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Coffin Bay Ground EM Survey – Town Water Supply

Tim Munday, Kevin Cahill, Camilla Sorensen, Marta Sosnicka and Mike Hatch

Technical Report No: EP2025-4385

18 Nov 2025.

Government of South Australia
Department for Environment and Water

CSIRO Mineral Resources

Citation

Tim Munday, Kevin Cahill, Camilla Sorensen, Marta Sosnicka and Mike Hatch (2025) Coffin Bay Ground EM Survey – Town Water Supply. CSIRO Technical Report EP2025-4385; CSIRO Australia. 144pp

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Acknowledgments

CSIRO acknowledges the support of the Department of Environment and Water in the instigation and conduct of this project, particularly Kate Hyland and Kent Inverarity. We also acknowledge the support of Shaun Ambrose at SA Water and Craig Nielson of Energy Australia for facilitating site access.

1 Introduction

Background

Groundwater in the Eyre Peninsula of South Australia is scarce with potable resources primarily limited to shallow aquifers which can recharge rapidly located on the western coastal margin and the southern tip of the Peninsula. These groundwater resources, also referred to as lenses, occur within the unconfined Quaternary limestone aquifer (the Bridgewater Formation). The lens systems at Coffin Bay township are of particular significance as they constitute the main source of reticulated public water supply. However, they are also affected by climate change, resulting in reduced recharge and the threat of increasing salinity.

A recent investigation of TEMPEST airborne electromagnetic data (Munday et al. 2025) indicated that the saltwater intrusion around Coffin Bay extends beneath the town water supply with a variable geometry (Figure 1-1). Modelling of these data suggested that the interface is elevated beneath the bore field as indicated in the conductivity-depth section for flight line 10260 (Figure 1-1 – lower section). The study of the TEMPEST data proposed the conduct of a ground transient electromagnetic program to confirm the modelling and interpretation of the AEM data. Suggested ground transects for the study are shown in Figure 1-2.

Objectives

The objectives of this study were to:

1. Undertake a targeted ground geophysical data acquisition program, using a mobile ground time domain electromagnetic system, near the Coffin Bay town water supply bores;
2. Model the subsurface conductivity structure from these data to define the depth to the saltwater interface beneath, and adjacent to the town water supply bores; and
3. Assess the results against modelled TEMEPST AEM data and borehole inductive conductivity data to corroborate the TEMPEST AEM results and assess whether there was any evidence of finer-scale up-coning in the vicinity of the bores.

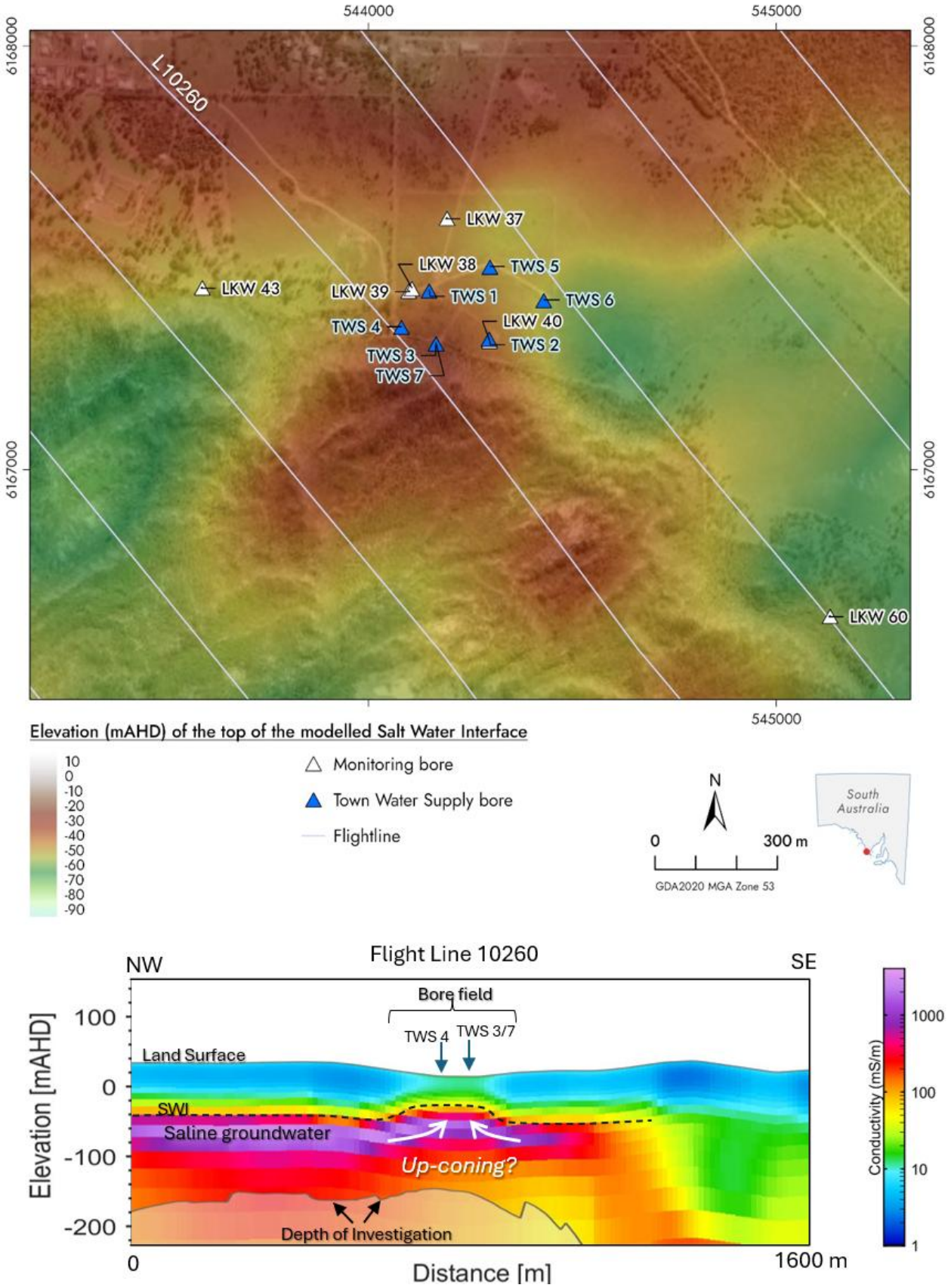


Figure 1-1: Map showing the modelled elevation of the saltwater interface from TEMPEST AEM data (top) in the vicinity of the Coffin Bay town water supply bore field. The lower panel shows a conductivity-depth section for flight line 10260 that transects the bore field on its southern margin.

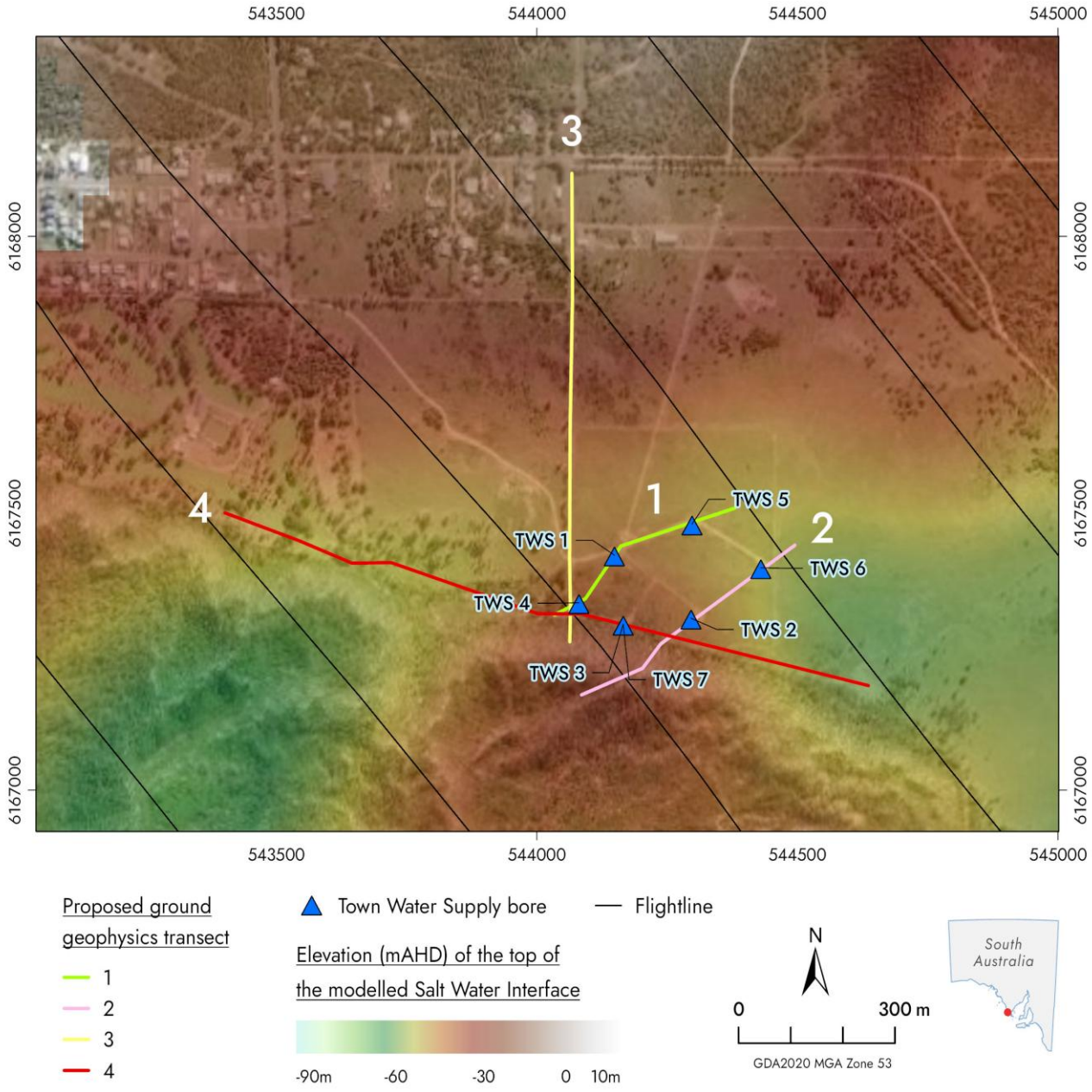


Figure 1-2: Coffin Bay study area with town water supply and monitoring bores overlain on a model of the elevation of the salt water interface derived from the modelling of TEMPEST AEM data. Initially proposed transects for the ground geophysical survey are also shown.

2 Methodology

Ground EM systems

Consideration was given to two ground EM systems for the verification of the findings arising from the focussed modelling of TEMPEST AEM data detailed in Munday et al. (2005). In that study, modelling of the AEM data suggested that the interpreted saltwater interface (SWI) beneath the town water supply bores was approximately 50m below the ground surface. The inverted TEMPEST data indicated that the near surface was resistive and that the SWI represented the main conductive interface encountered in the profile. For a ground investigation we also considered loop size and system geometry for the study site, given the limited size of the study area.

The sTEMProfiler (Maurya et al. 2024) and the Loupe (Street et al. 2018, Street and Duncan 2024) ground transient EM systems were assessed for their suitability. Prior experience with the Loupe system indicated that difficulties involved in adequate system characterisation, a key requirement for accurate modelling, meant that it was not the preferred option, and that the sTEMProfiler was better suited to the addressing the objectives of the study and the constraints of the area.

sTEMProfiler

The sTEMProfiler transient EM system uses a 3x3 m^2, 2-turn transmitter coil and a 3x3 m^2, 4-turn receiver coil (Table 1), in a configuration detailed in Figure 2-1. The offset between transmitter and receiver loops is ~10 m with the transmitter/receiver instrument (yellow box) positioned between the two. A 10Amp transmitter was used for the Coffin Bay survey, operating in a dual moment mode. The Low Moment (LM) operates with a current of 1Amp, and the High moment (HM) has a current of 10Amps. Low Moment data are sensitive to conductivity variations in the near surface, while the High Moment is more sensitive to deeper conductivity variation.

Table 1: Specifications of the sTEMProfiler

Transmitter (Tx) moment: Receiver Rx:	180 Am2 (2 turns, 10 Amp, 3x3m) 4 turns
Gate times:	12 us – 2.5 ms
Repetition rate:	218 Hz
Depth of investigation:	~50-100 m (model dependent)

Depending on the noise environment, data collection occurs over 1-to-5-minute interval, with soundings acquired from ~10-20m apart depending on survey requirements. The field configuration of the sTEMProfiler used at the Coffin Bay site is shown in Figure 2-2.

The system is operated using a tablet and an App. This allows the operator to visualise the station stack (processed data acquired for the sounding) and assess noise. The accumulated station stack

size is displayed in near real-time, along with the individual 1 – 3 sec stacks. The accumulated stack shows the data and the data uncertainties. An example of the stack is shown in Figure 2-3.

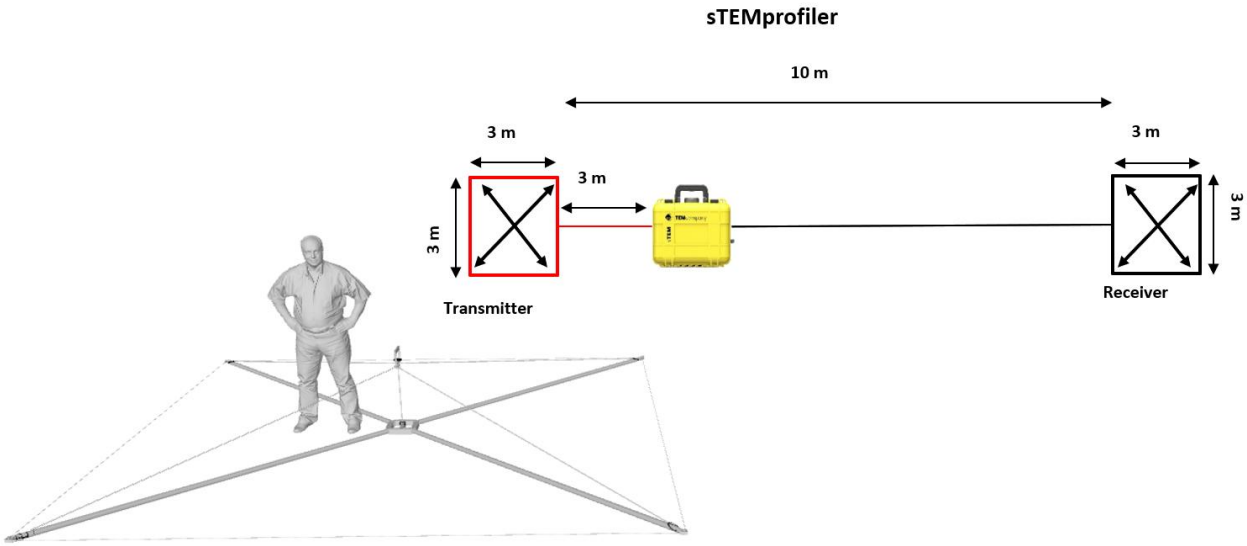


Figure 2-1: sTEMProfiler system layout and scale (source TEMCompany)

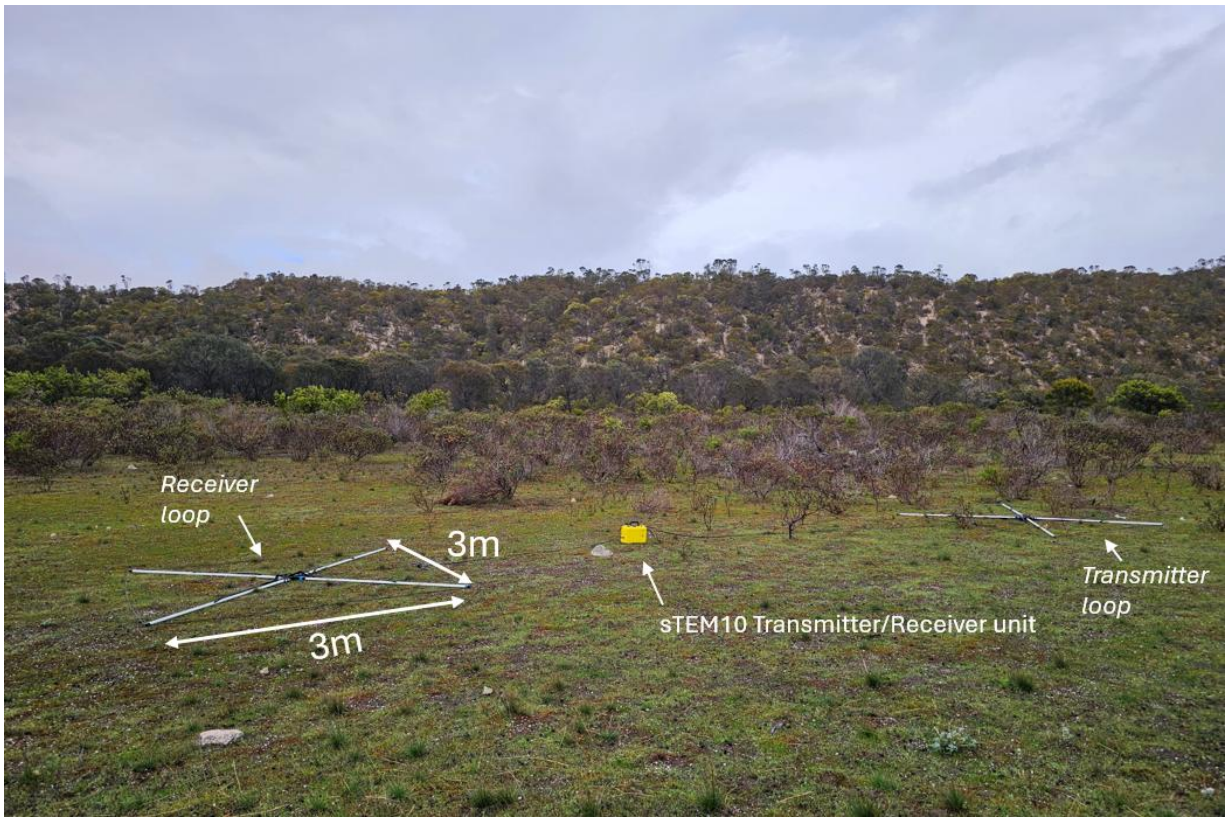


Figure 2-2: Field configuration of the sTEMProfiler at the Coffin Bay study site.

The collected data are processed and inverted (using a smooth model 1D layered inversion) for each sounding *during* data acquisition (Figure 2-4). This permits the operator to assess the quality of data being acquired and whether critical targets are being identified, along with the depth of investigation. The latter is determined by several factors including the area of the transmitter loop,

the area of the receiver loop, the stacking time, and the transmitter current. At the Coffin Bay study site, the depth of investigation for the sTEMProfiler was ~80m below the ground surface.



Figure 2-3: Stacked set of measurements for the low and high moment decay curves displayed in near real time on the operator's tablet.

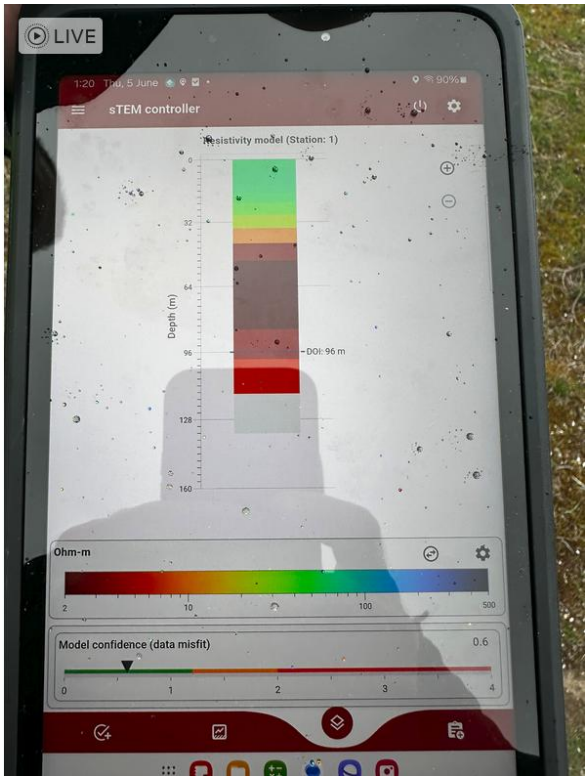


Figure 2-4: Smooth model 1Dlayered Earth Inversion (LEI) of one sounding displayed on the operators tablet during data acquisition.

Data acquisition

The ground survey was planned along a series of transects intended to verify the model of the SWI determined in the analysis of TEMEPST AEM data (See Munday et al. 2025) which suggested that there might be up-coning in the vicinity of the town water supply. The ground transects were oriented to ascertain whether the geometry of the modelled SWI surface, defined in the AEM inversion results, was also reflected with a higher resolution (spatially and with depth), independent technology, and whether the up-coning trend suggested in the AEM data could be validated. Figure 2-5 shows the orientation of the actual ground EM transects relative to the modelled elevation of the SWI. It is appropriate to note that the modelled SWI elevation from the TEMPEST data will be a crude, very smooth representation of the true geometry of the SWI, in part due to the flying height of a fixed wing system over the area, the wide line spacing of the survey, and the influence of infrastructure on the measured response.

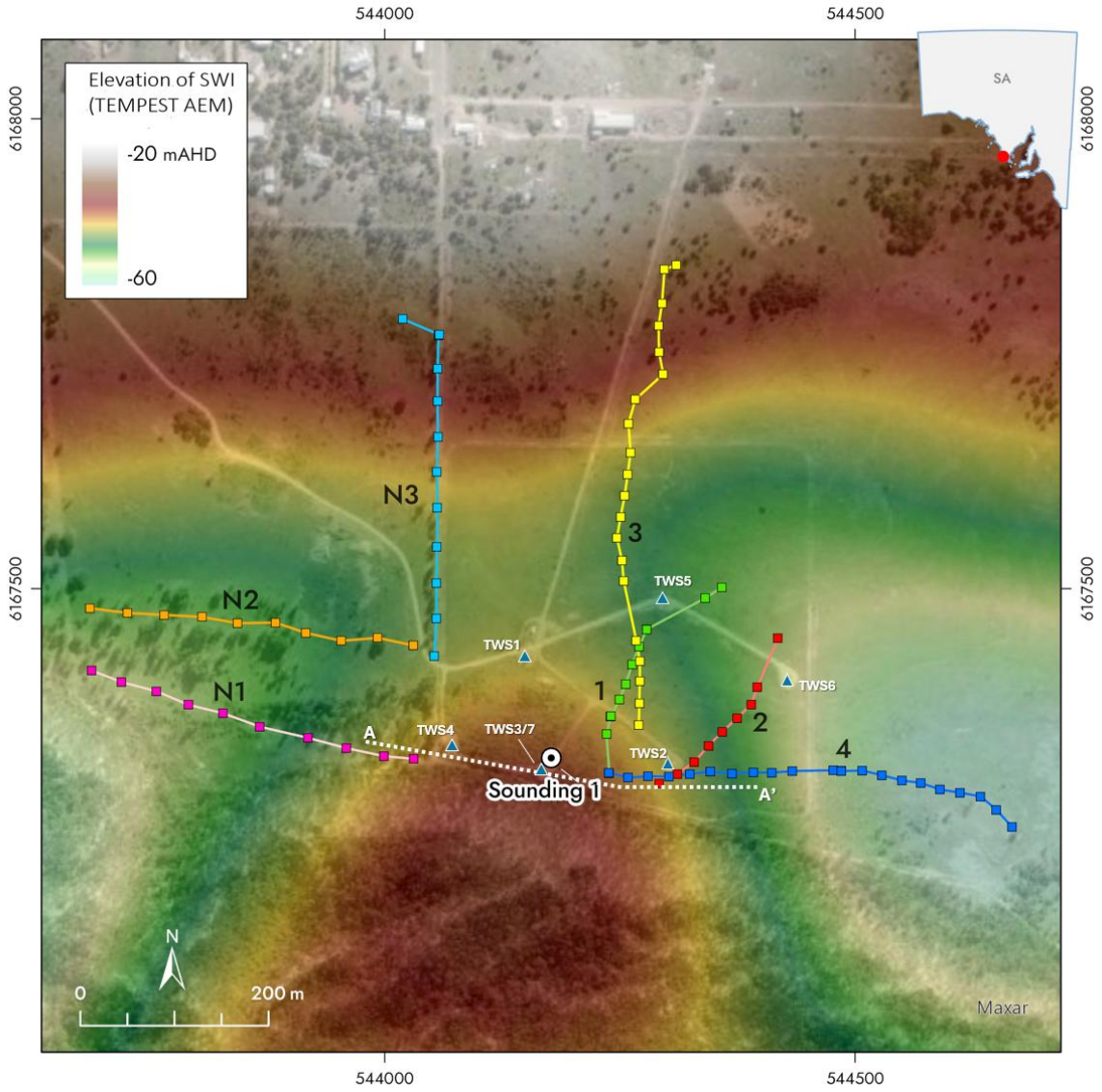


Figure 2-5: **Actual ground geophysical transects (numbered) with individual sounding points indicated (by squares, and in the case of Sounding 1, by a circle) in the vicinity of the town water supply bores. Transects are overlain on modelled elevation of SWI from 1D LEI inversion of the TEMEPST AEM data (represented by colour overlay on a satellite image).**

In the early phase of ground data acquisition, it became apparent that noise from buried cables and operating pumps was affecting the results. The final orientation of the transects was determined, in part by the need to avoid noise sources, but also by a desire to define the finer-scale geometry of the SWI.

