downward through the Earth, is reflected, and, upon its return, is recorded using one or more receivers disposed on or above the subsurface region of the Earth. The seismic data recorded by the receivers may then be used to create an image or profile of the corresponding subsurface region.

[0005] Over time, as hydrocarbons are being extracted from the subsurface region of the Earth, the location, saturation, and other characteristics of the hydrocarbon reservoir and (e.g., overburden) within the subsurface region may change. As such, it may be useful to determine how the image or map of the subsurface region changes over time, such that the operations related to extracting the hydrocarbons may be modified to more efficiently extract the hydrocarbons from the subsurface region of the Earth.

SUMMARY

[0006] A summary of certain embodiments disclosed herein is set forth below. It should be understood that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.

[0006a] According to a first aspect of the present invention, there is provided a method for aligning a plurality of seismic images associated with a subsurface region of the Earth, including: receiving, via a processor, the plurality of seismic images acquired via one or more seismic surveys, wherein the plurality of seismic images represents the subsurface region of the Earth; determining, via the processor, a first respective relative shift volume between a first seismic image of the plurality of seismic images and a second seismic image of the plurality of seismic images, a second respective relative shift volume between the first seismic image and a third seismic image of the plurality of seismic images, and a third respective relative shift volume between the second seismic image of the plurality of seismic images and the third seismic image of the plurality of seismic images; determining a first shift volume associated with the first

seismic image and a second shift volume associated with the second seismic image based on the first, second, and third respective relative shift volumes; and applying, via the processor, the first shift volume to the first seismic image and the second shift volume to the second seismic image to generate a first shifted seismic image and a second shifted seismic image, respectively, wherein the first and second shifted seismic images are aligned with each other and indicate one or more properties of hydrocarbon deposits within the subsurface region of the Earth.

[0006b] According to a second aspect of the present invention, there is provided a non-transitory computer-readable medium, including computer-executable instructions configured to cause a processor to: (a) receive a plurality of seismic images acquired via a plurality of seismic sensors, wherein the plurality of seismic images represents a subsurface region of the Earth; (b) receive a number K of index images; (c) assign one of the plurality of seismic images as a pilot image; (d) determine a first respective relative shift volume between the pilot image and each seismic image of the plurality of seismic images within the number K of index images to the pilot image; (e) repeat blocks (c) and (d) for each remaining seismic image of the plurality of seismic images as the pilot image, thereby determining a plurality of relative shift volumes; (f) determine N number of shift volumes based on the plurality of relative shift volumes, wherein the N number corresponds to a number of the plurality of seismic images received, and wherein each respective shift volume of the N number of shift volumes corresponds to a respective seismic image of the plurality of seismic images; and (g) apply each respective shift volume of the N number of shift volumes to the respective seismic image of the plurality of seismic images, thereby generating a plurality of shifted seismic images, wherein each of the plurality of shifted seismic images are aligned with each other and indicate one or more properties of hydrocarbon deposits within the subsurface region of the Earth.

[0006c] According to a third aspect of the present invention, there is provided a method for drilling into a subsurface region of the Earth, including: analyzing a plurality of shifted seismic images associated with the subsurface region, wherein each of the plurality of shifted seismic images is aligned with each other; and performing one or more drilling operations or one or more

production operations into the subsurface region based on an analysis of the plurality of shifted seismic images, wherein the plurality of shifted seismic images is determined by: receiving, via a processor, a plurality of seismic images acquired in one or more seismic surveys, wherein the plurality of seismic images represents the subsurface region of the Earth; determining, via the processor, a first respective relative shift volume between a first seismic image of the plurality of seismic images and a second seismic image of the plurality of seismic images, a second respective relative shift volume between the first seismic image and a third seismic image of the plurality of seismic images, and a third respective relative shift volume between the second seismic image of the plurality of seismic images and the third seismic image of the plurality of seismic images; determining a first shift volume associated with the first seismic image and a second shift volume associated with the second seismic image based on the first, second, and third respective relative shift volumes; and applying, via the processor, the first shift volume to the first seismic image and the second shift volume to the second seismic image to generate a first shifted seismic image and a second shifted seismic image, respectively, of the plurality of shifted seismic images.

[0006d] According to a fourth aspect of the present invention, there is provided a method for aligning a plurality of seismic images associated with a subsurface region of the Earth, including: receiving, via a processor, the plurality of seismic images acquired via one or more seismic surveys, wherein the plurality of seismic images represents the subsurface region of the Earth; determining, via the processor, a first respective relative shift volume between a first seismic image of the plurality of seismic images and a second seismic image of the plurality of seismic images, a second respective relative shift volume between the first seismic image and a third seismic image of the plurality of seismic images, and a third respective relative shift volume between the second seismic image of the plurality of seismic images and the third seismic image of the plurality of seismic images; determining a first shift volume associated with the first seismic image and a second shift volume associated with the second seismic image based on the first, second, and third respective relative shift volumes; and applying, via the processor, the first shift volume to the first seismic image and the second shift volume to the second seismic image

to generate a first shifted seismic image and a second shifted seismic image, respectively, wherein the first and second shifted seismic images are aligned with each other and indicate one or more properties of hydrocarbon deposits within the subsurface region of the Earth.

[0006e] According to a fifth aspect of the present invention, there is provided a non-transitory computer-readable medium, including computer-executable instructions configured to cause a processor to: (a) receive a plurality of seismic images acquired via a plurality of seismic sensors, wherein the plurality of seismic images represents a subsurface region of the Earth; (b) receive a number K of index images; (c) assign one of the plurality of seismic images as a pilot image; (d) determine a first respective relative shift volume between the pilot image and each seismic image of the plurality of seismic images within the number K of index images to the pilot image; (e) repeat blocks (c) and (d) for each remaining seismic image of the plurality of seismic images as the pilot image, thereby determining a plurality of relative shift volumes; (f) determine N number of shift volumes based on the plurality of relative shift volumes, wherein the N number corresponds to a number of the plurality of seismic images received, and wherein each respective shift volume of the N number of shift volumes corresponds to a respective seismic image of the plurality of seismic images; and (g) apply each respective shift volume of the N number of shift volumes to the respective seismic image of the plurality of seismic images, thereby generating a plurality of shifted seismic images, wherein each of the plurality of shifted seismic images are aligned with each other and indicate one or more properties of hydrocarbon deposits within the subsurface region of the Earth.

[0007] Seismic data processing, such as seismic data registration, may involve determining a multi-dimensional displacement volume (which may be a shift solution indicative of position differences between corresponding events in two seismic images or datasets). Generally, the two seismic images may be acquired at two different times, but it should be noted that the seismic data registration techniques may also be performed using two seismic images acquired at the same time in order to align them (or to resolve