CLAIMS

1. A method for estimation of electromagnetic earth responses for a marine electromagnetic survey, comprising:

estimating initial values of the electromagnetic earth responses and ambient noise applicable to the marine electromagnetic survey; and

processing electromagnetic data based on the initial values of the electromagnetic earth responses and the ambient noise to obtain a joint estimation of updated values of the electromagnetic earth responses and the ambient noise, wherein the electromagnetic data was acquired with one or more electromagnetic sensors, wherein the electromagnetic data contains measurements of an electromagnetic field, characterised in that

the processing comprises

recursively updating probability distributions of the electromagnetic earth responses and the ambient noise using the electromagnetic data.

2. The method of claim 1, further comprising averaging the initial estimate of the electromagnetic earth responses.

3. The method of claim 1 or claim 2, wherein the processing the electromagnetic data is performed with a Kalman filter.

4. The method of any of the preceding claims further comprising producing a geophysical data product from at least the joint estimation of the updated values, storing the geophysical data product on a tangible, non-volatile machine-readable medium suitable for importing onshore, importing the geophysical data product onshore and performing further data processing or geophysical analysis on the geophysical data product.

5. The method of any of the preceding claims, wherein the joint estimating is performed for electromagnetic earth responses and parameters related to the ambient noise.

6. The method of any of the preceding claims, further comprising acquiring the electromagnetic data for the marine electromagnetic survey using the electromagnetic sensors, wherein the electromagnetic sensors are disposed on a receiver array that is at least one of located on a streamer towable by a survey vessel, located on an ocean bottom cable, or fixed at or near a water bottom, and activating an electromagnetic energy source to generate the electromagnetic field.

7. A system, comprising

a data processing system configured to at least:

(i) estimate initial values of electromagnetic earth responses and ambient noise applicable to a marine electromagnetic survey; and

(ii) process the electromagnetic data measured using the electromagnetic sensors to obtain a joint estimation of updated values of the electromagnetic earth responses and the ambient noise, wherein the processing is based on the initial values of the electromagnetic earth responses and the ambient noise,

characterised in that the data processing system is further configured to

recursively update probability distributions of the electromagnetic earth responses and the ambient noise in the processing the electromagnetic data.

8. The system of claim 7, wherein the data processing system is configured to determine subsurface resistivities using at least the updated values of the electromagnetic earth responses.

9. The system of claim 7 or claim 8, wherein the receiver array is configured to be at least one of located on a streamer towable by a survey vessel, located on an ocean bottom cable, or fixed at or near at a water bottom.

10. The system of any of claims 7 to 9, wherein the data processing system is configured to not use the electromagnetic data from the electromagnetic sensors in the estimation of the initial values.

11. The system of any of claims 7 to 10, wherein the electromagnetic sensors comprise at least one of receiver electrodes or magnetometers.

12. A non-transitory machine-readable medium storing instructions executable by a processing resource to cause the machine to perform the method of any of claims 1 to 3.

13. The non-transitory machine-readable medium of claim 12, wherein the instructions further cause the machine to extract prior probability distribution using Gaussian formulations in the estimation of initial values.