Data processing and inversion

All field data were processed and then re-inverted in Aarhus Workbench (Auken et al., 2015). Data for each transect was imported, processed and inverted as a line of stations (see Figure 2-6).

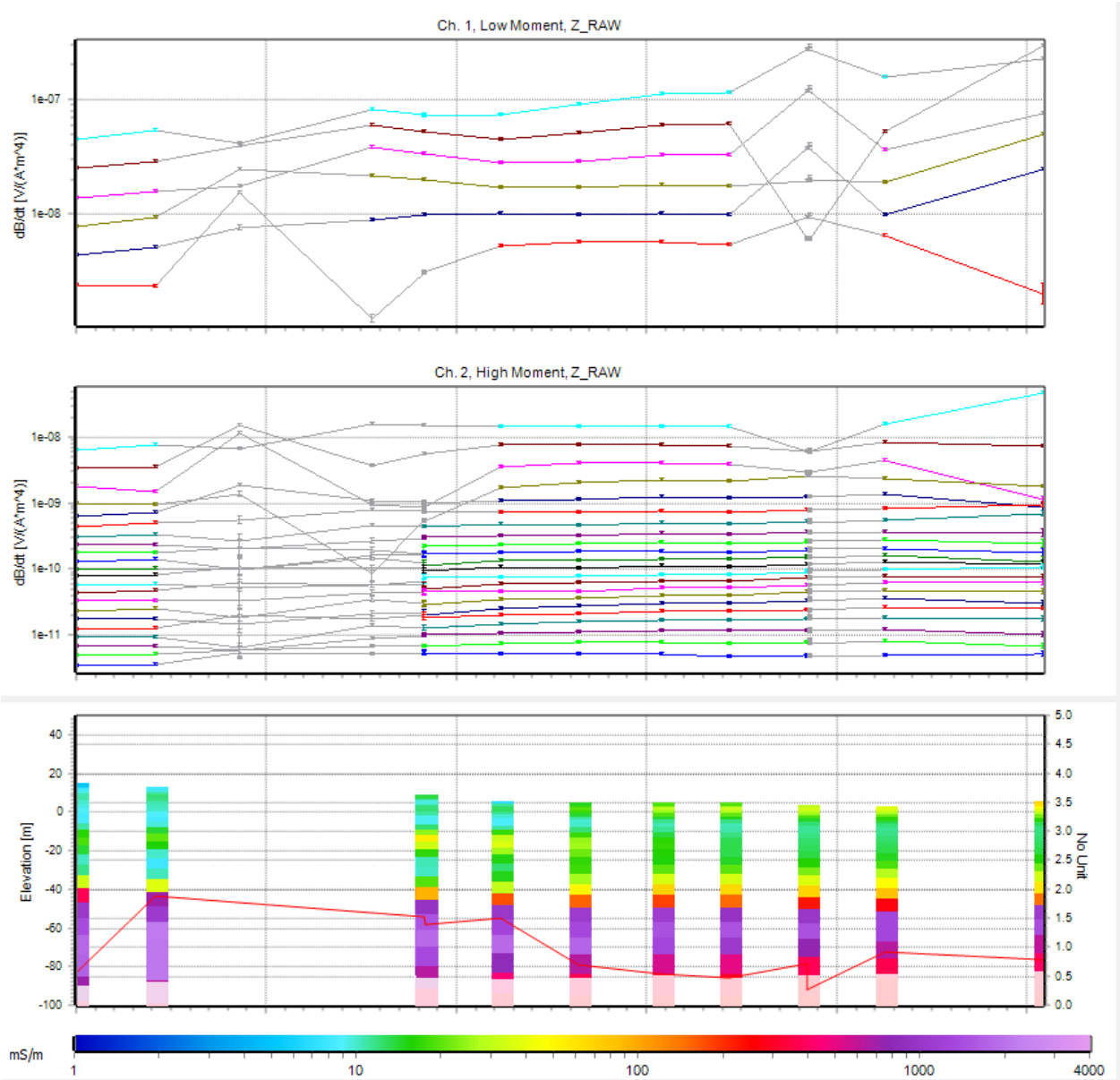


Figure 2-6: sTEMProfiler data for Transect 1 (Figure 2-5) showing amplitude responses for low moment (top panel) and high moment (middle panel), and derived conductivity models from a 1D Layered Earth Inversion for each sounding (lower panel). Noisy data for each gate/sounding exceeding desirable limits have been deleted (greyed-out areas in the amplitude responses).

Considered data processing ensures that noisy data are not taken into the inversion, and in some instances individual soundings, showing noisy gates, were removed from the transect modelling. Spurious models of ground conductivity are not generated or interpreted as a consequence.

Modelling and inversion of the field data employed a 1D Layered Earth Inversion using the AarhusInv Code (Auken et al. 2015), with the inversion solving for both the Low and High Moment data. This approach yields the maximum possible resolution of model parameters, as the Low Moment contains information from the near surface, and the High Moment information relating to the deeper part of the models. In this study we used a 30 Layer smooth model, with a 1m thick first layer, increasing logarithmically to a last boundary layer at 200m below the ground surface. The starting model for the inversion used a 10 Ωm half space. Those gates culled, prior to modelling for the Low and High moments are shown for each Transect in the Appendices. Each sounding was inverted independently of adjacent soundings, that is there were no lateral constraints employed in the inversion. In part this was because some soundings are modelled without some gates because of noise or related issues, while other adjacent soundings are modelled with all gates.

A Depth of investigation (DoI) was also determined to ensure that the observed variations in measured conductivity reflect changing ground conditions, rather than inversion or model dependent changes arising from the inversion process. The DOI provides an indication of the depth to which the model is the most reliable, and model information below the DOI should be used with caution. The approach used here is described in Christiansen and Auken (2012) and on the model of each sounding it is represented as a line and a shaded white area below the DOI.

3 Results

An initial assessment of modelled sTEM data was made against downhole EM data acquired by DEW for the LKW40 monitoring bore located adjacent to TWS bore # 2 (Figure 2-5). The closest system sounding was plotted against the downhole EM along with a modelled sounding from the TEMPEST data inversion. Results are shown in Figure 2-7.

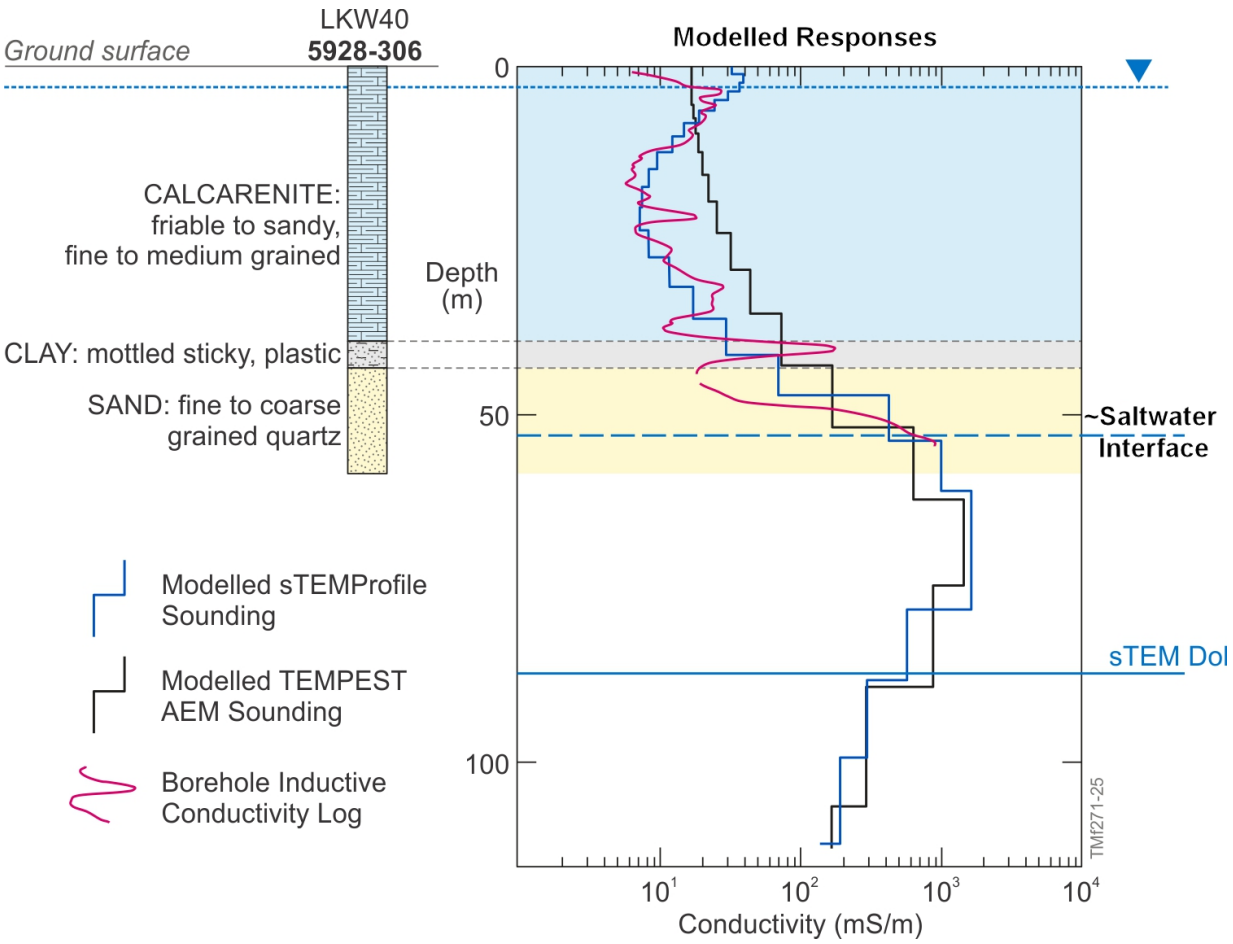


Figure 3-1: Modelled responses from the closest sTEM and TEMPEST soundings plotted against downhole EM data for Monitoring Bore LKW40. The lithology of the main aquifers is plotted on the left of the modelled responses. (Lithology data from WaterConnect).

Data for the sTEM Profiler were acquired in July 2025, and the downhole EM in October 2024. The TEMPEST data were acquired in September 2006. The modelled sTEM sounding fits the downhole EM response closely, suggesting that the modelling approach is likely to yield models closely resembling the true subsurface conductivity structure. The downhole induction logs have a higher sensitivity to vertical changes in conductivity, likely lithology related in the upper part of the profile, as is evidenced by the elevated response around 40m below the ground surface associated with mottled clay unit – interpreted as being the Uley Formation. We suggest that other peaks in the downhole EM response within the Bridgewater Formation Calcarenite may also be coincident with clay-rich bands within the Quaternary aquifer.

However, at a depth of ~45m, within a sandy unit interpreted to be the Cenozoic Wanilla Formation, the downhole EM response is observed to increase rapidly. This is mirrored by trends in the both the ground surface and airborne EM modelled data. Downhole EC logs acquired at the same time as the inductive conductivity measurements indicate an increase in salinity of groundwater at this depth. We interpret this to be associated with a saltwater interface with both the sTEM and TEMPEST data modelling a similar peak in conductivity.

The monitoring bore LKW40, located adjacent to TWS bore #2 (see Figure 2-8), is positioned over an area of elevated conductivity at depth in the TEMPEST data, associated with the upper part of the saltwater interface that underlies the area (see Munday et al. 2025). Modelled sTEM Profiler soundings acquired along transect 4 (see Appendix 1) suggest that the saltwater interface, rises upwards to ~40mAHD from a regional conductivity high at around 50mAHD, immediately in the vicinity of TWS2 (see Figure 2-8 – right panel), possibility due to up-coning. This pattern is also reflected in a section A-A' (Figure 2-5), which indicates that "spikes" in the saltwater interface may also occur in the vicinity of other production bores; in this example beneath/adjacent to TWS3/7 (Figure 2-9).

While acquisition of ground EM data using the sTEMProfiler was efficient and effective, noise associated with active pumps and associated cabling around the production bore field made it difficult to generate quality information and an insight into the extent of localised up-coning around all the bores. Future studies of this nature *may* warrant temporary cessation of pumping and power to the pumps for a short period while surface soundings are acquired. Alternatively surface EM acquisition could be scheduled for periods when pumps undergo maintenance. While some effort was given to extending the stacking time for soundings affected by noise, there is a trade off between trying to get good signal versus the timely completion of a survey.

Modelling of sTEM Profiler data along all transects (Figure 2-5) is summarised as a series of modelled sections shown in Appendix A1. All the sections indicate a highly conductive (saline) substrate to the beneath and away from the bore field. However, while some transects (1, 2, 3 &4) indicate a resistive upper part to the subsurface profile, related to the aquifer containing fresh water, other transects (e.g. Transect N3) suggest that brackish water overlying a more saline aquifer may be relatively close to the surface (<10m) and possibly upgradient of the borefield. Locally, the modelled ground data may also define changes in lithology (e.g. clay-rich zones) within what is defined as the Quaternary Bridgewater Formation (see, for example, Transect 1 in Appendix A1.).

In some Transects, for example N1 and N2 (see Appendix A1.), the modelled sTEMProfiler data suggest the presence of a thin moderate conductor (between ~25 and 30m below the surface) above what is interpreted as the saltwater interface (the layer of high conductivity at 45m). This may define a thin layer of Uley Formation clay, which is resolved because of the Low Moment data being recorded. In some Transects, where Low Moment data are not used in the modelling (eg Transect 1 southern end – see Appendix A1.), as thin nearer surface layer is not resolved, and although it may be absent here, results point to the Low Moment data as being important is defining additional structure in the profile.

Overall, the observed conductivity structure defined by the ground EM supports the findings from updated modelling of the TEMPEST airborne EM data covering the Coffin Bay study area; namely that the saltwater interface extends beneath the bore field, at an elevation of ~45-50mAHD. The

finer-scale, improved sensitivity and smaller footprint associated with this mode of ground EM data acquisition allowed better definition of localised up-coning of the SWI.

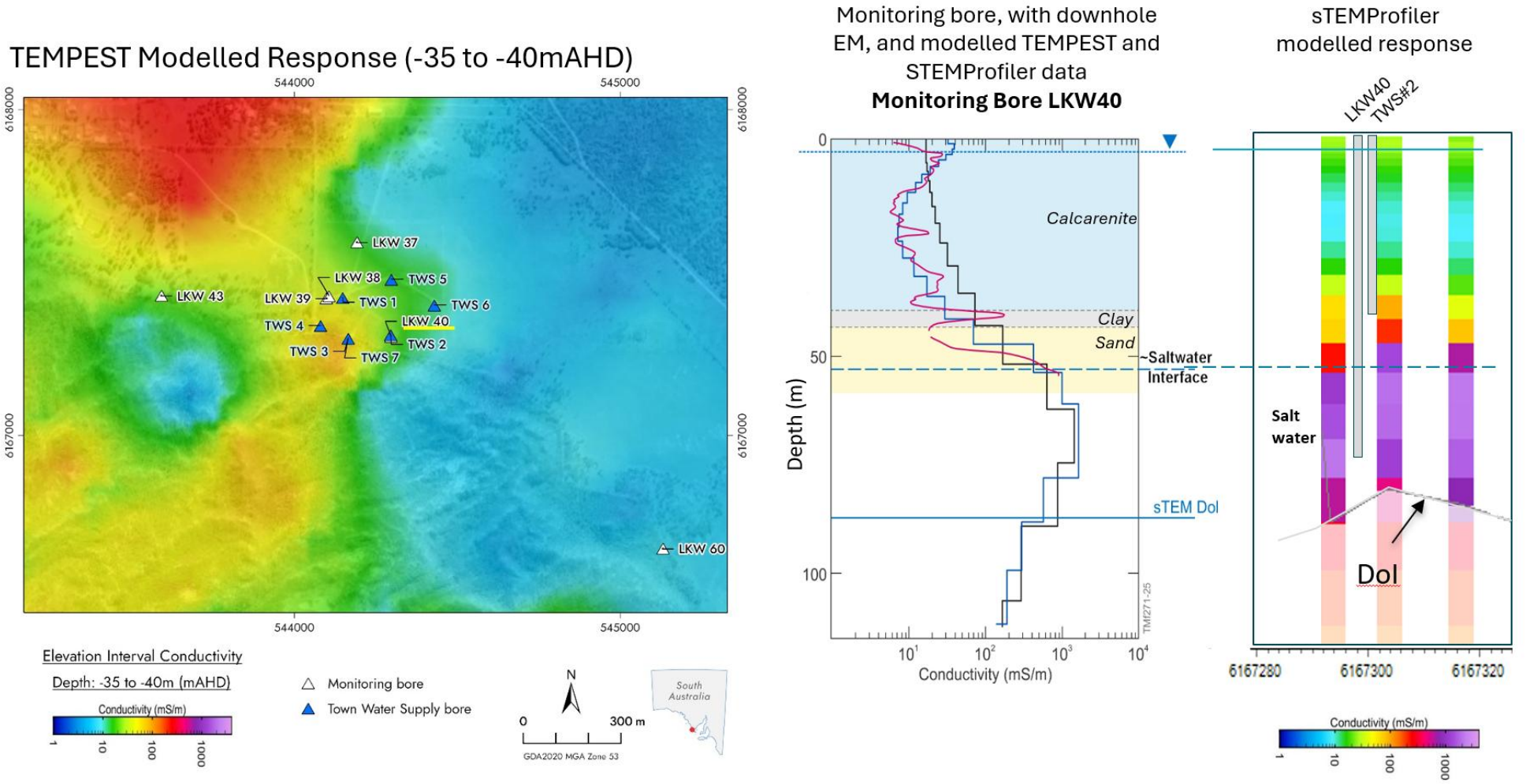


Figure 3-2: Comparative responses between the modelled TEMPEST data (interval conductivity image on the left), and nearest sounding to Monitoring Bore LKW040, a downhole inductive conductivity model and modelled sTEMProfiler data. Modelled responses of several sTEM Profiler soundings around the monitoring and TWS2 water supply bore are shown in the panel on the right. (Downhole EM data courtesy of DEW).

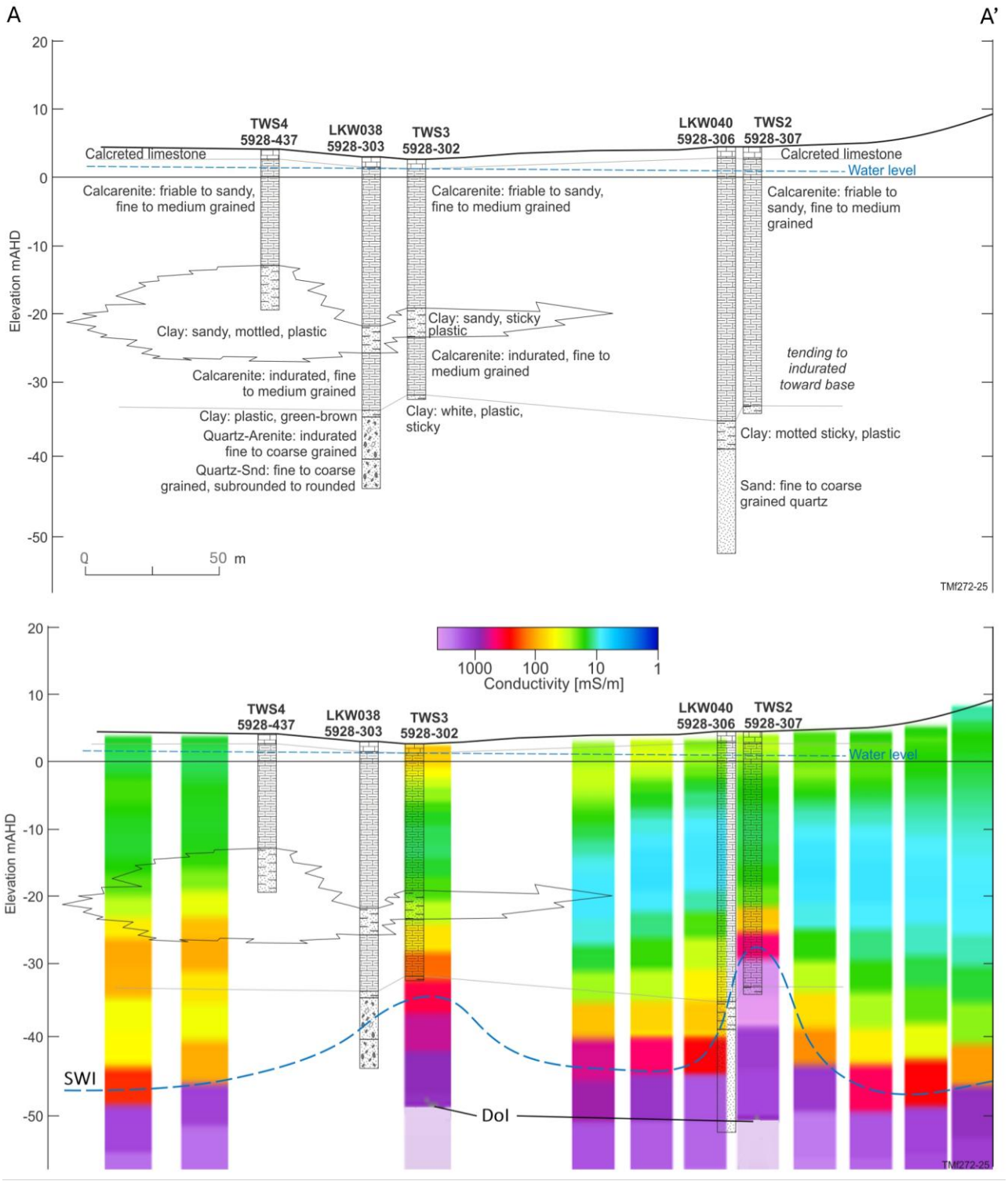


Figure 3-3: Geological section A-A' (top panel) running east to west across the town water supply bore field at Coffin Bay. The location of the section is shown in Figure 2-5. The section is reproduced with modelled sTEMProfiler soundings projected onto the section (represented as coloured conductivity models). A generalised interpretation of the SWI is presented as a blue dashed line in the lower section, overlying the modelled conductivity.

4 Summary and Conclusions

Results from the modelling of the ground EM data acquired around the Coffin Bay town water supply bores indicate:

1. That the potable water in the Quaternary aquifer, the source of the town water supply, is immediately underlain by a very conductive layer, interpreted to be associated with highly saline system, namely the saltwater interface (SWI);
2. It confirms an interpretation of the independently inverted and interpreted TEMPEST AEM data;
3. That the geometry of the SWI is better defined in the ground EM data and is more appropriate for fine-scale investigations. The SWI defined by the TEMPEST data is likely affected by artefacts introduced by infrastructure, partly because of the large footprint - > 200m of a fixed wing system at the surface. Although the processing steps in the inversion have attempted to address these issues, where they are identified, the effects of fences, powerlines etc. may persist in the modelled results. Hence, we urge caution in using the defined geometry of the SWI from the AEM, and recommend it be considered as indicative only, and be used only to guide further, more detailed, ground-based investigation;
4. That while the geometry of the SWI modelled with the TEMPEST data is generally matched by the geometry observed in the ground data, the latter has also defined finer scale evidence of localised up-coning associated with the production bores;
5. That proximal to bores TWS2, TWS3/7 and possibly TWS5, the geometry of the saltwater interface suggests up-coning around these production bores;
6. Real-time visualisation of system responses and initial model results enable a more efficient and effective application of the ground EM system for aquifer characterisation in noisy environments such as encountered in the Coffin Bay town water supply bore field;
7. That when accounting for the effects of noise, this is an effective, relatively low-cost approach to measure and monitor the depth to and variation in the SWI in coastal aquifers on the Eyre Peninsula.

Operationally, the use of time domain EM systems such as that deployed in this study, should give due consideration to likely sources of noise prior to, and during, data acquisition.

