CLAIMS

1. A method for use in seismic exploration of a region of the subsurface of the earth, wherein is provided a plurality of continuously recorded seismic traces collected in a seismic survey conducted proximate to the region of the subsurface of the earth, each of said traces being recorded by a receiver having a clock, the method comprising the steps of:

(a) identifying a plurality of proximate trace pairs, each proximate trace pair comprising a first trace recorded by a first receiver and a second trace recorded by a second receiver proximate to said first receiver, wherein the second receiver is proximate to the first receiver if it records signals from the same seismic event;

(b) for each of said proximate trace pairs, determining a relative time shift between said first trace and said second trace;

(c) inverting said relative time shifts determined in step (b) to obtain a clock drift estimate for each of the clocks of said first and second receivers by solving the equation:

$$\begin{bmatrix} 1 & -1 & \dots & 0 & 0 \\ 1 & 0 & -1 & \dots & 0 \\ \vdots & & & & \vdots \\ 0 & 0 & \dots & 1 & -1 \end{bmatrix} \begin{bmatrix} \Delta t_1 \\ \Delta t_2 \\ \vdots \\ \Delta t_N \end{bmatrix} = \begin{bmatrix} \Delta_{1,2} \\ \Delta_{1,3} \\ \vdots \\ \Delta_{N-1,N} \end{bmatrix}$$

for Δt_i , $i = 1, N$,

where Δt_i is said clock drift estimate associated with an *ith* one of said clocks of said first and second receivers,

where N is a number of said clocks of said first and second receivers, and,

where Δ_{kj} is said relative time shift between a *kth* one of said first traces and a jth one of said second traces; and

(d) using said clock drift estimates obtained in step (c) to time correct the first and second traces of each proximate trace pair, thereby forming a plurality of time-corrected seismic traces representative of the subsurface of the earth.

2. The method according to claim 1, wherein step (a) comprises the steps of:

(a1) identifying a plurality of proximate trace pairs, each proximate trace pair comprising a first trace recorded by a first receiver and a second trace recorded by a second receiver proximate to said first receiver;

(a2) for the clock in each of said first and second receivers, selecting a shooting time window;

(a3) calculating a linear estimate of a drift correction for each of said clocks during said shooting time window; and

(a4) adjusting said first and second traces in time according to the calculated linear estimate of said drift correction for the corresponding clock.

3. The method according to claim 1 or claim 2, further comprising identifying at least two trace sections for each of said first and second traces, and performing steps (a) to (d) separately for each of the trace sections, thereby forming a plurality of time-corrected traces representative of the subsurface of the earth wherein each time-corrected trace comprises at least two sections of time-corrected trace using the clock drift estimate obtained for the respective section of trace.

4. The method according to any one of the preceding claims, wherein the relative time shift between said first trace and said second trace is determined in step (b) by determining the relative time shifts between a plurality of shot records comprised in said first trace and corresponding shot records in said second trace, and determining the average of said relative time shifts between said corresponding shot records.

5. The method according to any one of the preceding claims, further comprising the step of, for each proximate trace pair, applying a kinematic correction to remove the effect of differential arrival times between the first and second receivers associated with said proximate trace pair.

6. The method according to claim 5, wherein said kinematic correction is an NMO correction or an LMO correction.

7. The method according to any one of the preceding claims, wherein determining said relative time shift in step (b) comprises calculating a cross-correlation between said first and second traces.

8. The method according to any one of the preceding claims, whereby at least one of said receivers has a clock which is an accurate clock, and wherein step (c) further comprises setting the clock drift estimate associated with said accurate clock to zero in the equation.

9. The method according to any one of the preceding claims, wherein the proximate trace pairs are identified in step (a) such that each proximate trace pair is associated with at least one other proximate trace pair.

10. The method according to any one of the preceding claims, further comprising the steps of:

(e) using said plurality of time-corrected seismic traces to image at least a portion of said region of the subsurface of the earth; and

(f) using said imaged region of the subsurface of the earth in exploration for hydrocarbons within the region of the subsurface of the earth.

11. The method of any one of the preceding claims, wherein step (c) further comprises identifying a trend in the clock drift estimates for each of the clocks of said first and second receivers and removing said trend from said clock drift estimates, thereby forming de-trended clock drift estimates for each of the clocks of the first and second receivers;

and wherein step (d) comprises using said de-trended clock drift estimates obtained in step (c) to time correct the first and second traces of each proximate trace pair, thereby forming a plurality of time-corrected seismic traces representative of the subsurface of the earth.

12. A method of seismic exploration of a region of the subsurface of the earth, wherein is provided a plurality of continuously recorded seismic traces collected in a seismic survey conducted proximate to the region of the subsurface of the earth, each of said traces being recorded by a receiver having a clock, the method comprising the steps of:

(a) accessing a plurality of time-corrected traces created by a method comprising the steps of:

(i) identifying a plurality of proximate trace pairs, each proximate trace pair comprising a first trace recorded by a first receiver and a second trace recorded by a second receiver proximate to said first receiver, wherein the second receiver is proximate to the first receiver if it records signals from the same seismic event;

(ii) for each of said proximate trace pairs, determining a relative time shift between said first trace and said second trace;

(iii) inverting the relative time shifts determined in step (ii) to obtain a clock drift estimate for the clocks of the first and second receivers, by solving the equation:

$$\begin{bmatrix} 1 & -1 & \dots & 0 & 0 \\ 1 & 0 & -1 & \dots & 0 \\ \vdots & & & & \vdots \\ 0 & 0 & \dots & 1 & -1 \end{bmatrix} \begin{bmatrix} \Delta t_1 \\ \Delta t_2 \\ \vdots \\ \Delta t_N \end{bmatrix} = \begin{bmatrix} \Delta_{1,2} \\ \Delta_{1,3} \\ \vdots \\ \Delta_{N-1,N} \end{bmatrix}$$

for Δt_i , $i = 1, N$,

where Δt_i is said clock drift estimate associated with an *ith* one of said clocks of said first and second receivers,

where N is a number of said clocks of said first and second receivers, and,

where Δ_{kj} is said relative time shift between a *kth* one of said first traces and a jth one of said second traces; and

(iv) using the clock drift estimates obtained in step (iii) to time correct the first and second traces of each proximate trace pair, thereby forming a plurality of time-corrected seismic traces representative of the subsurface of the earth;

(b) using said accessed time-corrected seismic traces to image at least a portion of said region of the subsurface of the earth; and

(c) using said imaged at least a portion of the subsurface of the earth in exploration for hydrocarbons within the region of the subsurface of the earth.