second perturbed velocity model; and
generating and assigning a second measure of quality to the second image.

10. The method of claim 9, comprising determining whether the second measure of
15 quality assigned to the second image is a second optimal measure of quality at the second location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.

11. The method of claim 10, comprising updating the current velocity model utilized to
20 generate the seismic image to generate a second revised velocity model utilizing the second measure of quality assigned to the second image when the second measure of quality assigned to the second image is determined to be the second optimal measure of quality at the second location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.

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12. The method of claim 11, comprising generating an updated current velocity model by summing the revised velocity model and the second revised velocity model.

13. The method of claim 12, comprising:

- 5 generating a second seismic image utilizing the updated current velocity model,
wherein the second seismic image represents hydrocarbons in a subsurface region of Earth or
subsurface drilling hazards; and
determining whether a quality of the second seismic image meets a threshold value.

10 14. The method of claim 13, comprising:

refining a scale of width of a perturbation in at least one direction subsequent to a
determination that the quality of the second seismic image does not meet the threshold value;

updating the current velocity model with the updated current velocity model;

adding a third velocity perturbation to the current velocity model to generate a third

15 perturbed velocity model;

generating a third image utilizing the third perturbed velocity model;

generating and assigning a third measure of quality to the third image;

determining whether the third measure of quality assigned to the third image is a third
optimal measure of quality at the particular location of the current velocity model; and

20 updating the current velocity model utilized to generate the seismic image to generate
a third revised velocity model utilizing the third measure of quality assigned to the third
image when the third measure of quality assigned to the third image is determined to be the
third optimal measure of quality at the particular location of the current velocity model.

15. A tangible, non-transitory, machine-readable media, comprising instructions that when executed cause a processor to:

receive seismic data inclusive of data that corresponds to reflections from a target below a distorting velocity feature in a subsurface, wherein the presence of the distorting

5 velocity feature results in distortion to a seismic image;

add a velocity perturbation to a current velocity model that represents a portion of the subsurface responsible for the distortion to the seismic image, in order to generate a perturbed velocity model;

10 generate an image via seismic migration of the seismic data and the perturbed velocity model;

generate and assign a measure of quality to the image;

determine whether the measure of quality assigned to the image is an optimal measure of quality at a particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image; and

15 update the current velocity model utilized to generate the seismic image to generate a revised velocity model utilizing the measure of quality assigned to the image when the measure of quality assigned to the image is determined to be the optimal measure of quality at the particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.

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16. The tangible, non-transitory, machine-readable media of claim 15, comprising instructions that when executed cause the processor to:

add a second velocity perturbation to the current velocity model that represents the portion of the subsurface responsible for the distortion to the seismic image to generate a

second perturbed velocity model when it is determined that an additional velocity perturbation is to be added to the current velocity model;

generate a second image utilizing the second perturbed velocity model; generate and assign a second measure of quality to the second image; and

5 determine whether the second measure of quality assigned to the second image is the optimal measure of quality at the particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.

17. The tangible, non-transitory, machine-readable media of claim 16, comprising
10 instructions that when executed cause the processor to update the current velocity model utilized to generate the seismic image to generate the revised velocity model utilizing the second measure of quality assigned to the second image when the second measure of quality assigned to the second image is determined to be the optimal measure of quality at the particular location of the current velocity model that corresponds to the portion of the
15 subsurface responsible for the distortion to the seismic image.

18. The tangible, non-transitory, machine-readable media of claim 15, comprising instructions that when executed cause the processor to:

determine whether an additional velocity perturbation is to be added to the current
20 velocity model at a second location of the current velocity model;
add a second velocity perturbation to the current velocity model at the second location to generate a second perturbed velocity model when it is determined that the additional velocity perturbation is to be added to the current velocity model at the second location of the current velocity model;

25 generate a second image utilizing the second perturbed velocity model;

- generate and assign a second measure of quality to the second image; and
- determine whether the second measure of quality assigned to the second image is a second optimal measure of quality at the second location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic
- 5 image.
19. The tangible, non-transitory, machine-readable media of claim 18, comprising instructions that when executed causes the processor to update the current velocity model utilized to generate the seismic image to generate a second revised velocity model utilizing
- 10 the second measure of quality assigned to the second image when the second measure of quality assigned to the second image is determined to be the second optimal measure of quality at the second location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image.
- 15 20. A device, comprising:
- a processor that when in operation:
- receives seismic data inclusive of data that corresponds to reflections from a target below a distorting velocity feature in a subsurface, wherein the presence of the distorting velocity feature results in distortion to a seismic image;
- 20 adds a velocity perturbation to a current velocity model that represents a portion of the subsurface responsible for the distortion to the seismic image, in order to generate a perturbed velocity model;
- generates an image via seismic migration of the seismic data and the perturbed velocity model;
- 25 generates and assign a measure of quality to the image;

determines whether the measure of quality assigned to the image is an optimal measure of quality at a particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the seismic image; and

- 5 updates the current velocity model utilized to generate the seismic image to generate a revised velocity model utilizing the measure of quality assigned to the image when the measure of quality assigned to the image is determined to be the optimal measure of quality at the particular location of the current velocity model that corresponds to the portion of the subsurface responsible for the distortion to the
- 10 seismic image.