5 References

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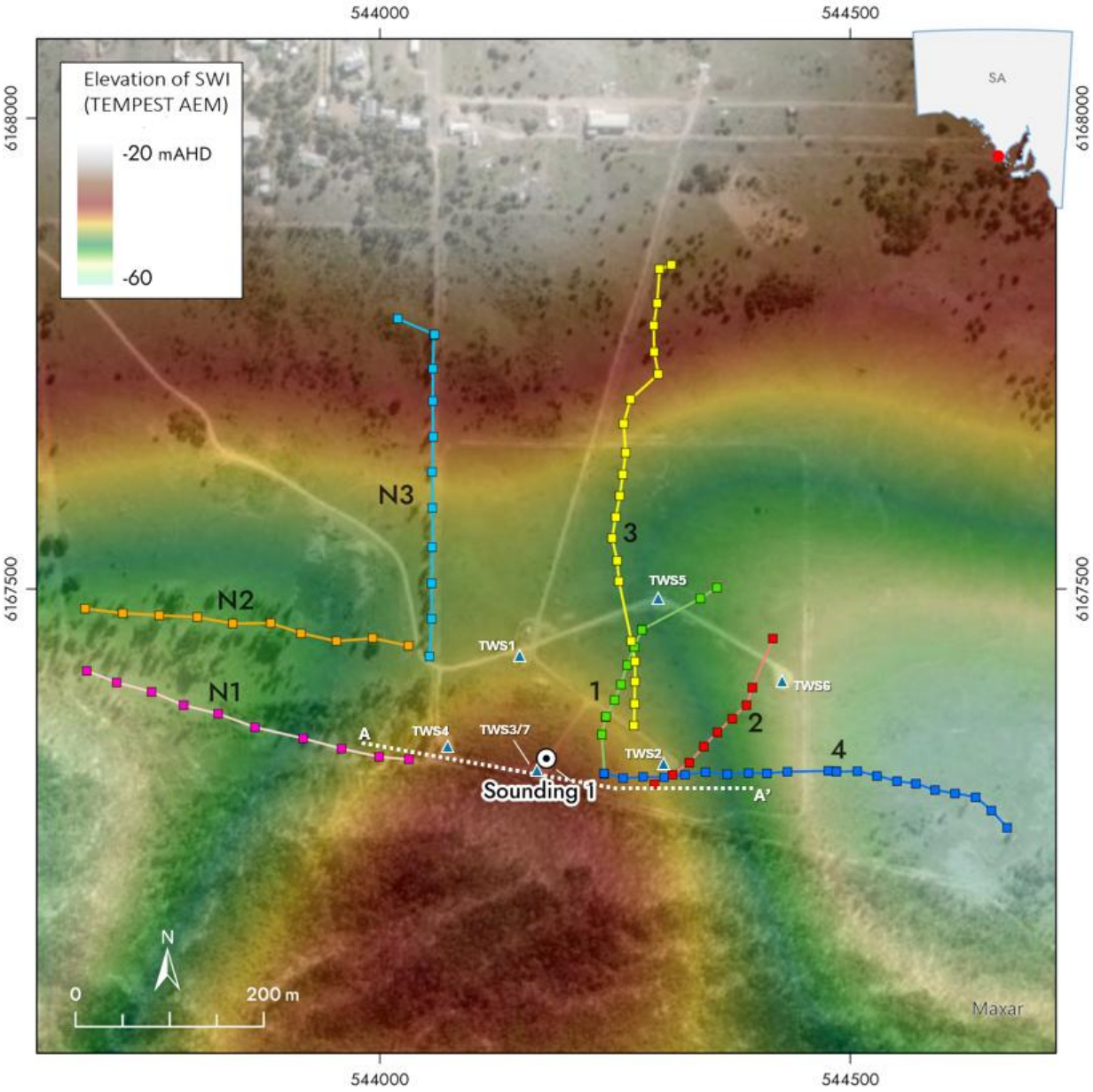
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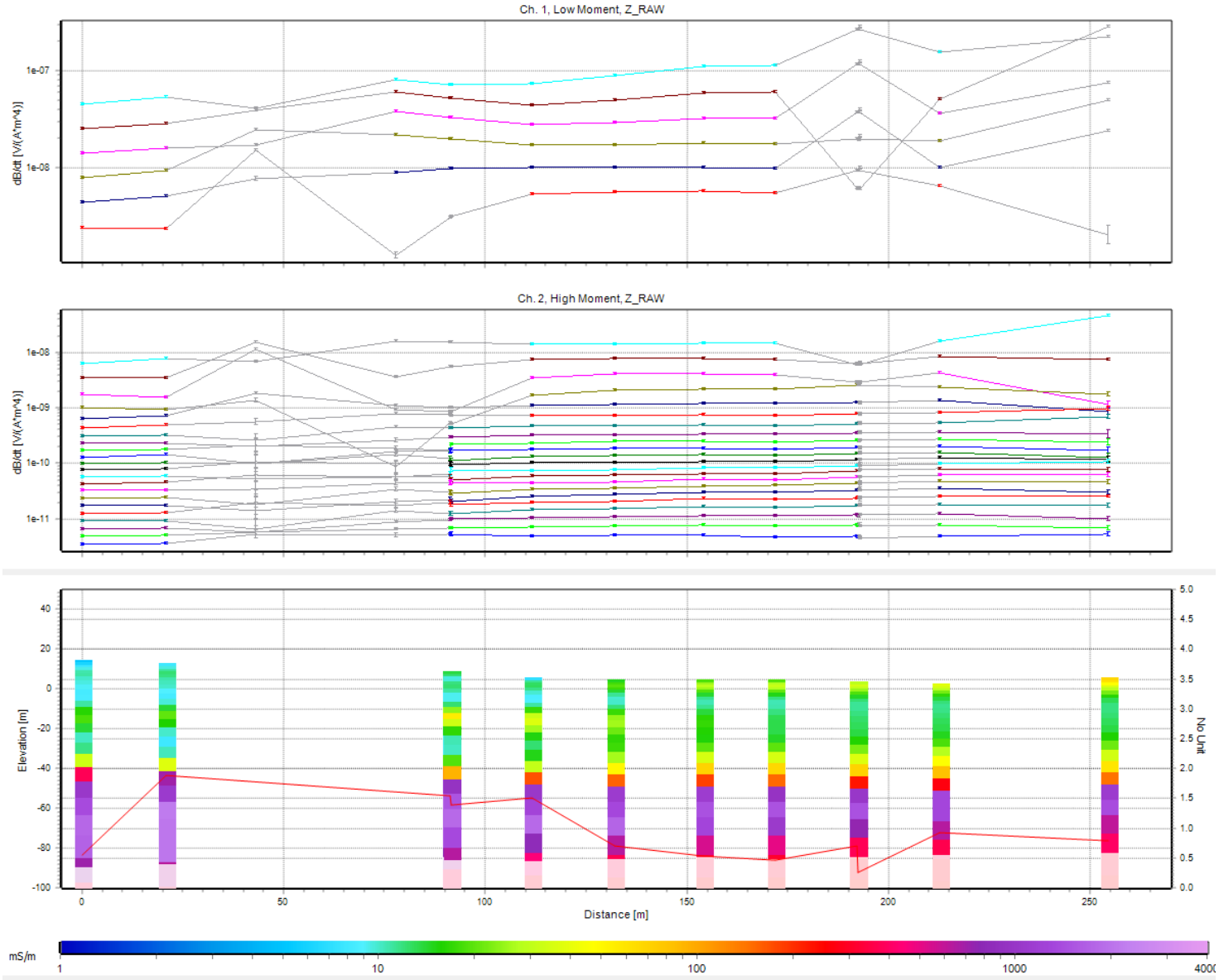
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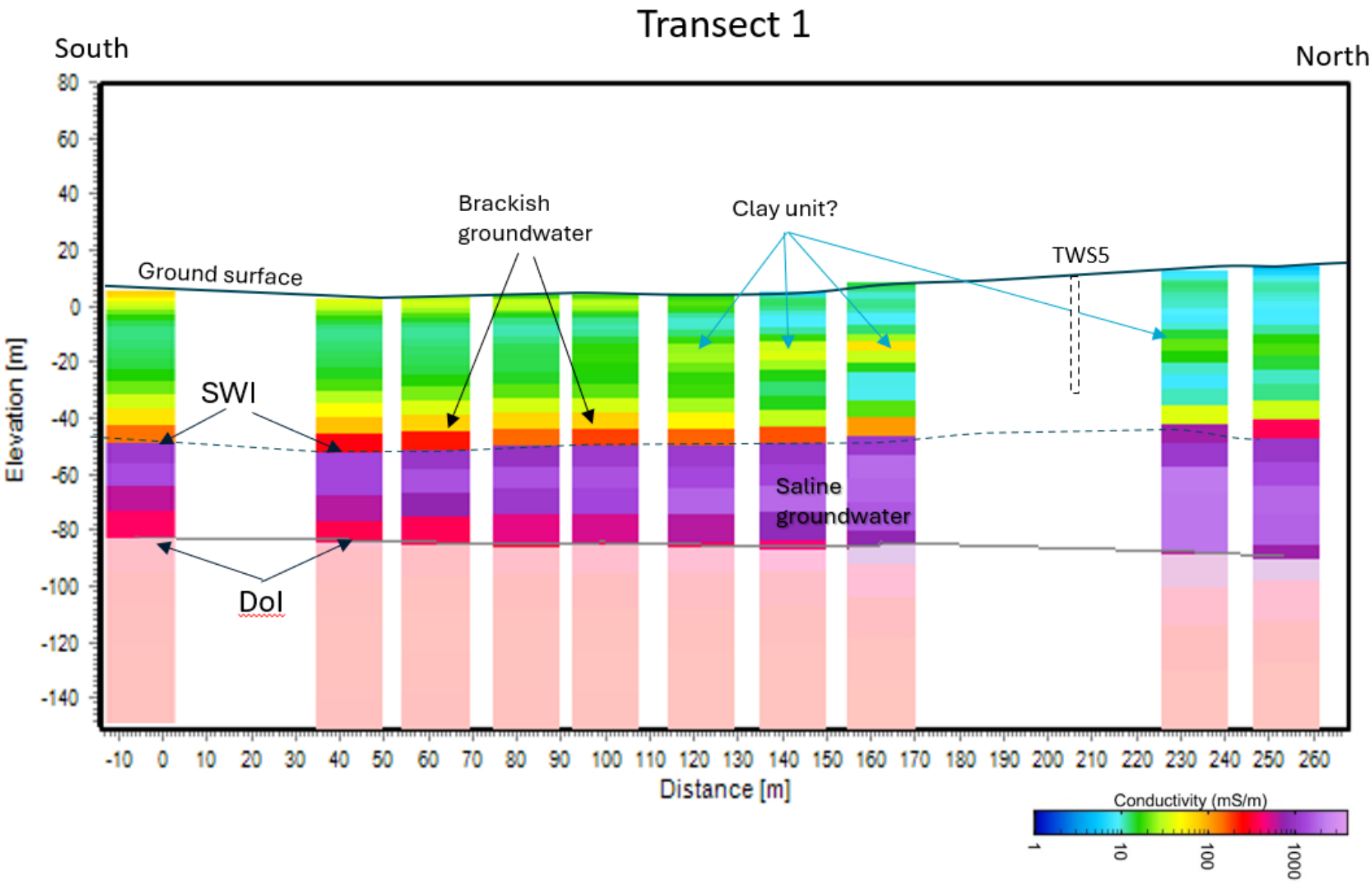
A.1 Appendix 1: Modelled Transect Data for Coffin Bay Town Water Supply Bore Field

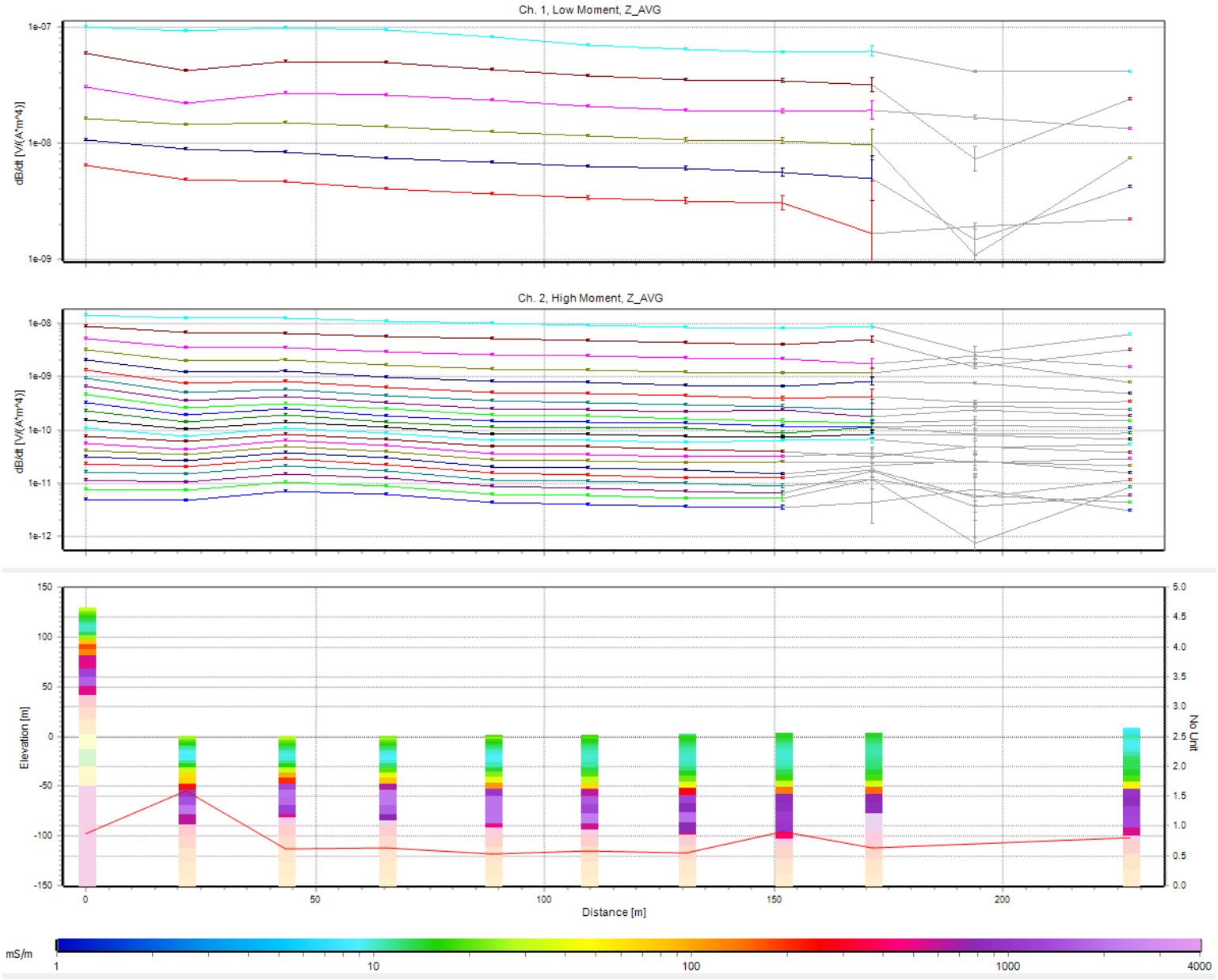


Appendix 1-1: Ground EM transects/soundings shown in relation to Coffin Bay town water supply bores overlain on a modelled elevation of the saltwater interface defined from the 1D LEI inversion of TEMPEST AEM data.

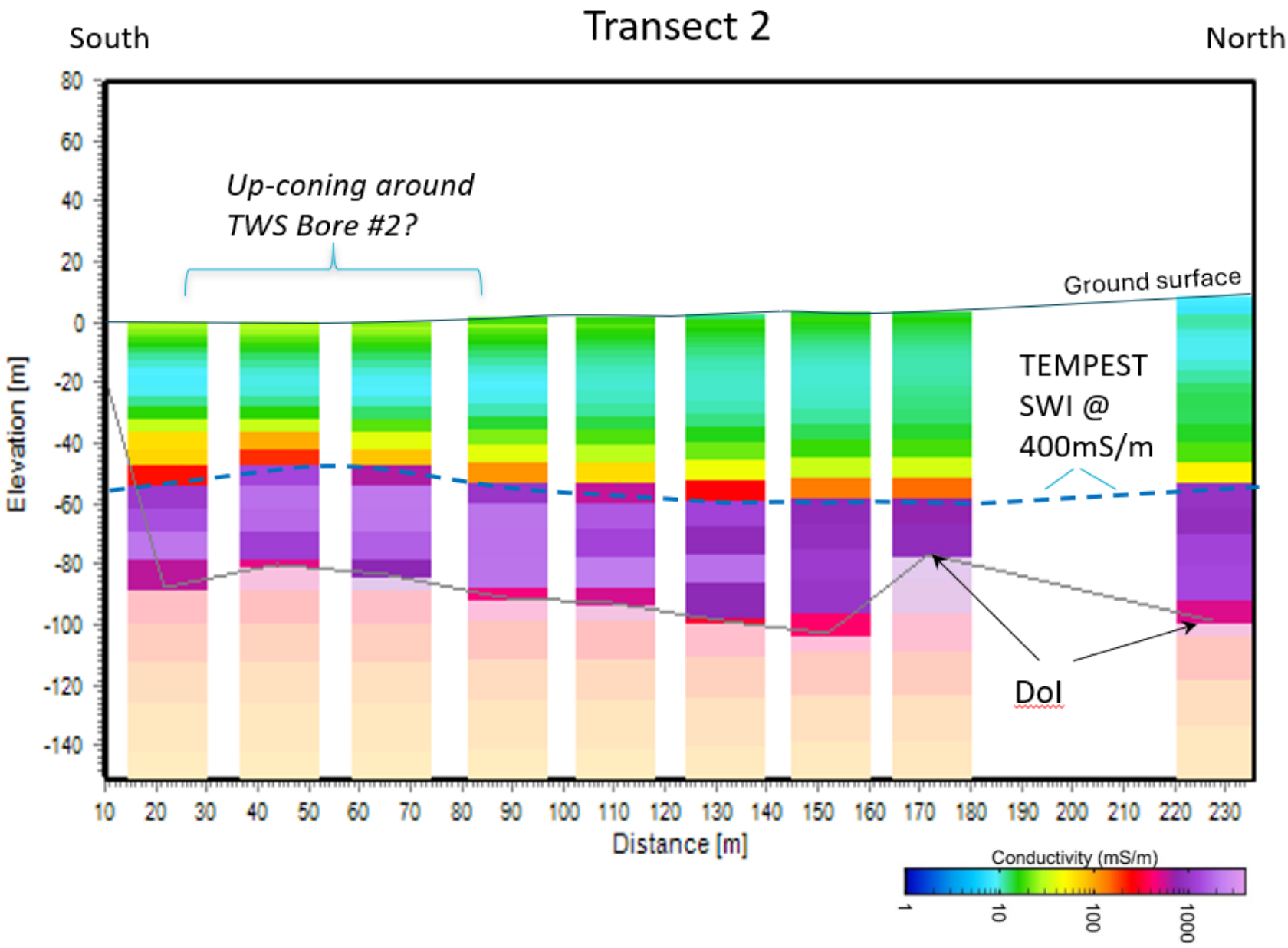


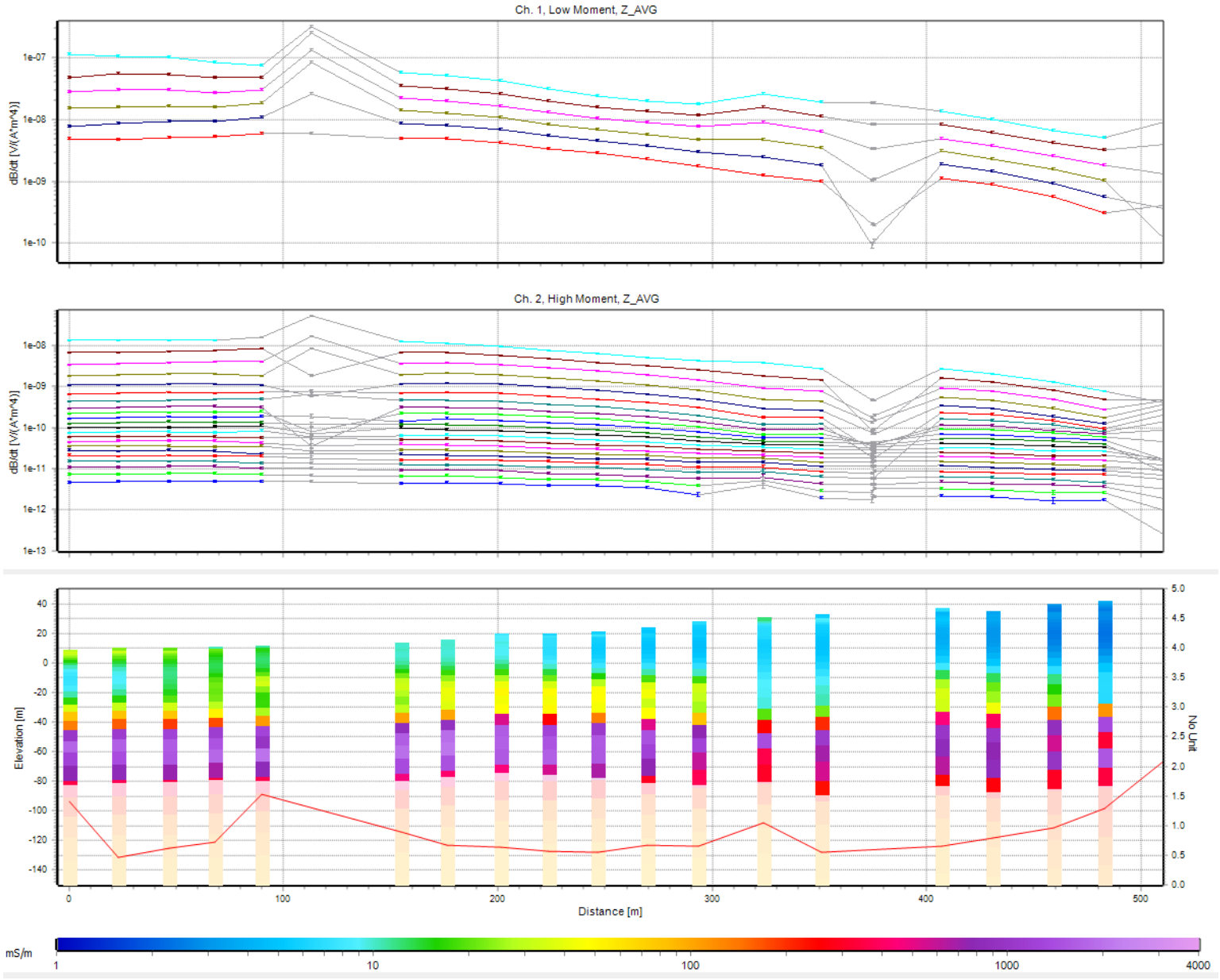
Transect 1: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect 1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.


Transect 1
South
North
Ground surface
Brackish groundwater
Clay unit?
TWS5
SWI
Saline groundwater
DoI
Elevation [m]
Distance [m]
Conductivity (mS/m)
1
10
100
1000

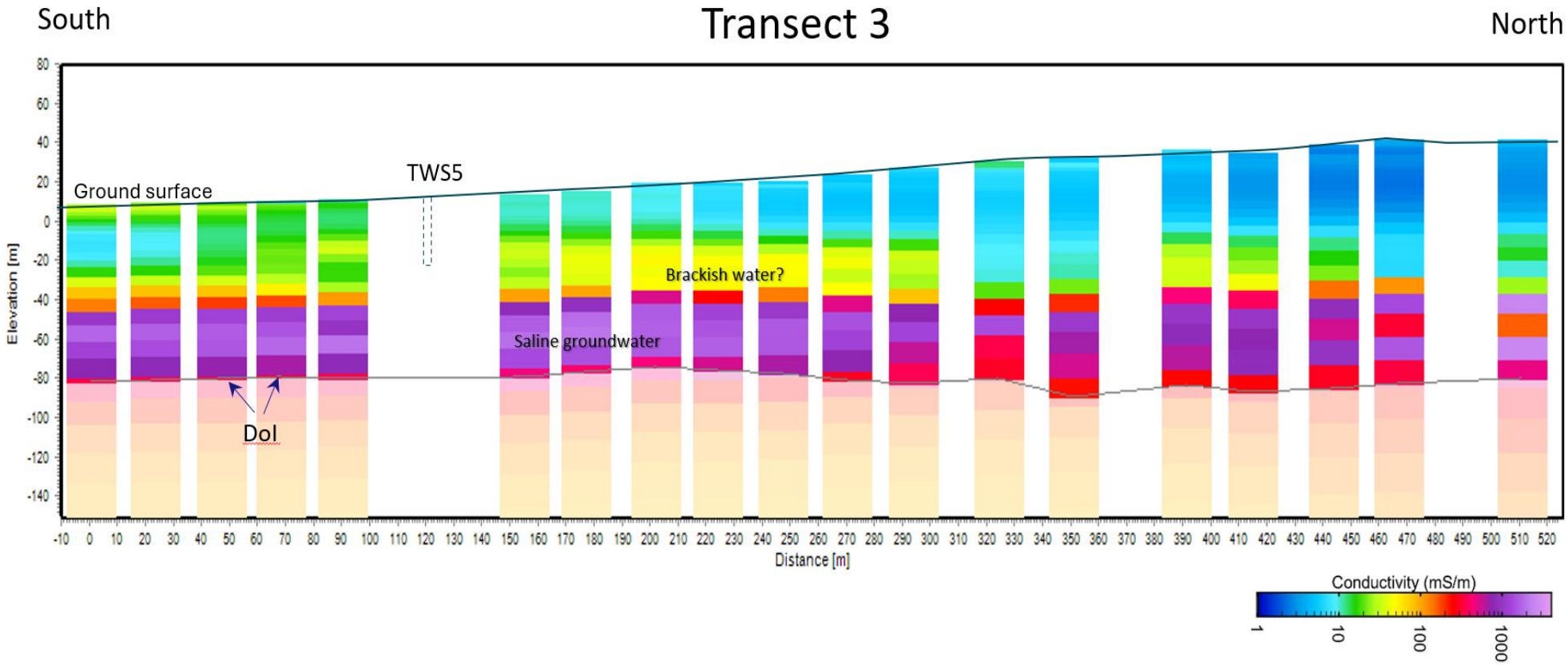


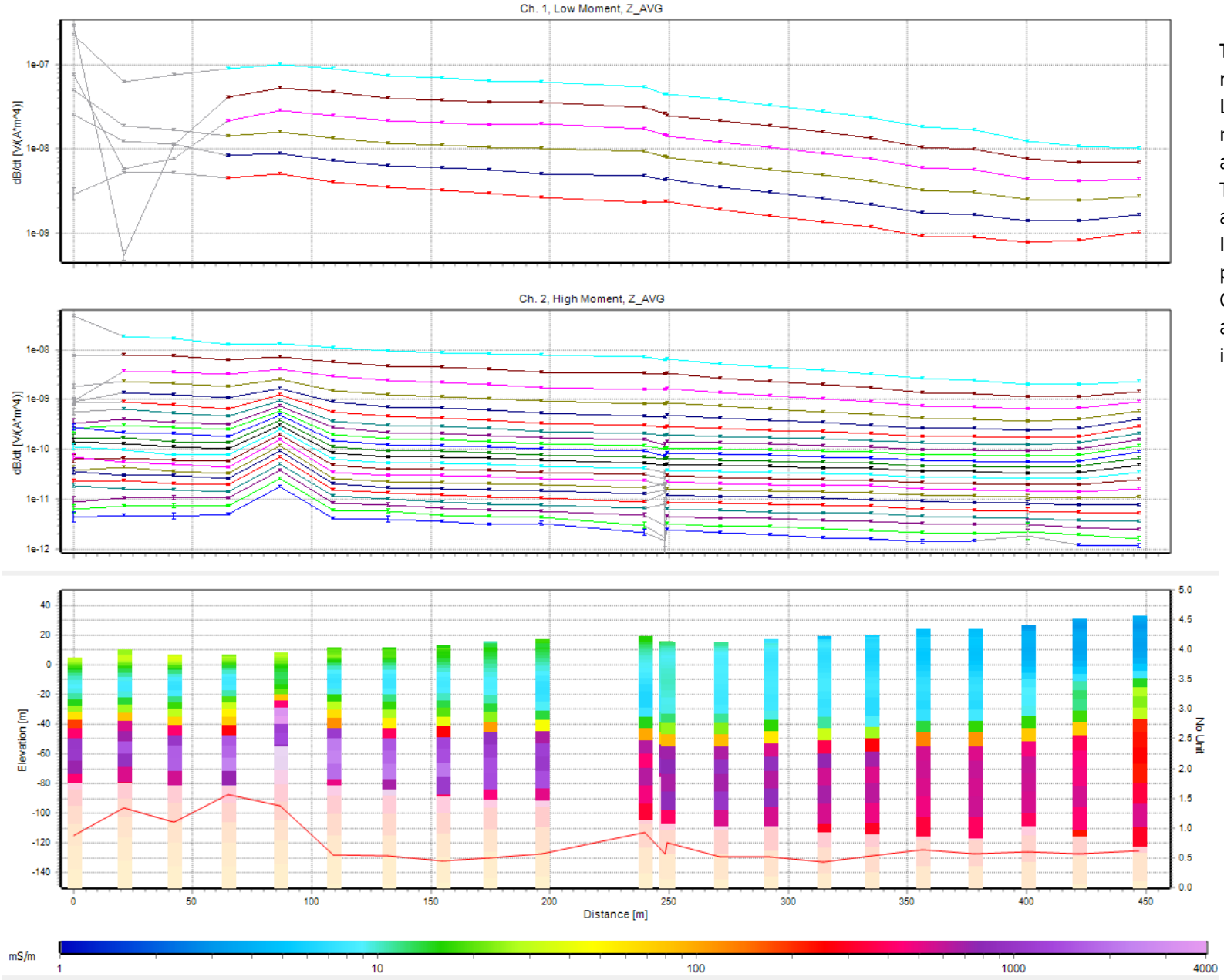
Transect 2: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect 2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.


Transect 2
South
North
Up-coning around
TWS Bore #2?
Ground surface
TEMPEST
SWI @
400mS/m
DoI
Elevation [m]
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Distance [m]
Conductivity (mS/m)
1
10
100
1000



Transect 3: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect 3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.


South
Transect 3
North
Ground surface
TWS5
Brackish water?
Saline groundwater
DoI
Elevation [m]
Distance [m]
Conductivity (mS/m)
1
10
100
1000



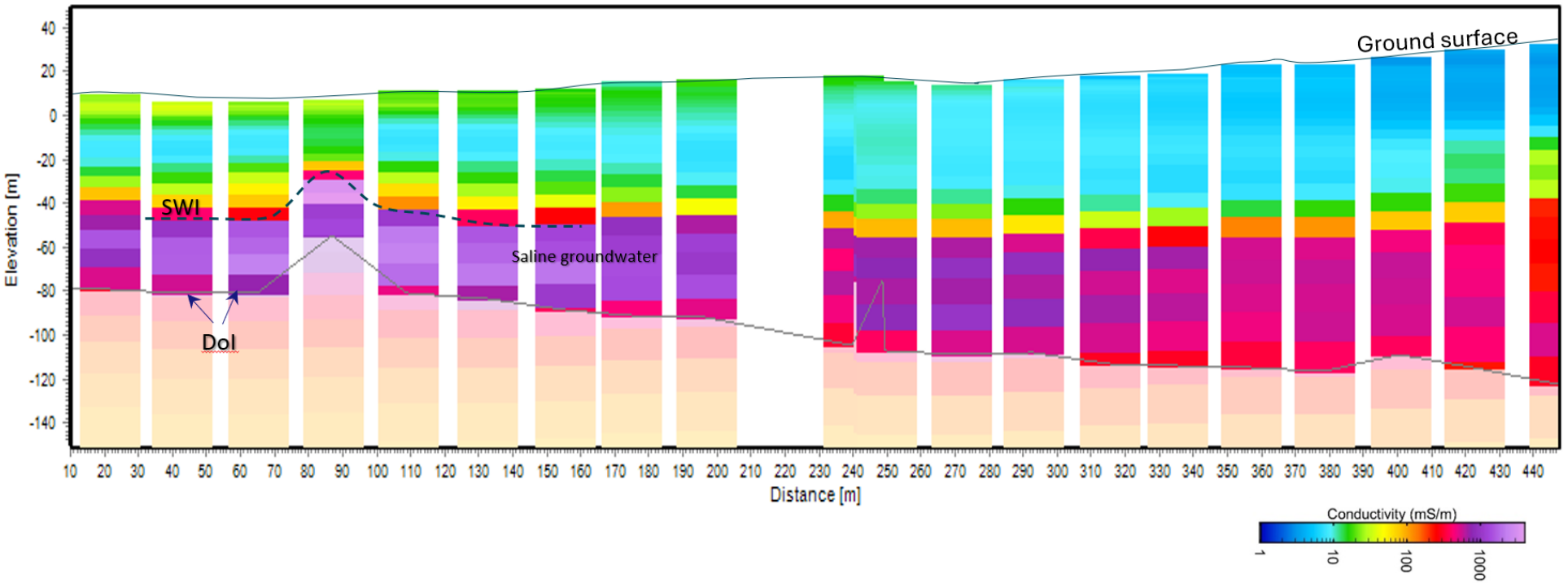
Transect 4: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect 4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.

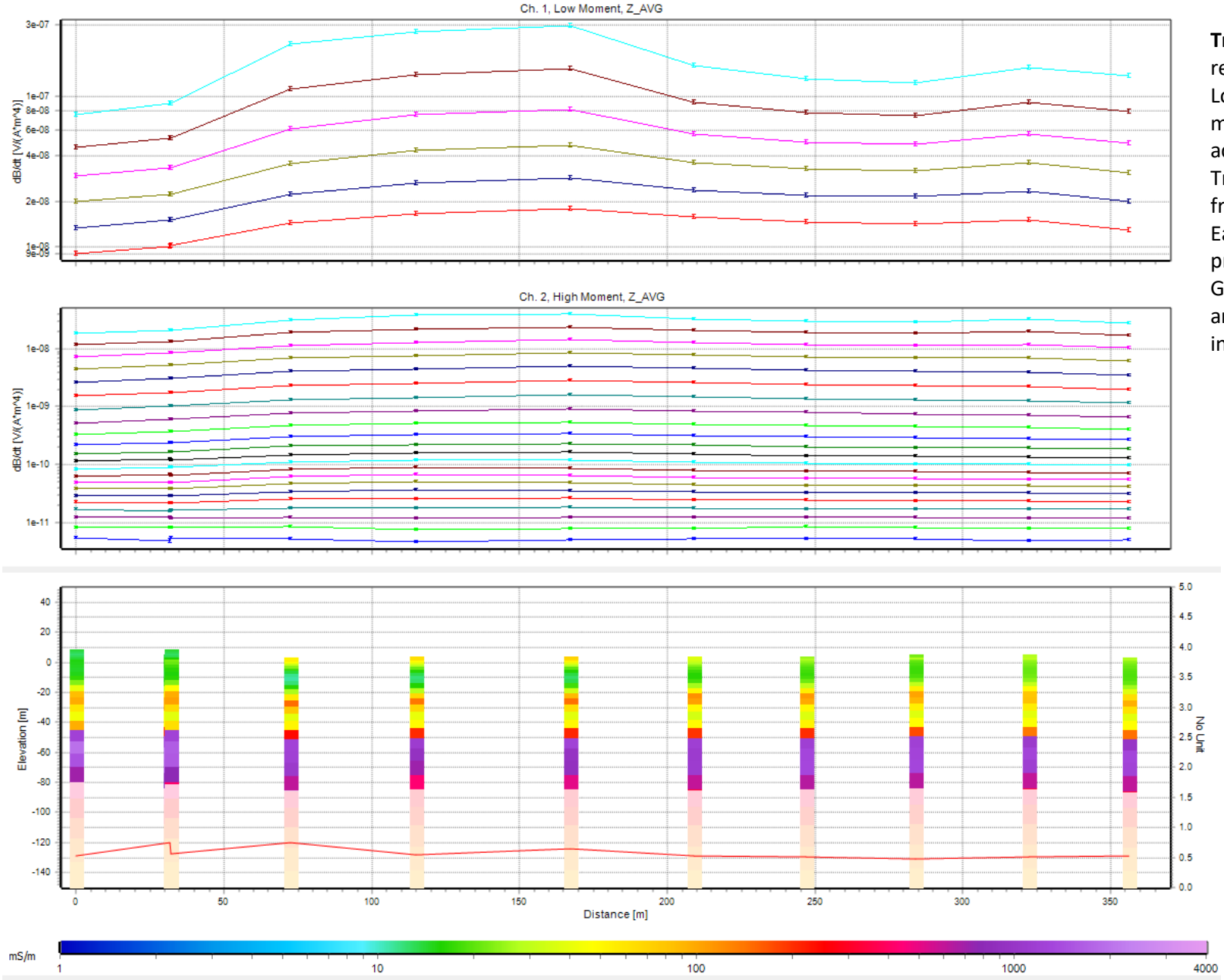
Up-coning around TWS Bore #2?

Transect 4

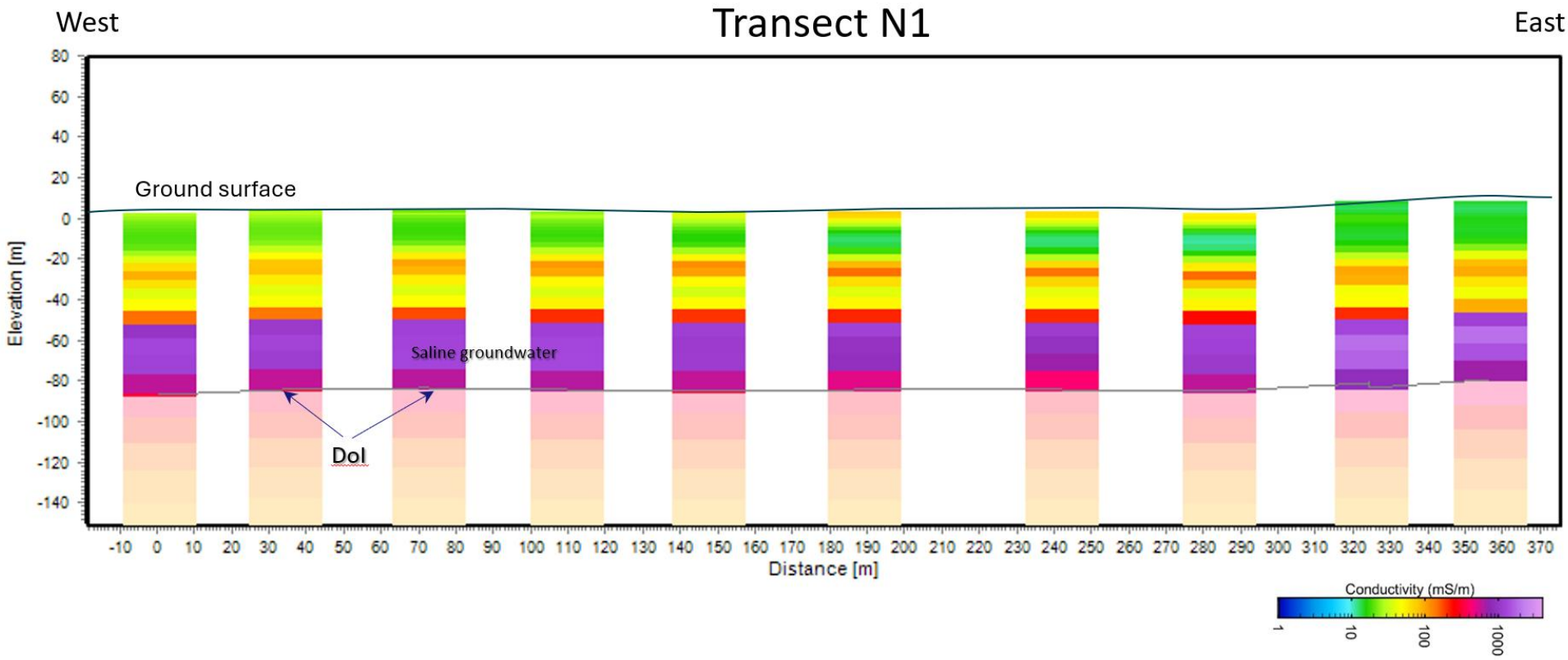
West

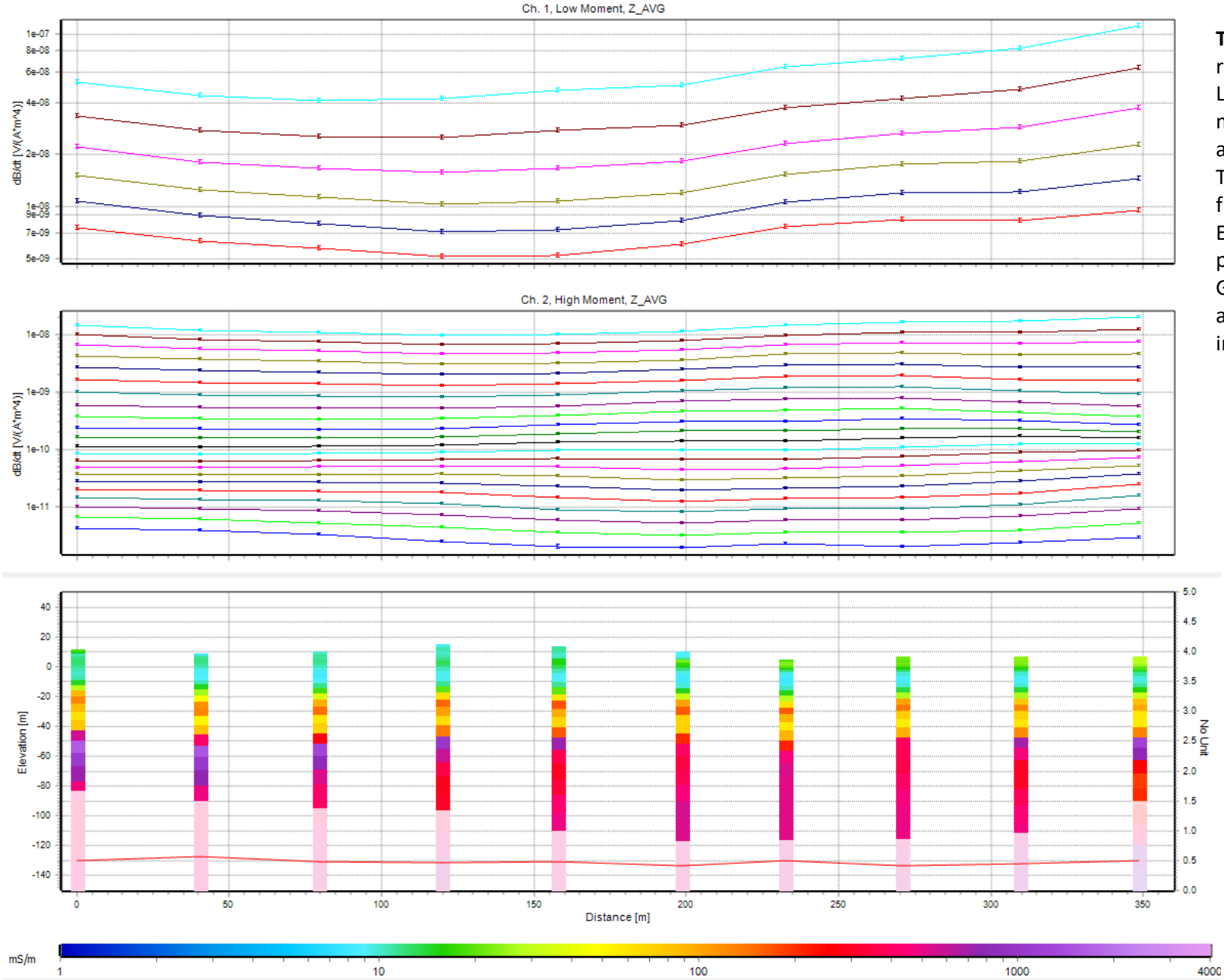
East



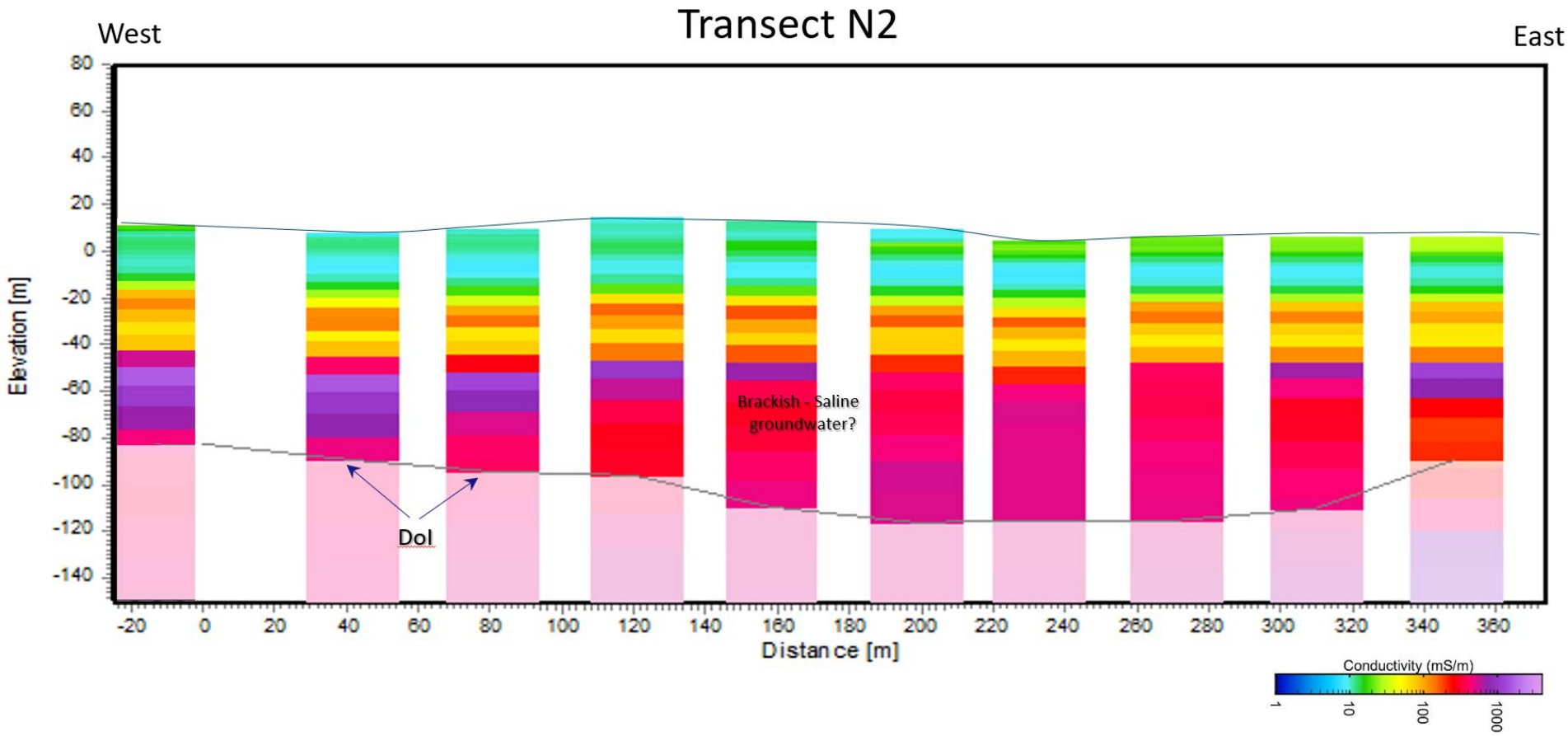


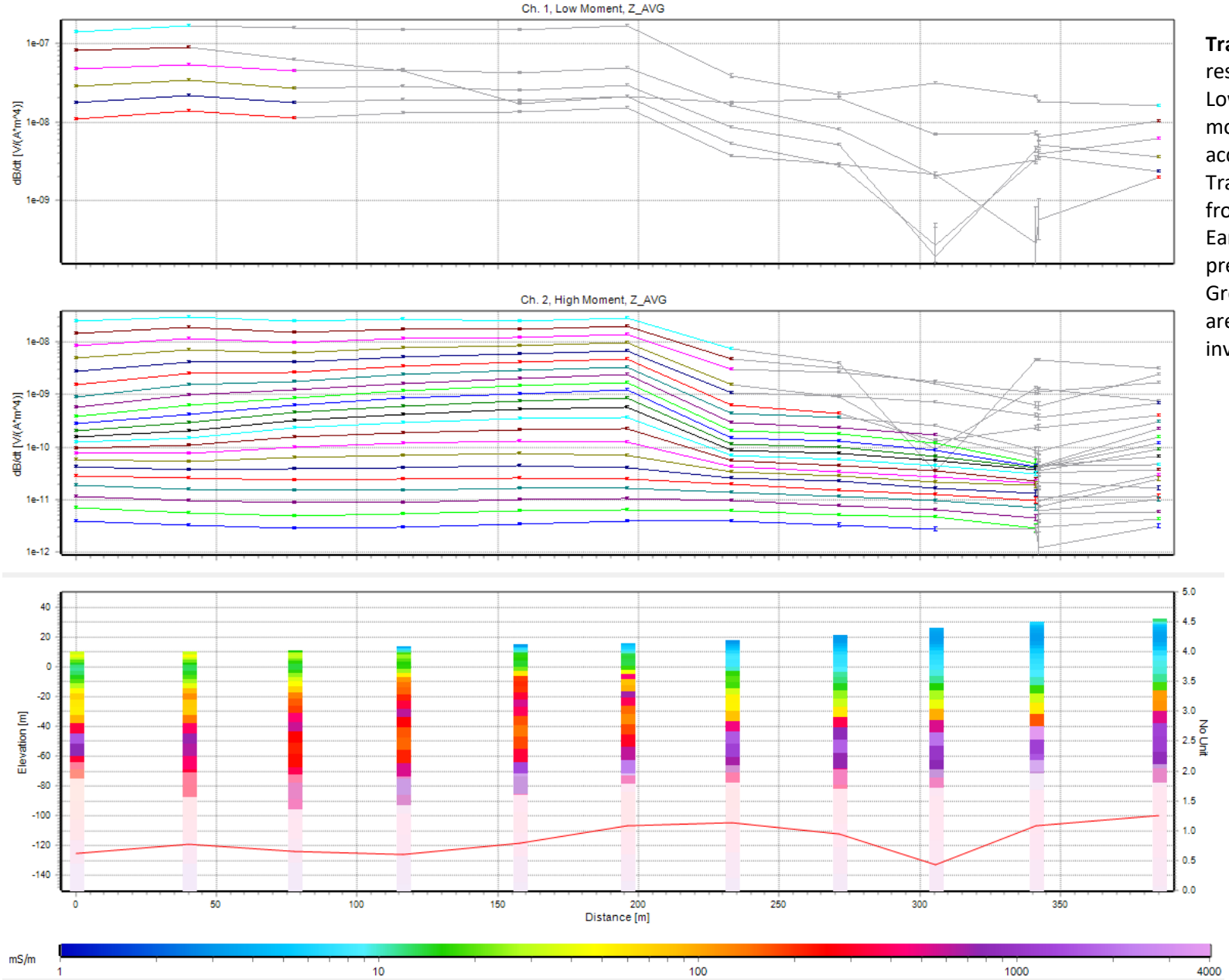
Transect N1: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect N1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.


West
Transect N1
East
Ground surface
Saline groundwater
DoI
Elevation [m]
Distance [m]
Conductivity (mS/m)
1
10
100
1000

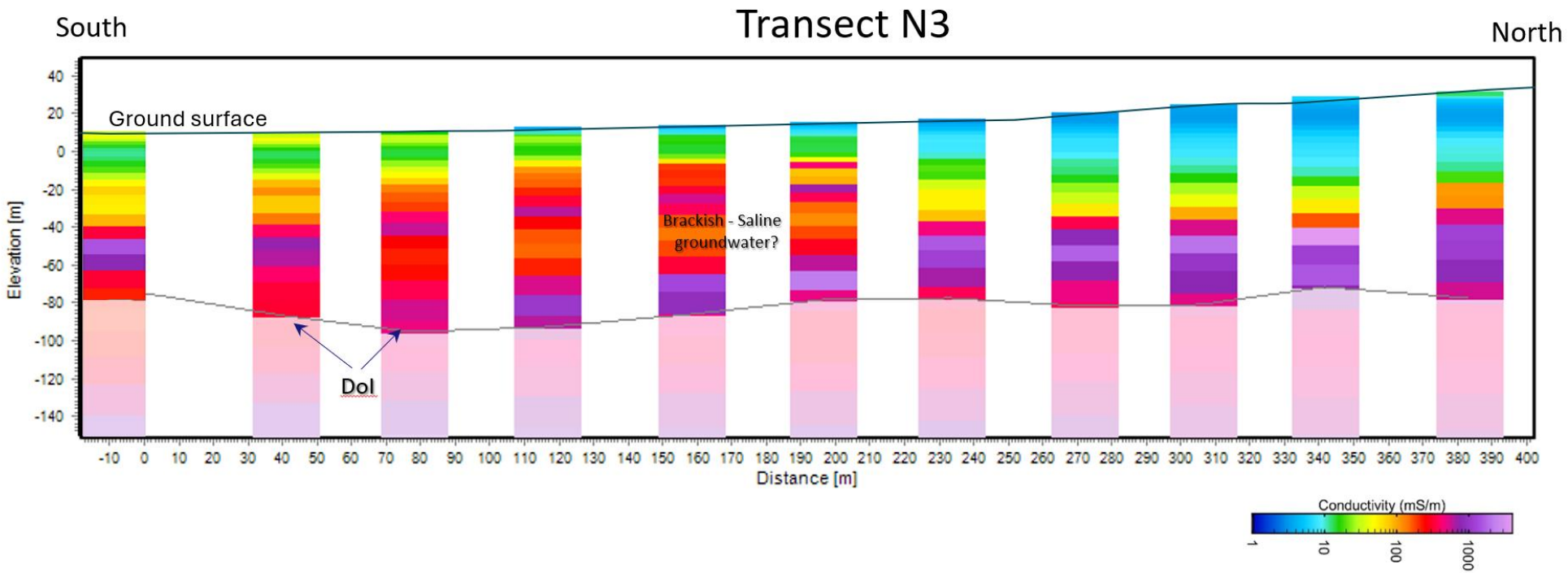


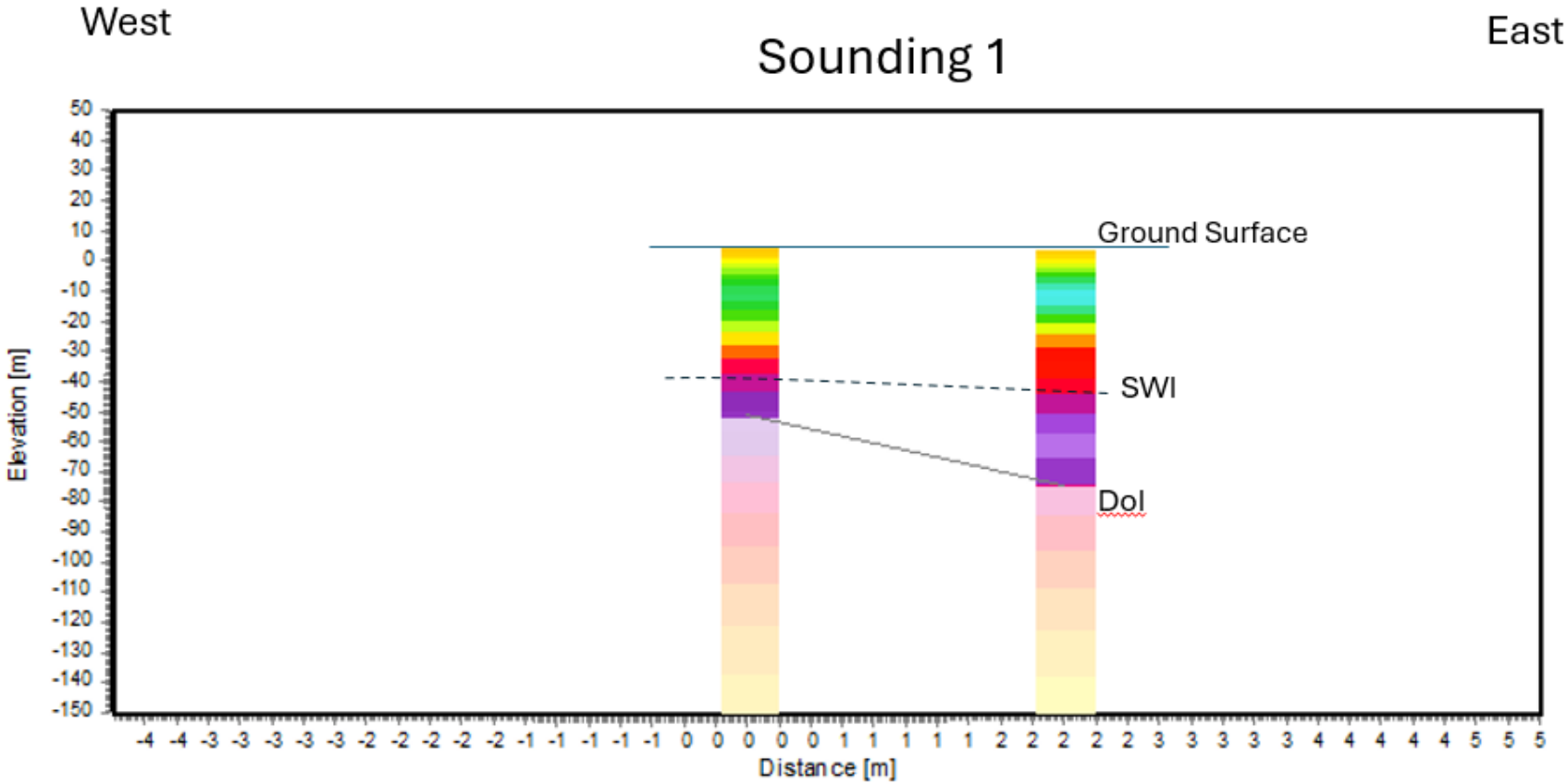
Transect N2: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect N2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.


Transect N2
West
East
Elevation [m]
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
Brackish - Saline groundwater?
Dol
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
Distance [m]
Conductivity (mS/m)
1
10
100
1000

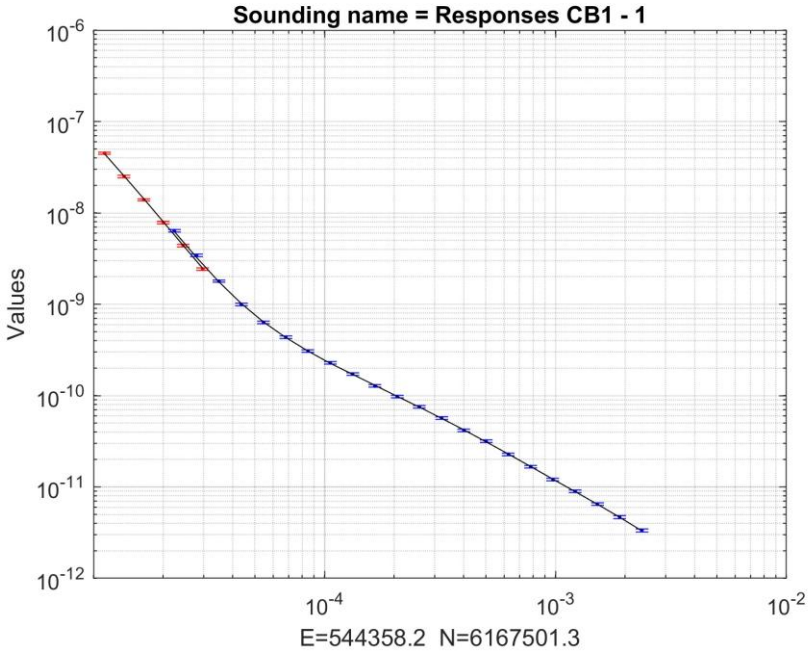


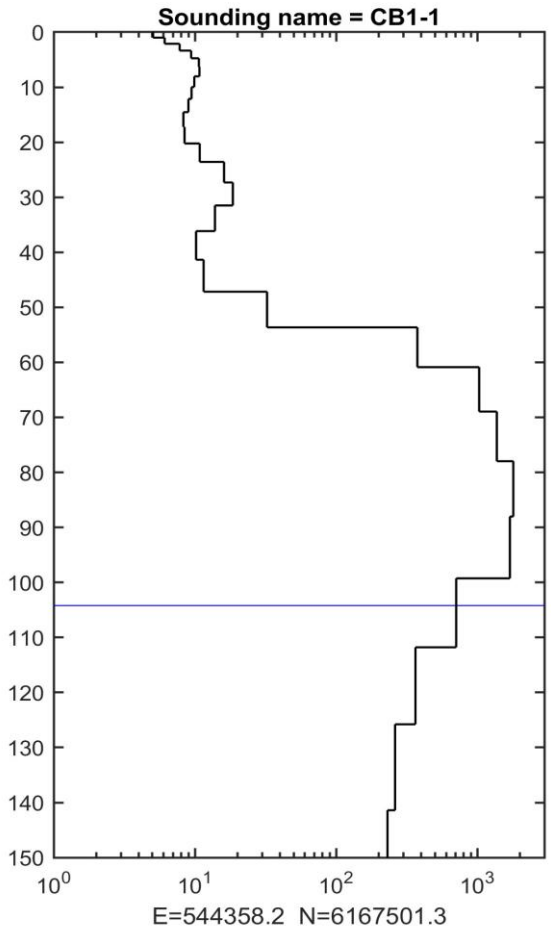
Transect N3: Amplitude responses for each gate of the Low (top panel) and High moment (middle panel) data acquired for soundings along Transect N3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Greyed-out gates and soundings are those deleted prior to inversion.


Transect N3
South
North
Ground surface
Brackish - Saline groundwater?
DoI
Elevation [m]
Distance [m]
Conductivity (mS/m)
1
10
100
1000

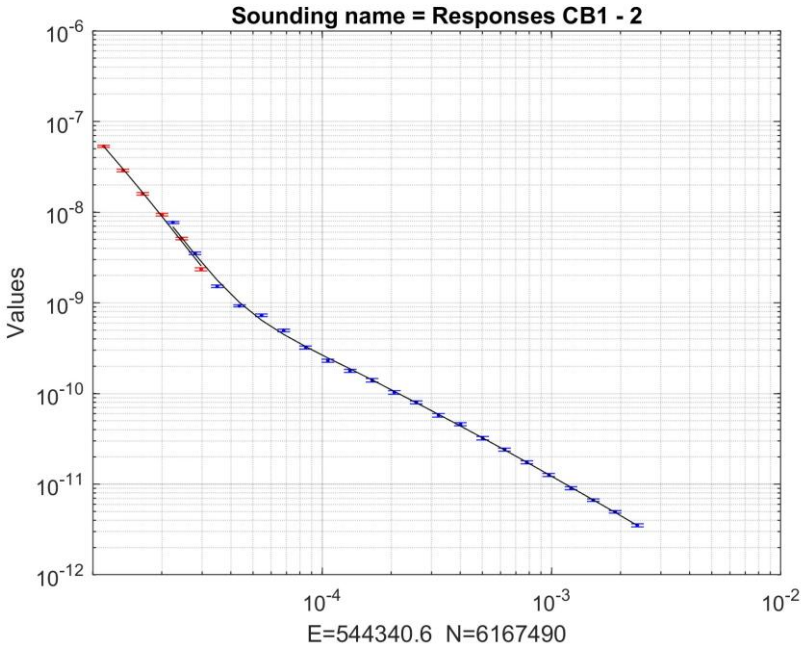

West
Sounding 1
East
Ground Surface
SWI
DoI
Elevation [m]
Distance [m]

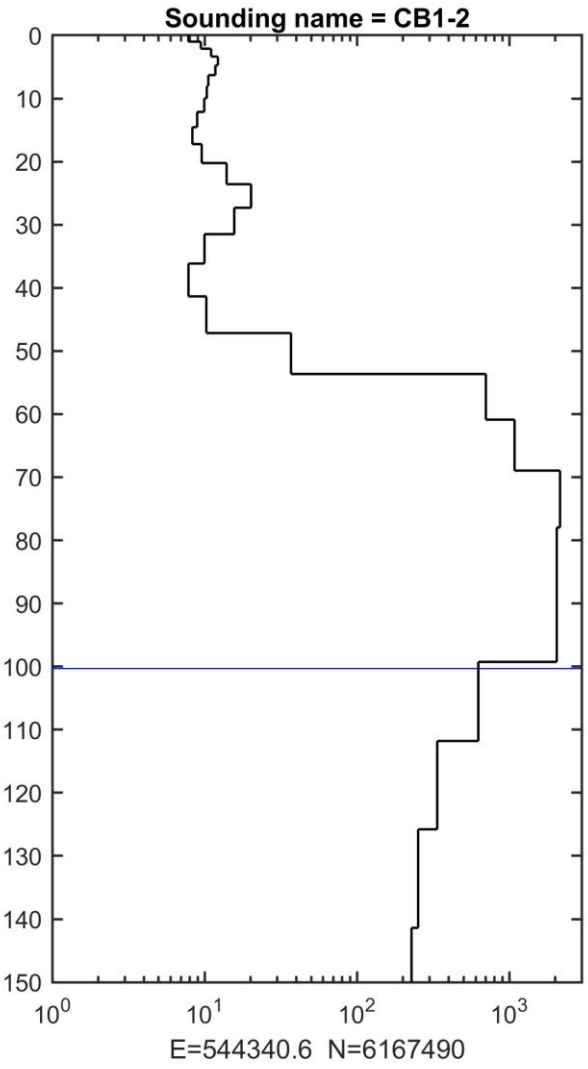
A.2 Appendix 2: Observed responses for low and high moments at each sounding on each transect and derived smooth 1D LEI models:



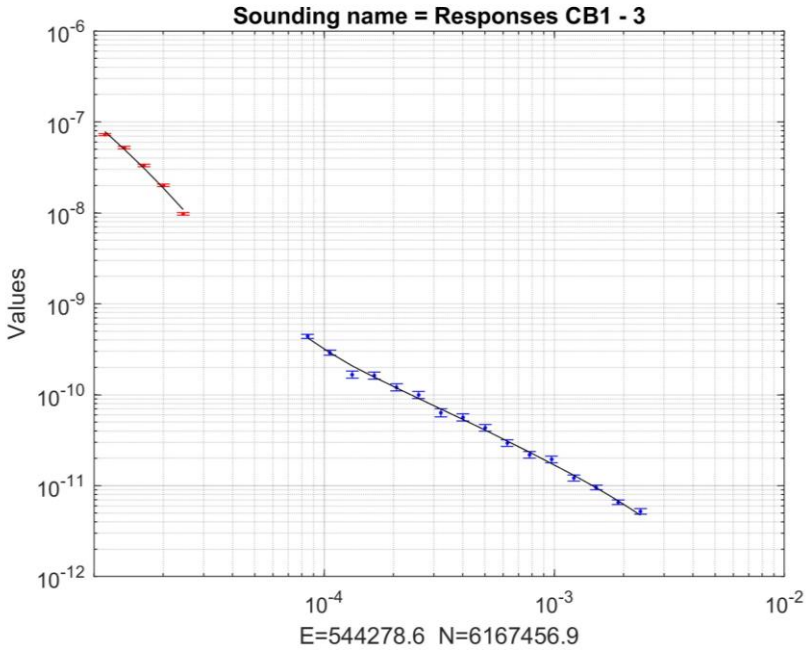


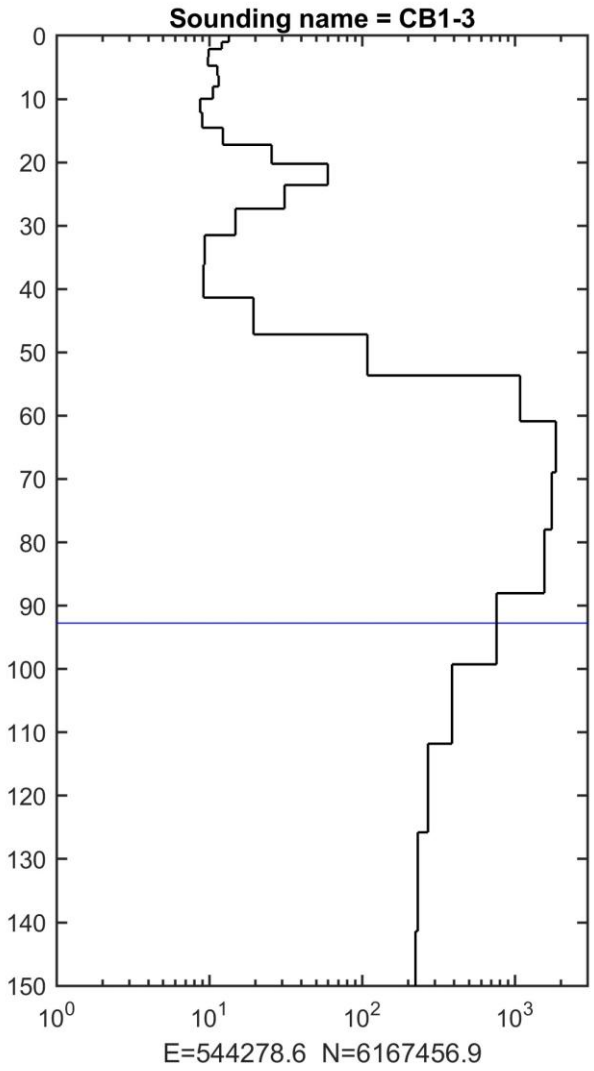
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



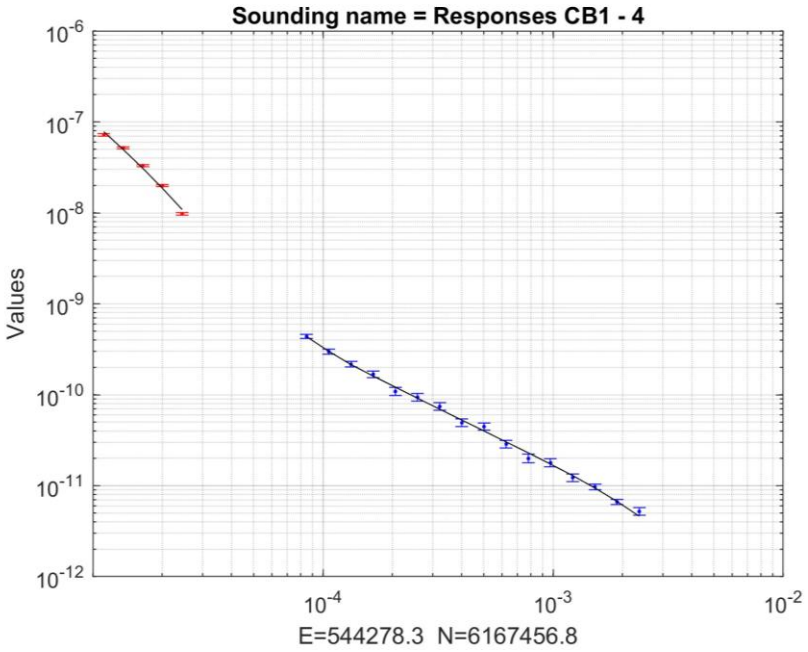


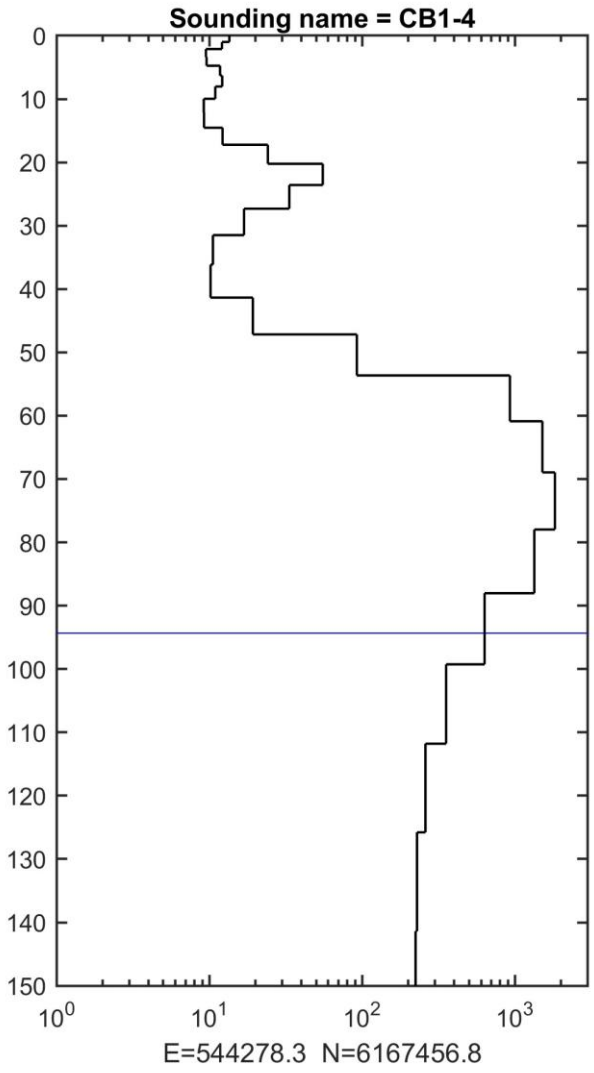
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



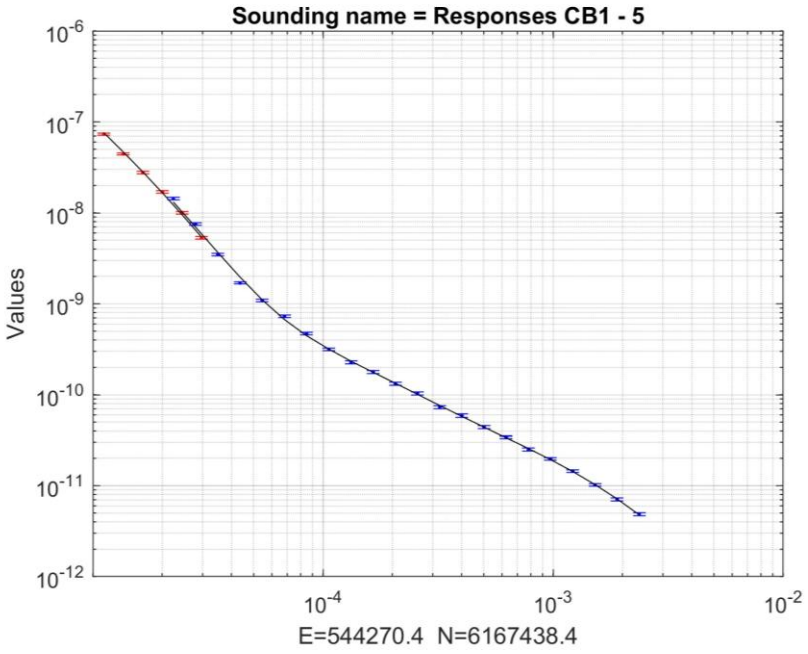


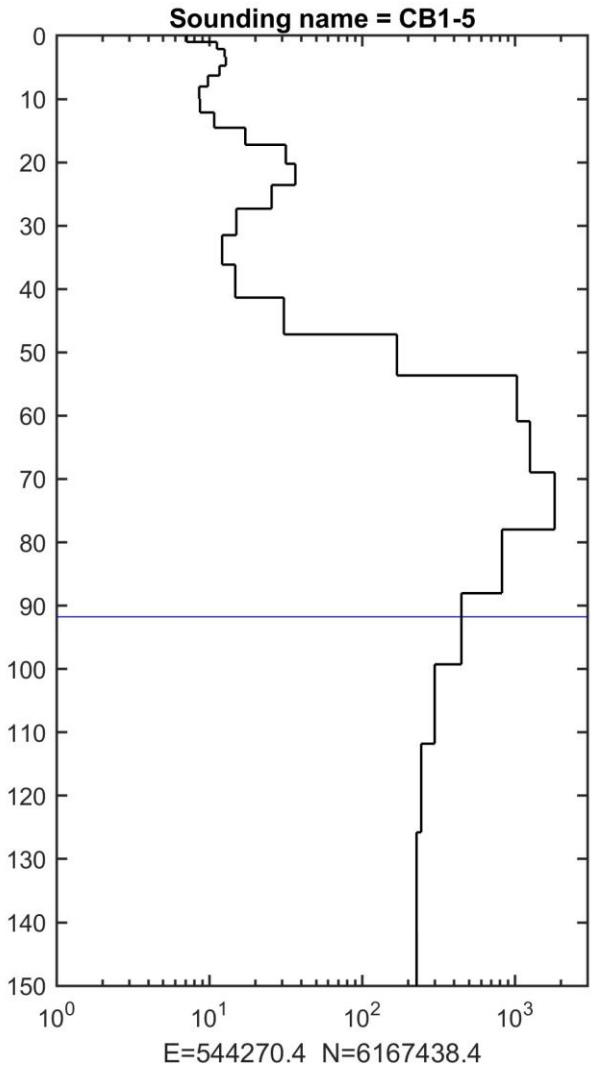
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



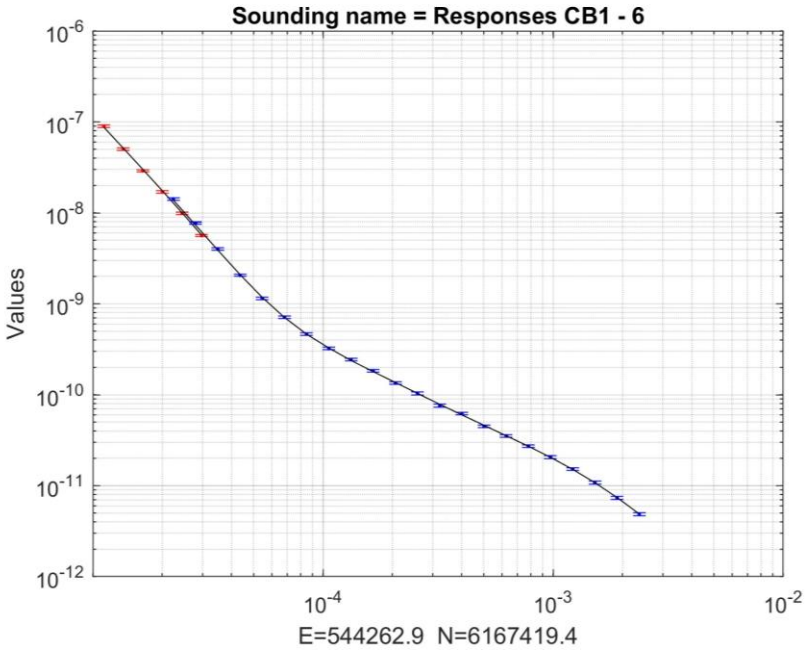


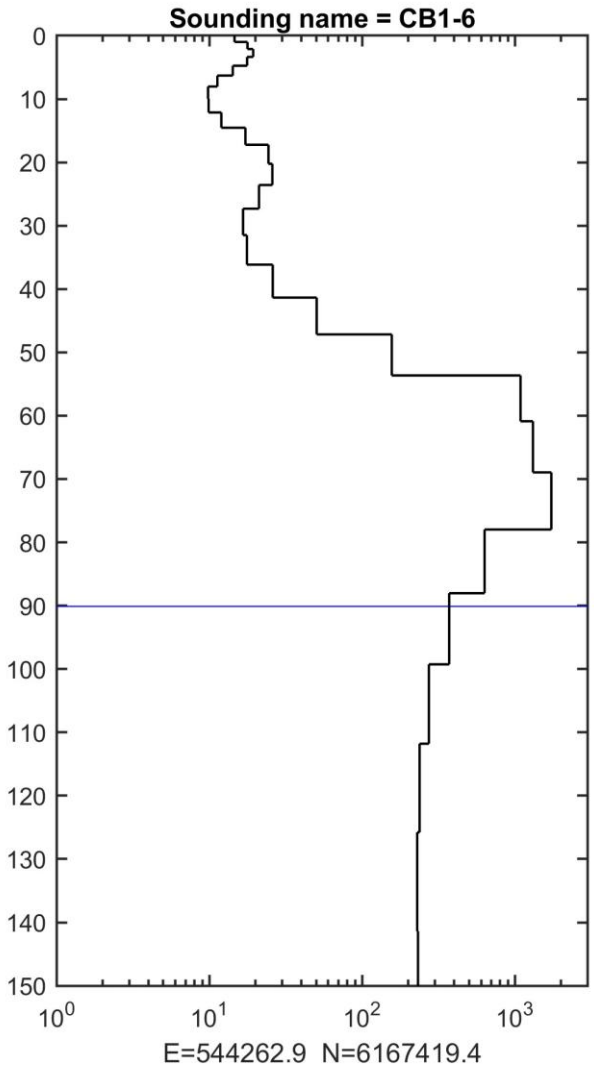
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



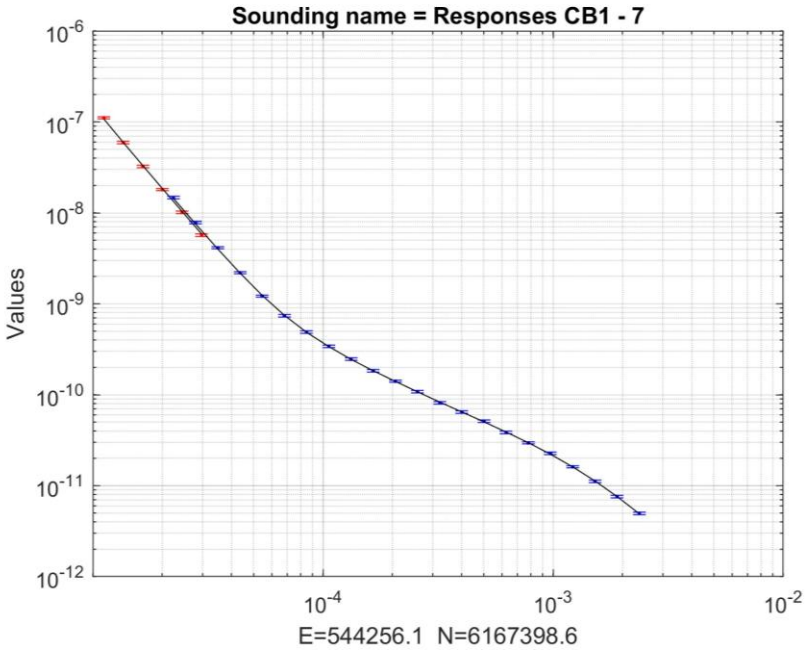


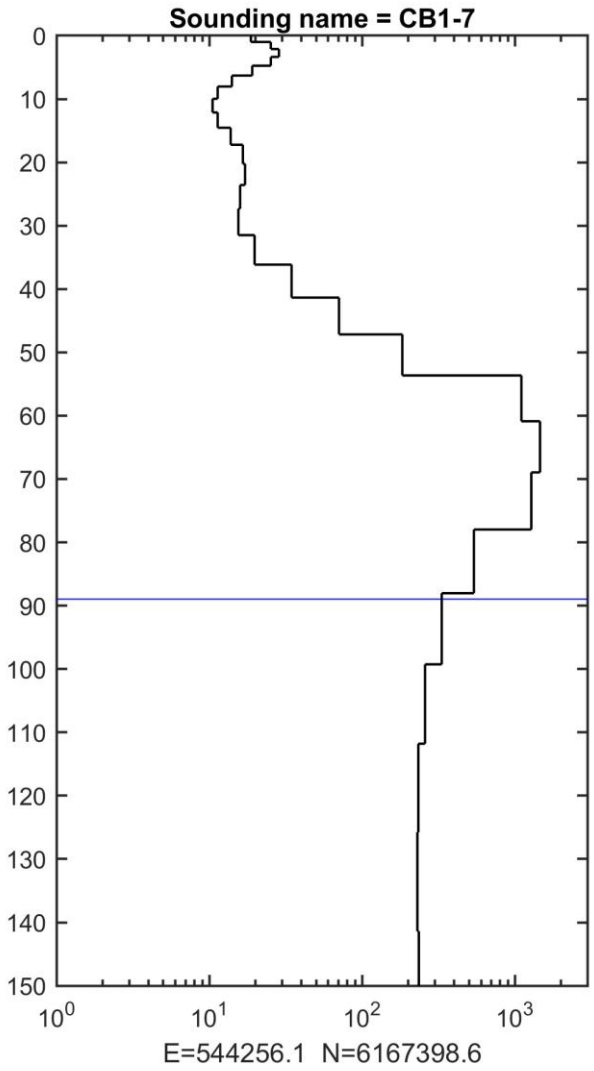
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



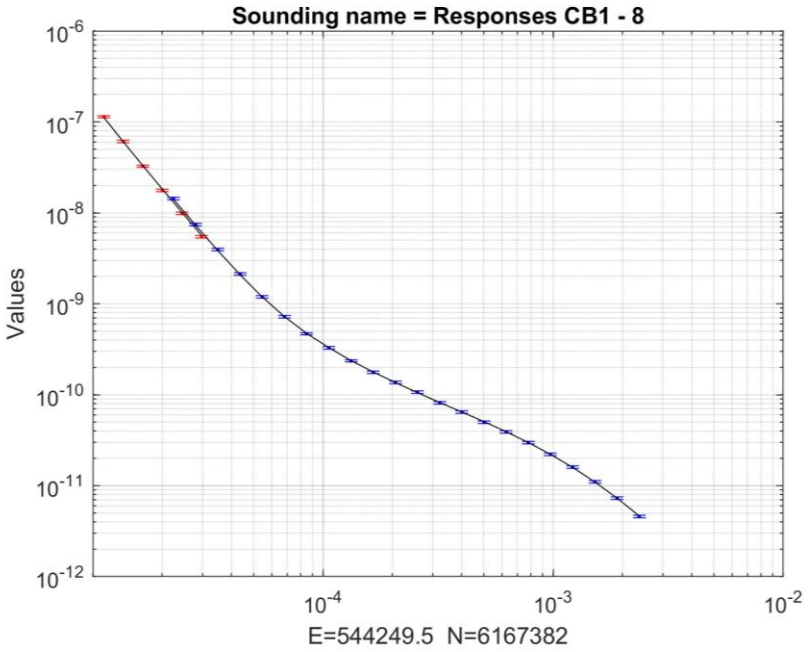


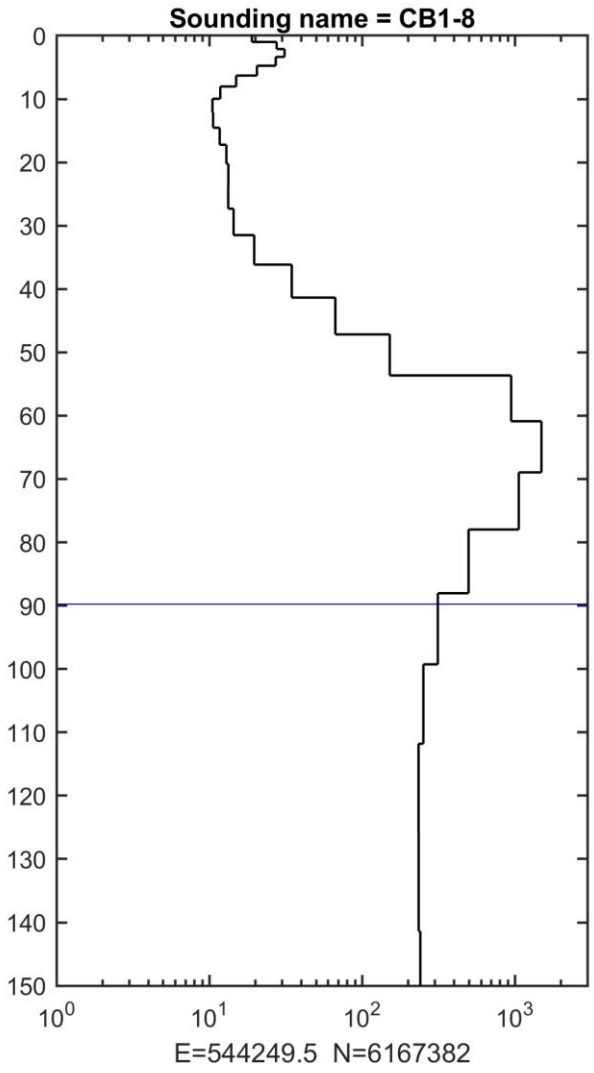
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



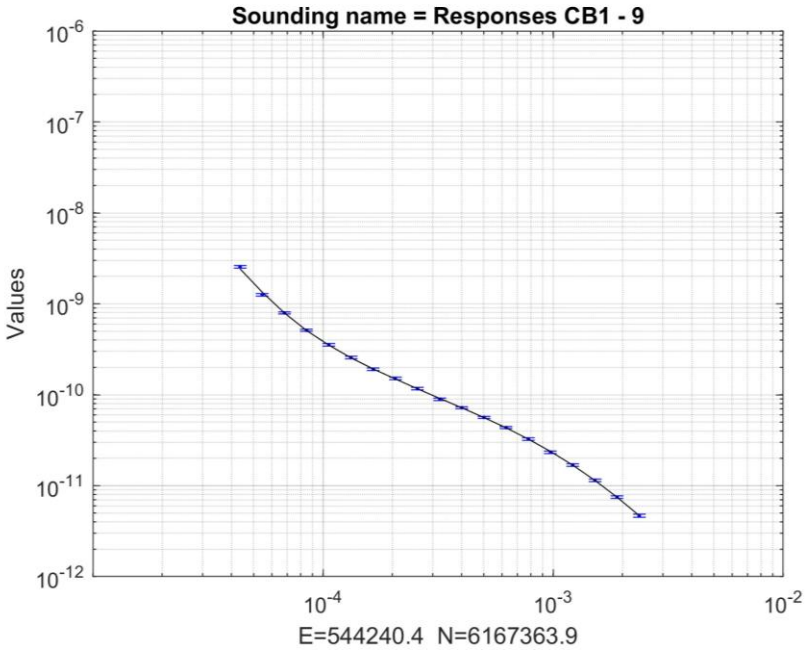


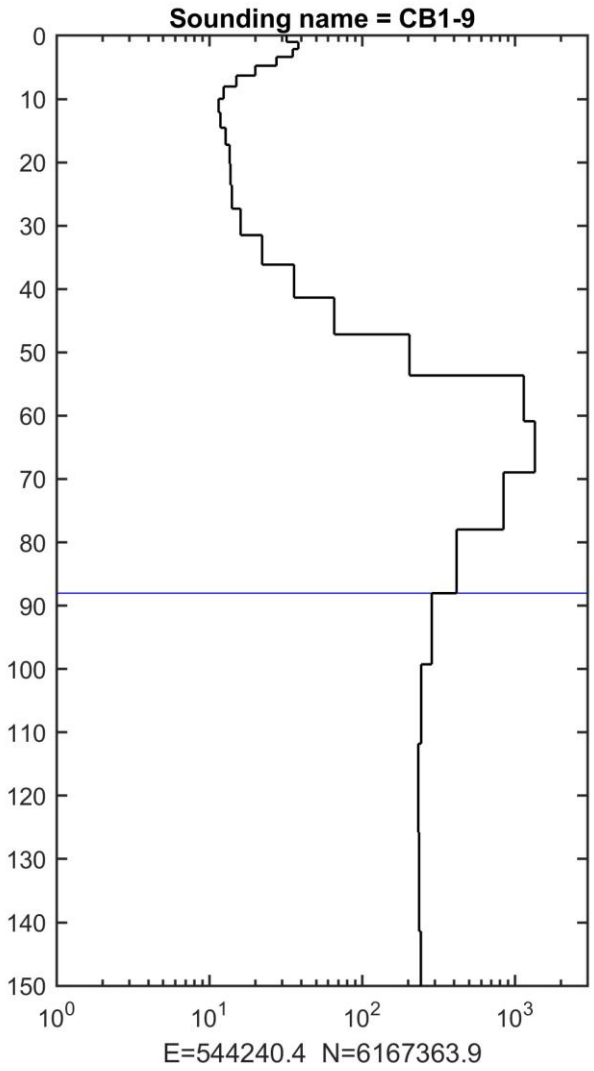
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



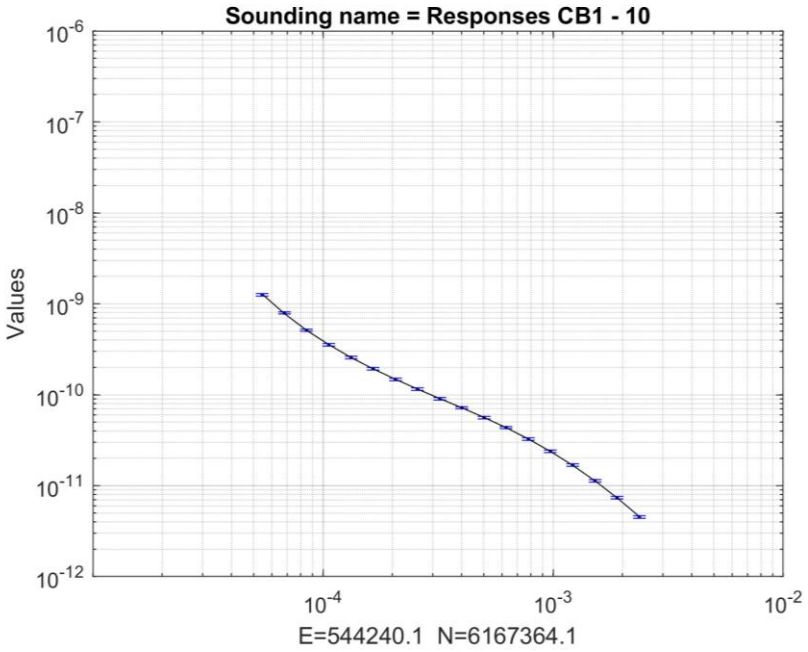


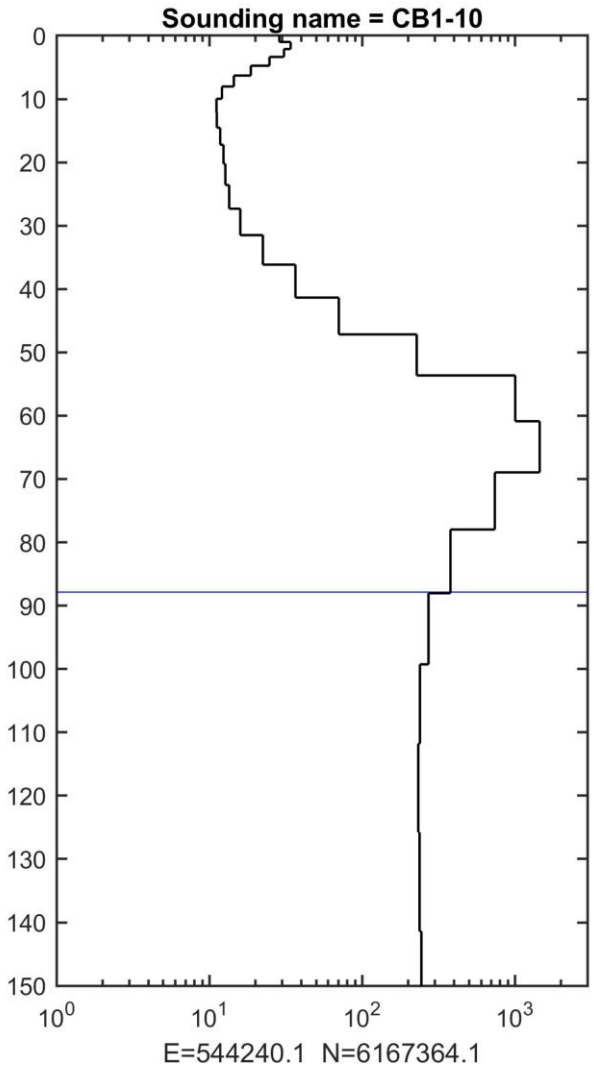
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



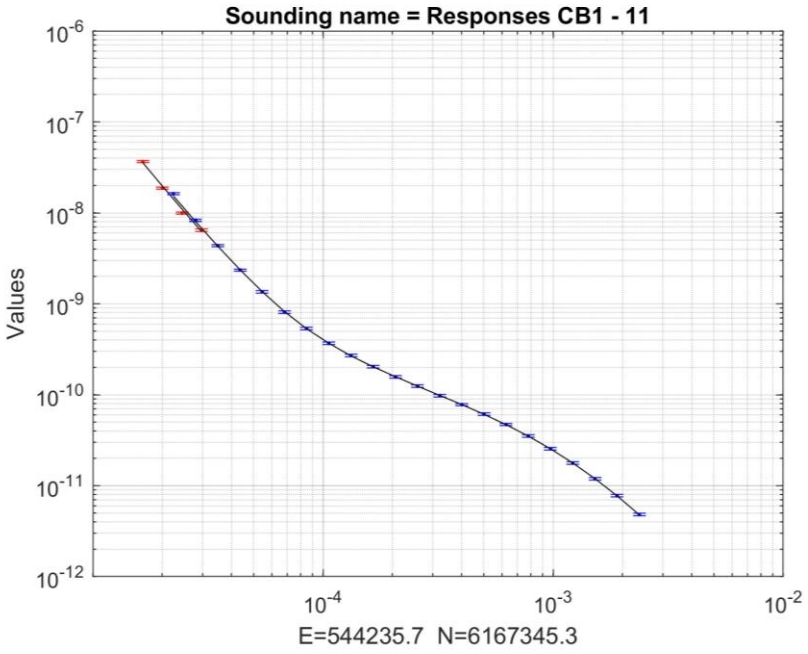


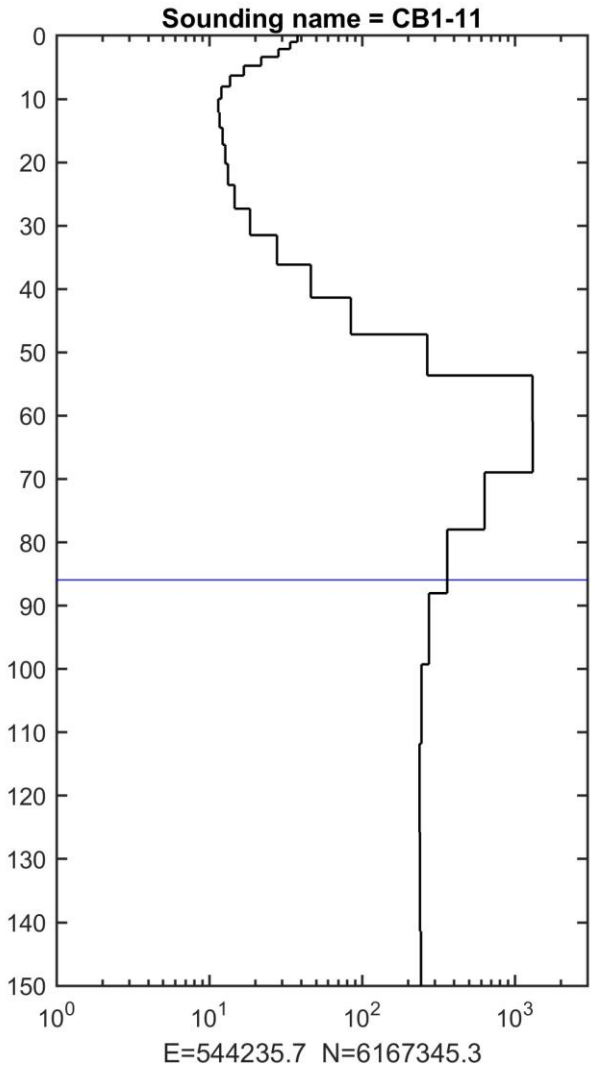
Transect 1: Observed responses – high moment (top panel) for Sounding CB1-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



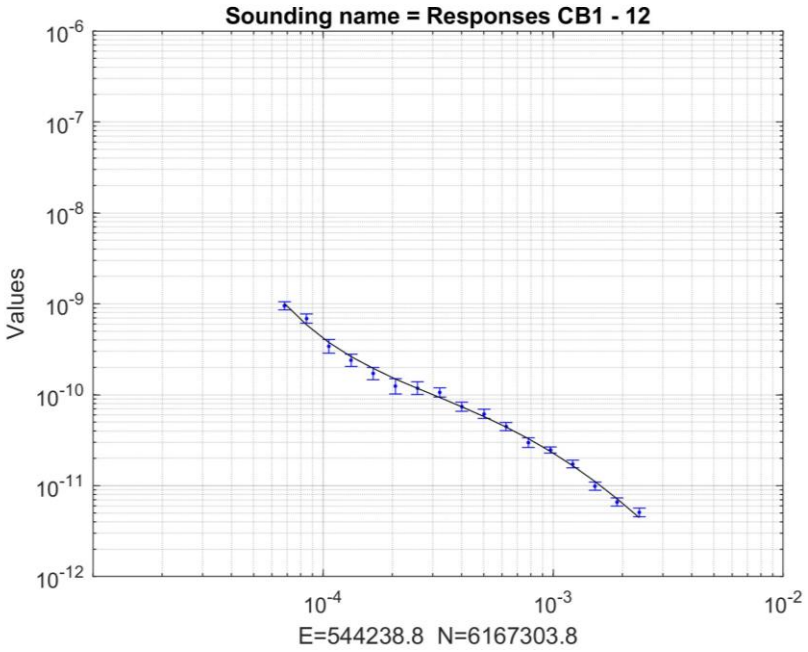


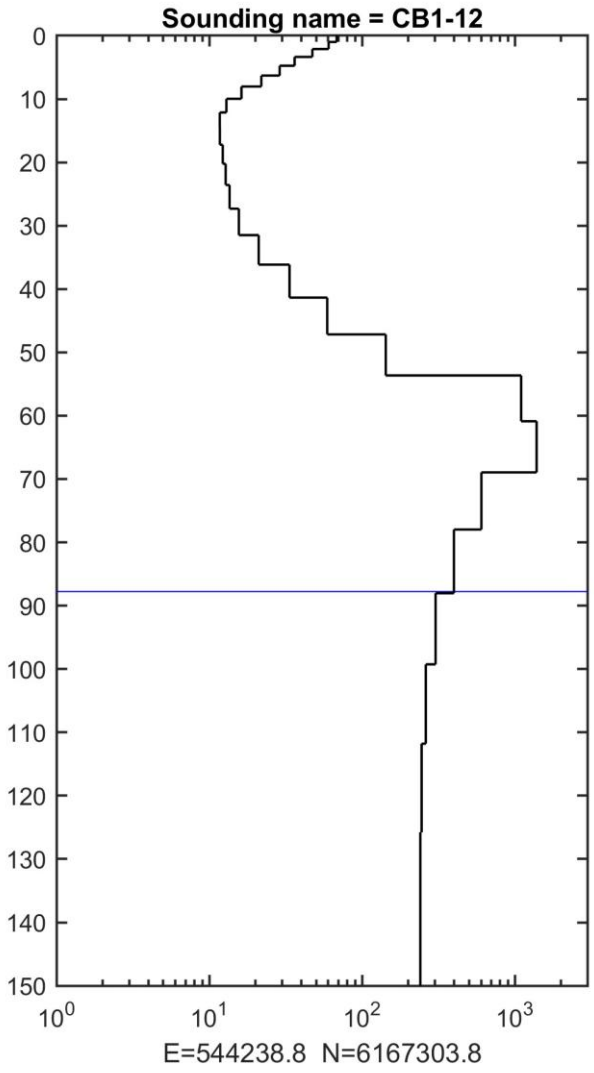
Transect 1: Observed responses – high moment (top panel) for Sounding CB1-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



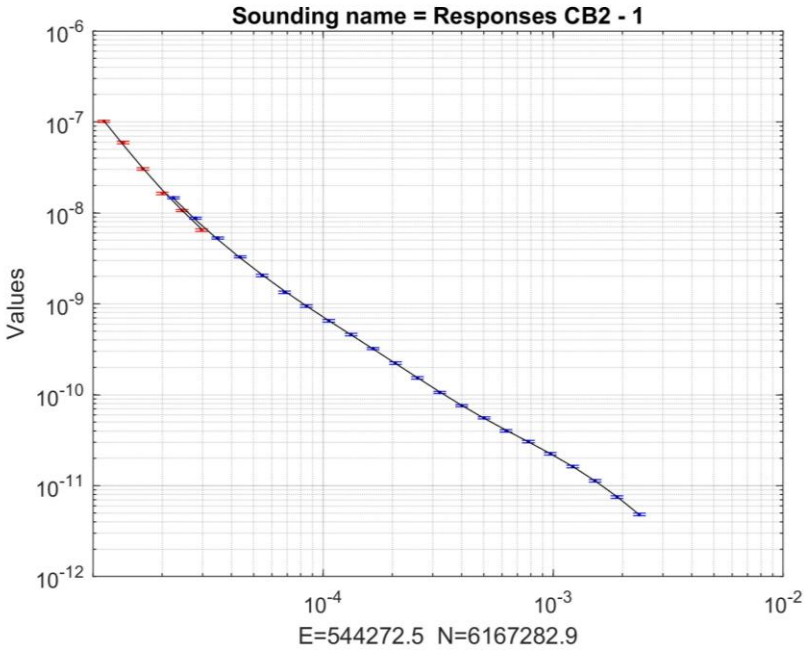


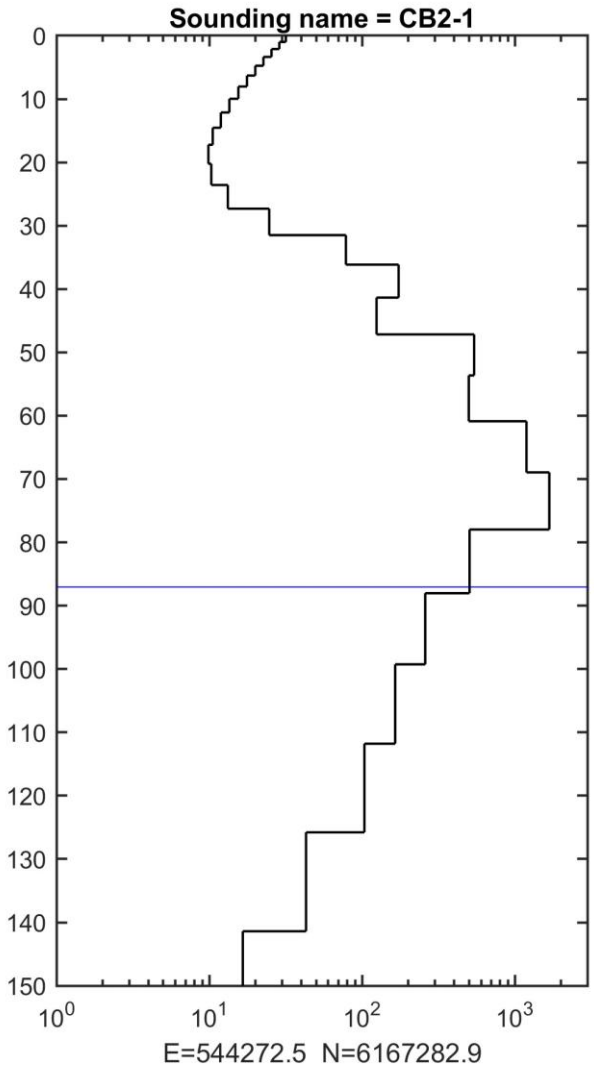
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-11. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



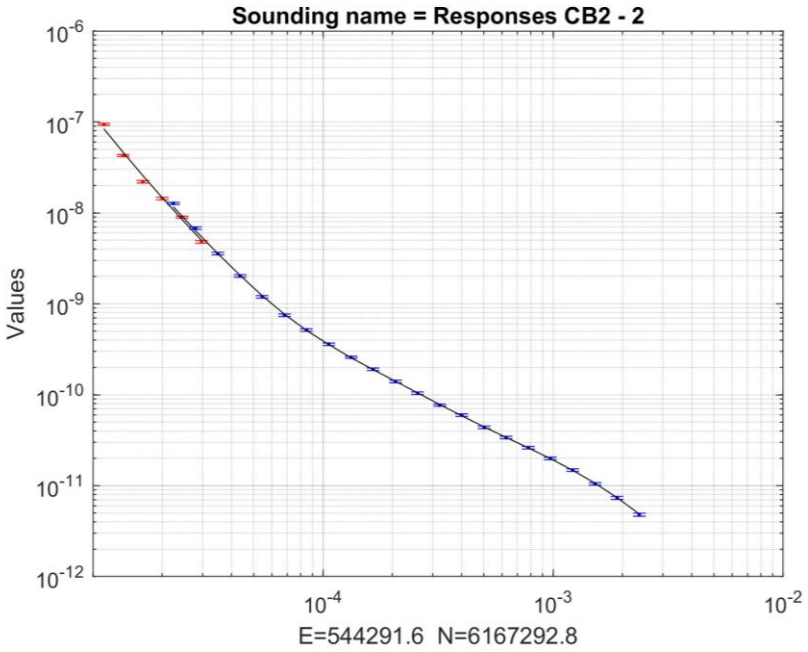


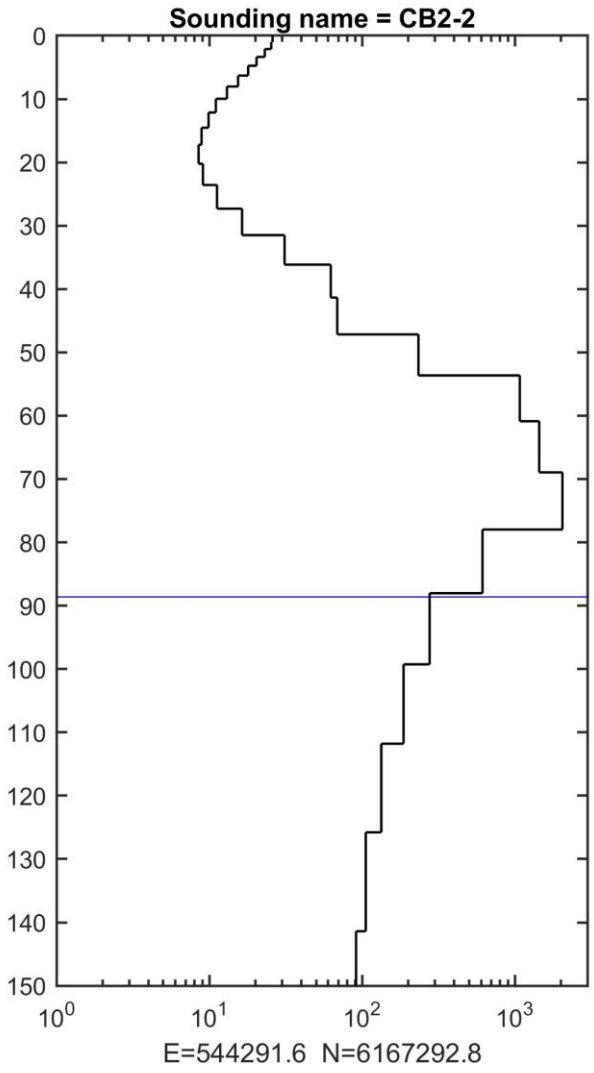
Transect 1: Observed responses – low and high moments (top panel) for Sounding CB1-12. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



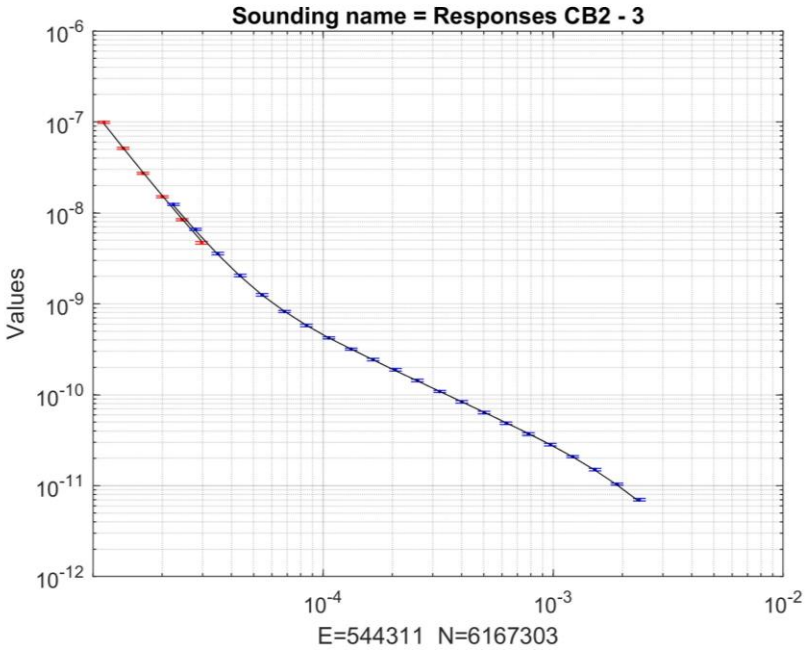


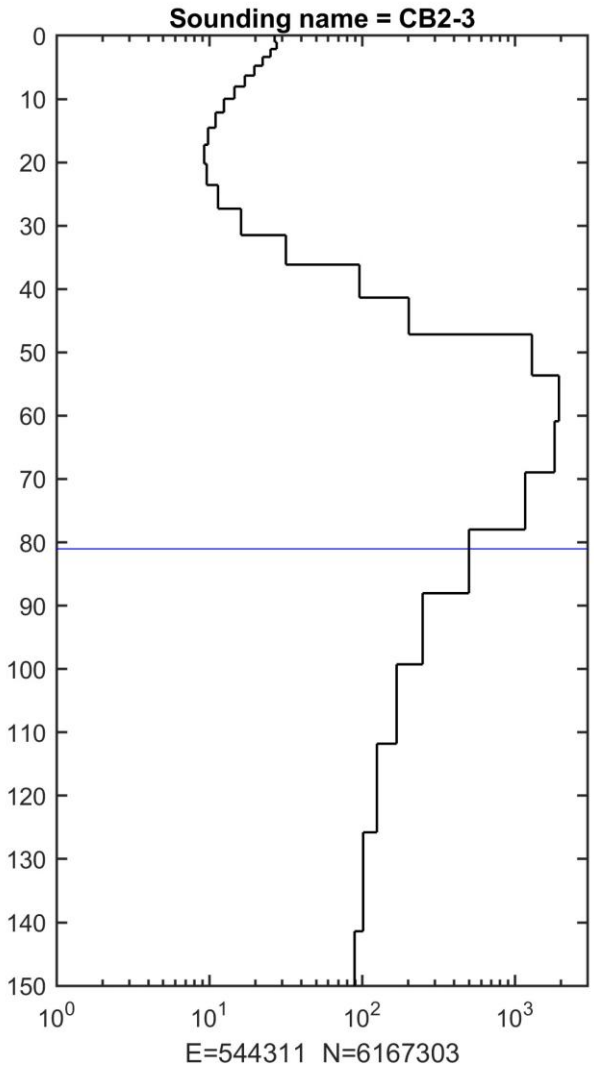
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



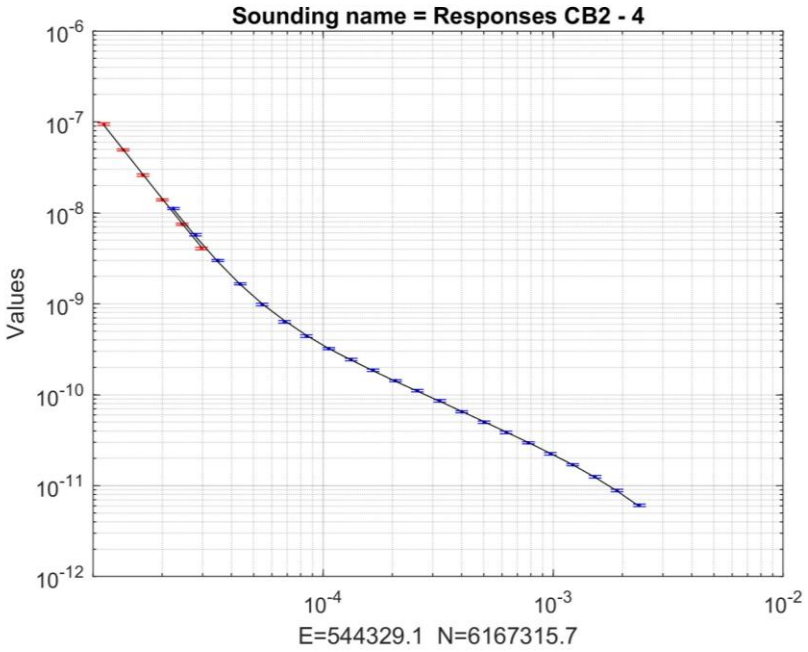


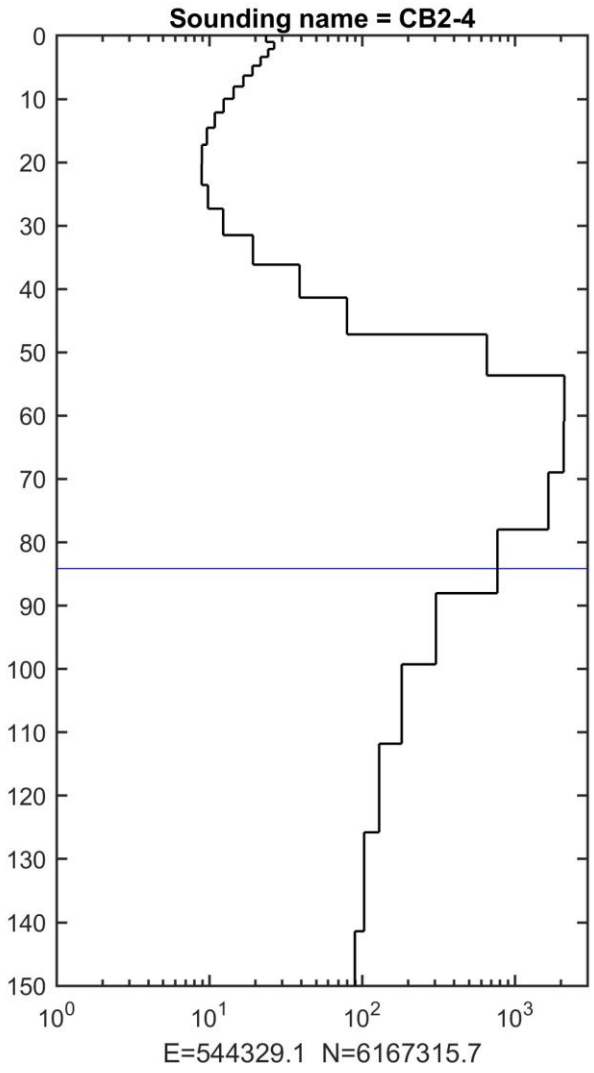
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



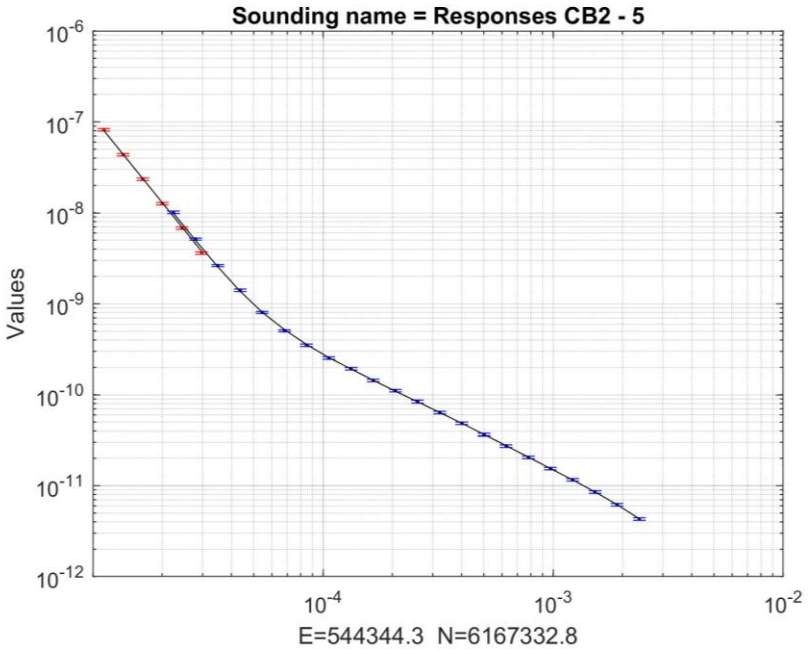


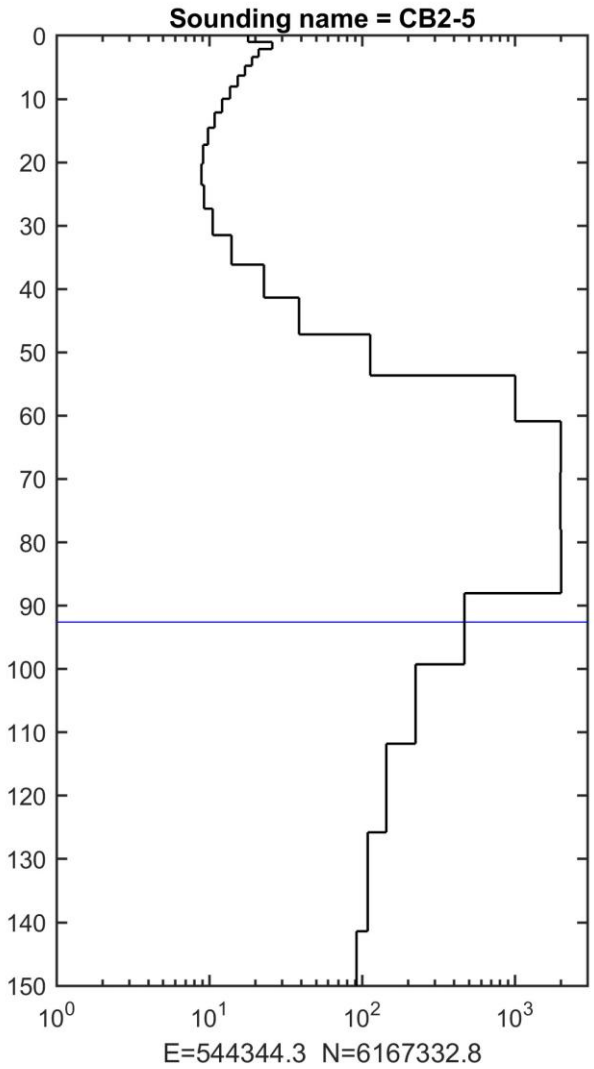
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



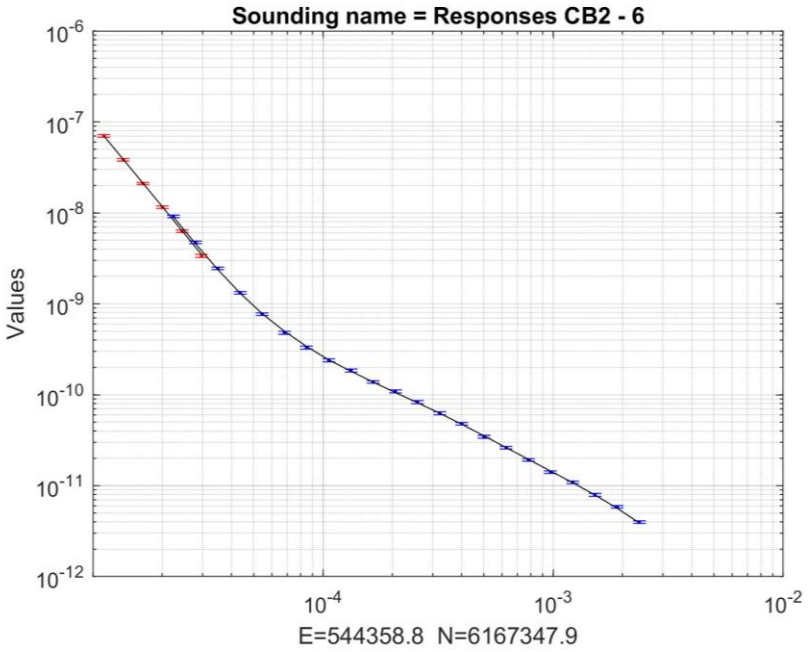


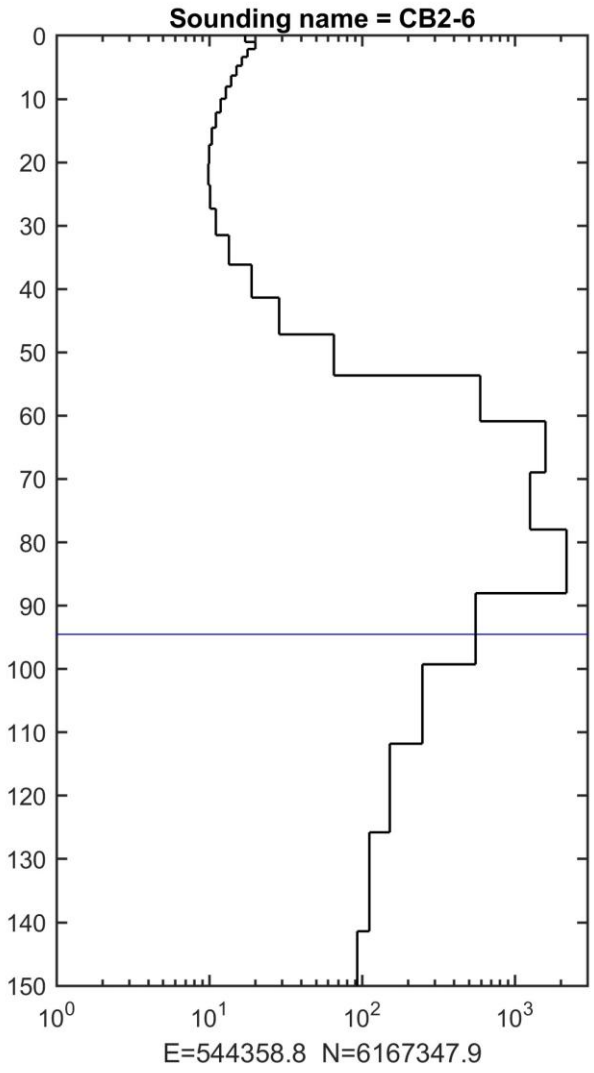
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



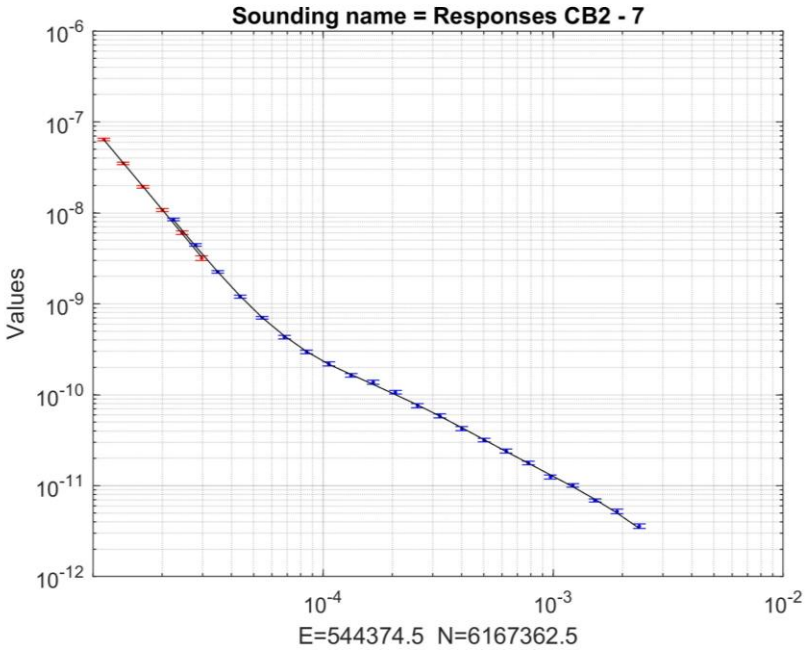


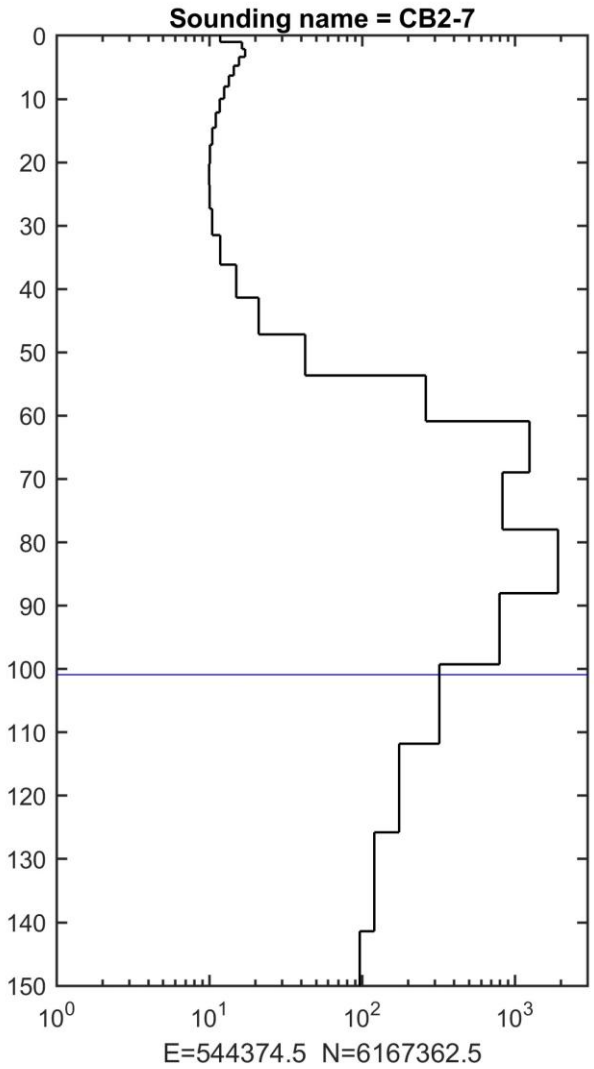
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



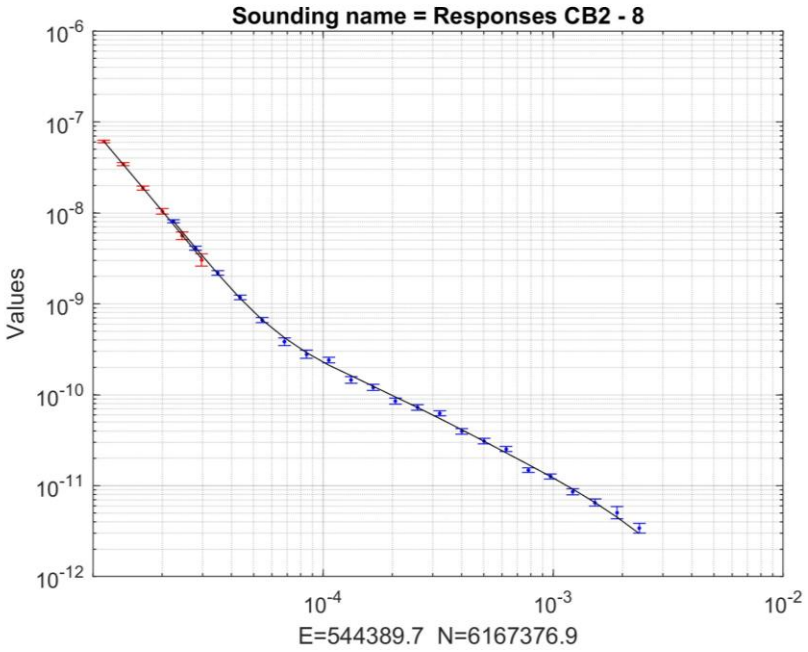


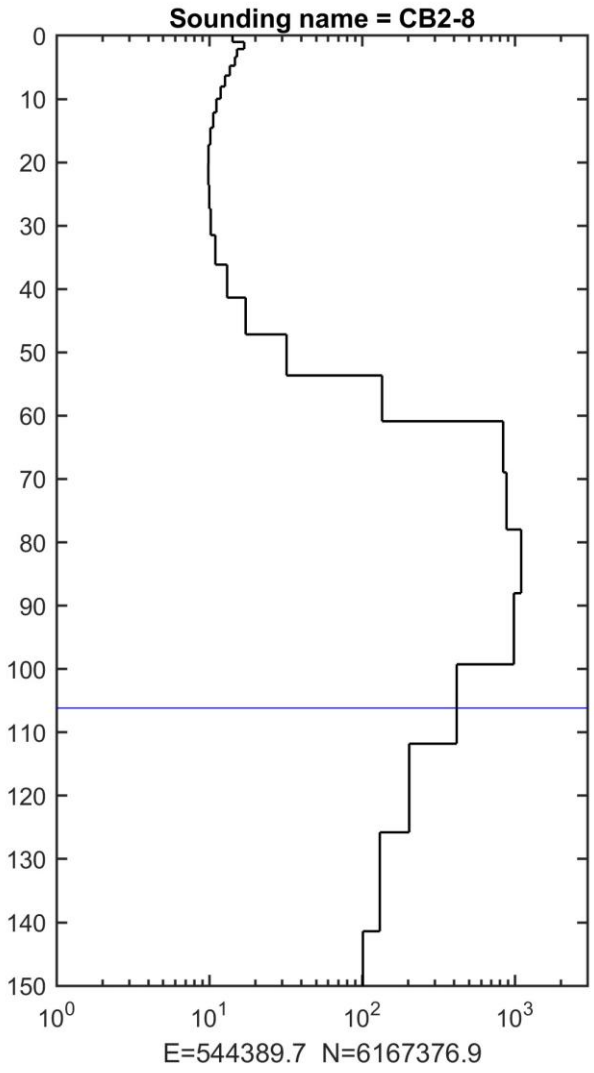
Transect 2 : Observed responses – low and high moments (top panel) for Sounding CB2-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



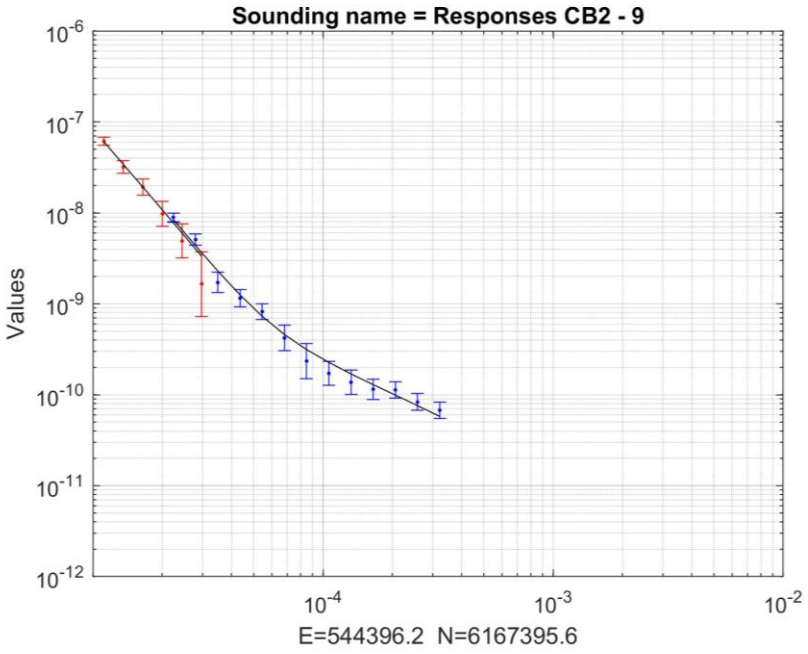


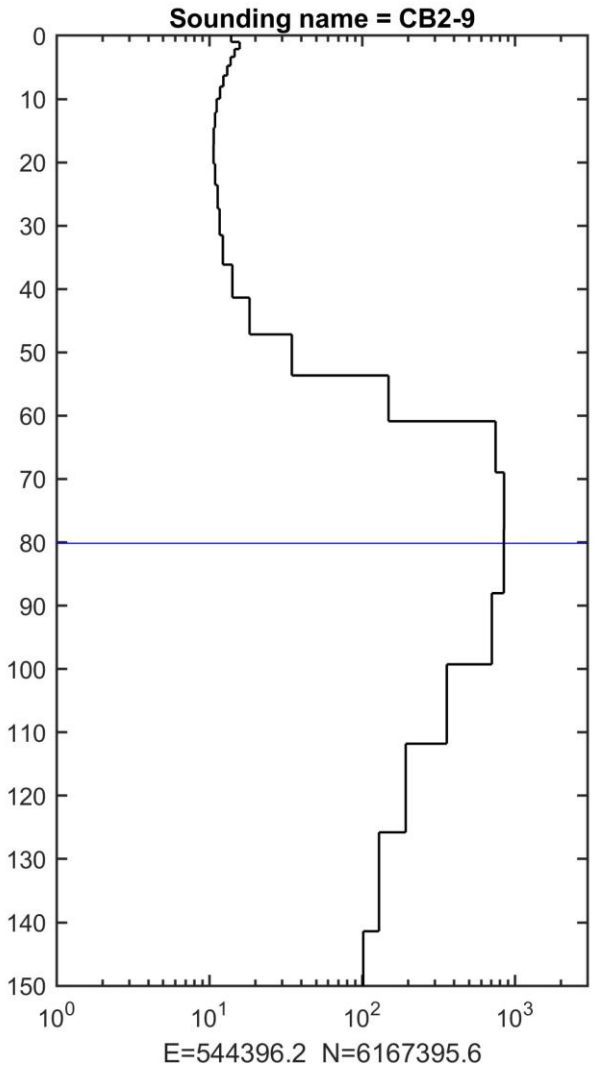
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



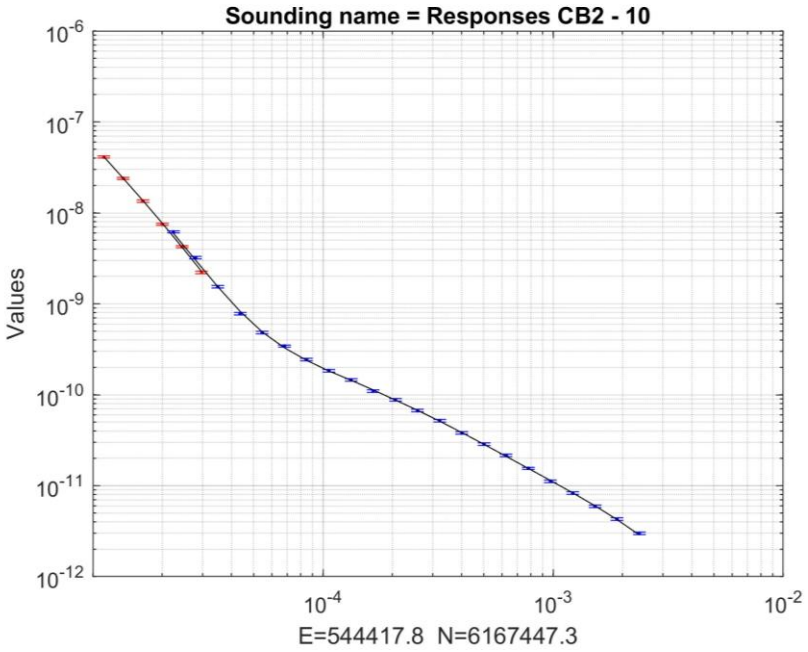


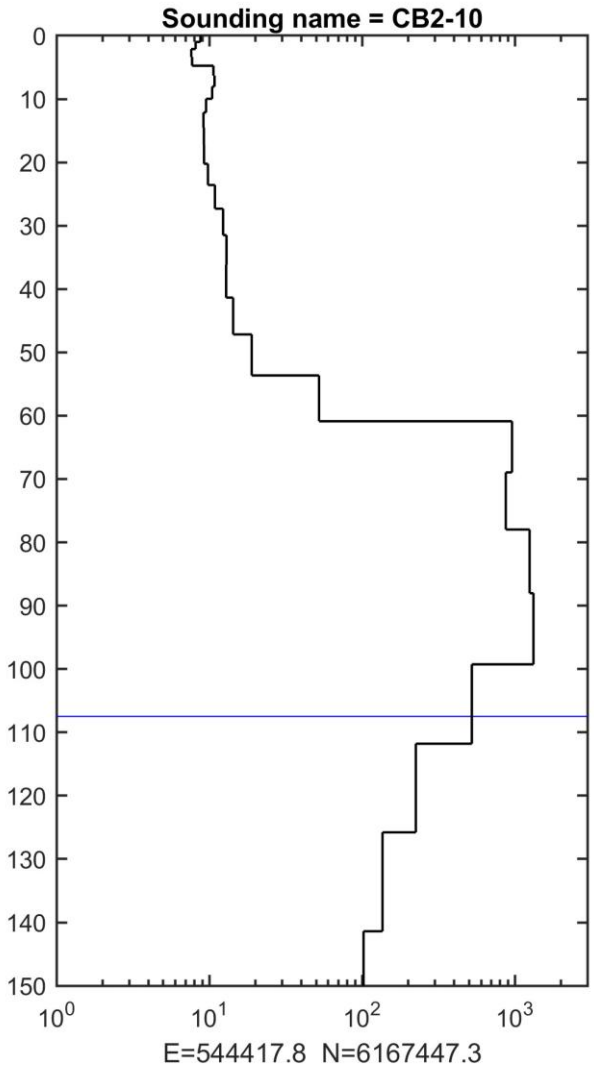
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



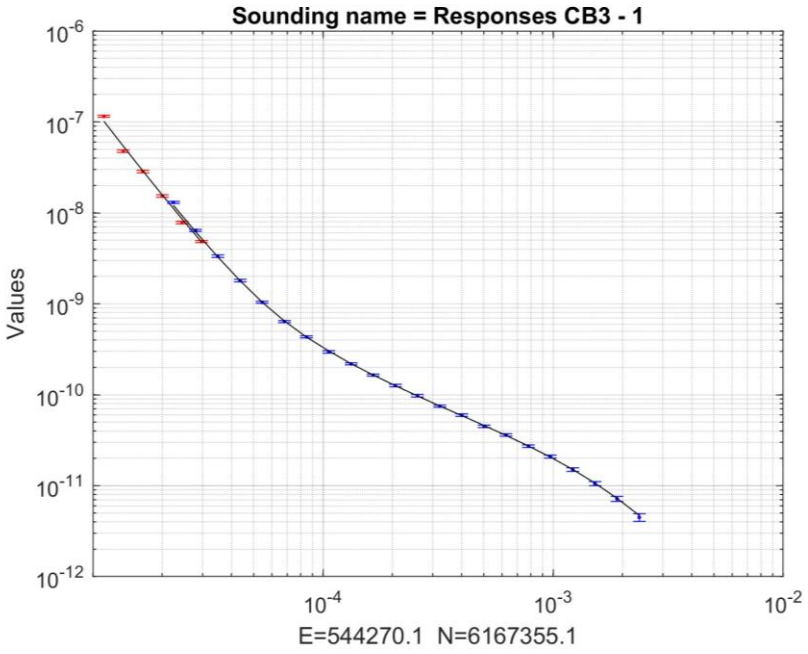


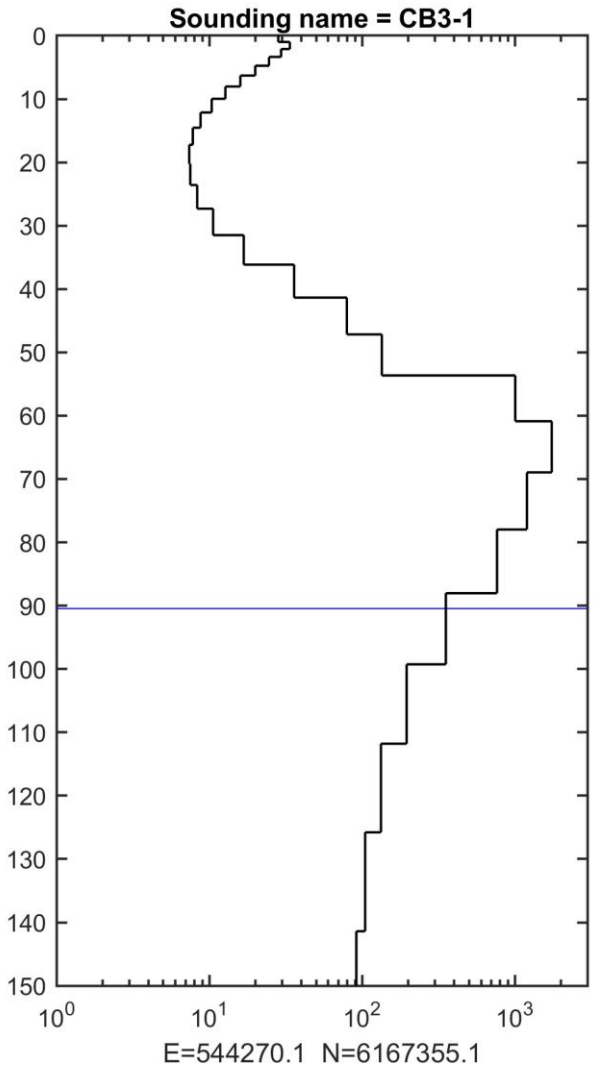
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



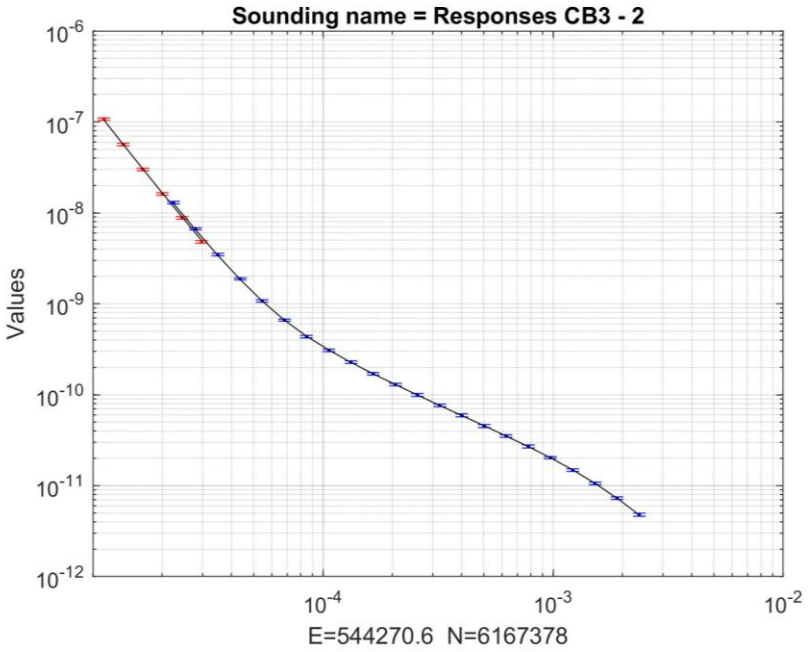


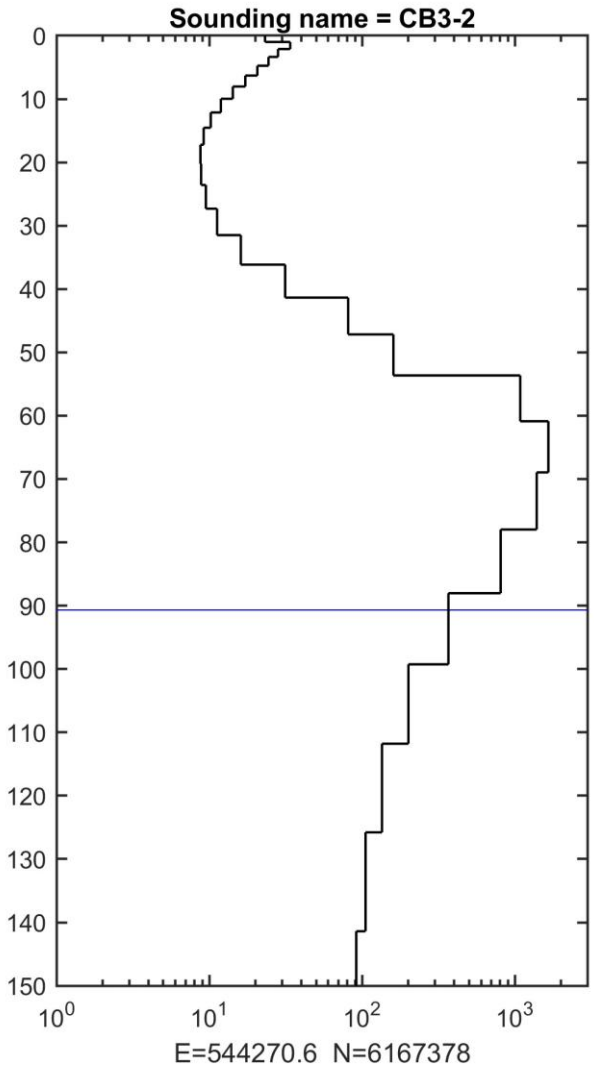
Transect 2: Observed responses – low and high moments (top panel) for Sounding CB2-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



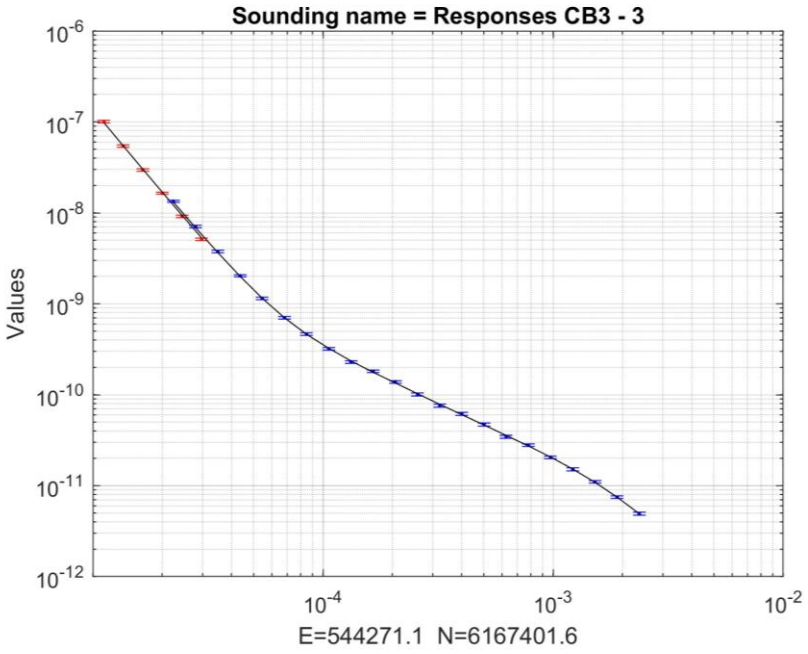


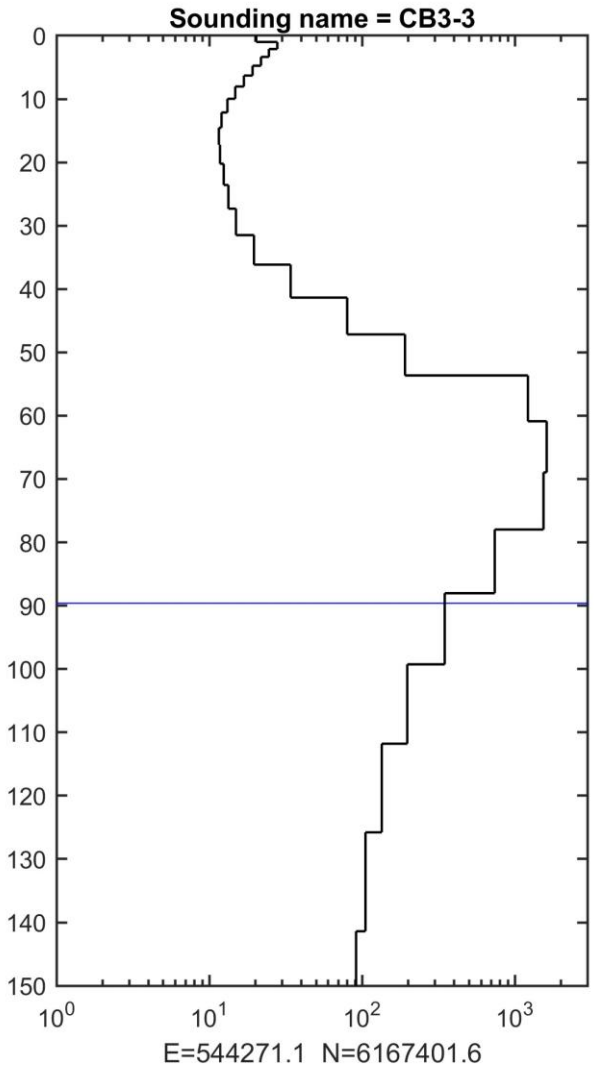
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



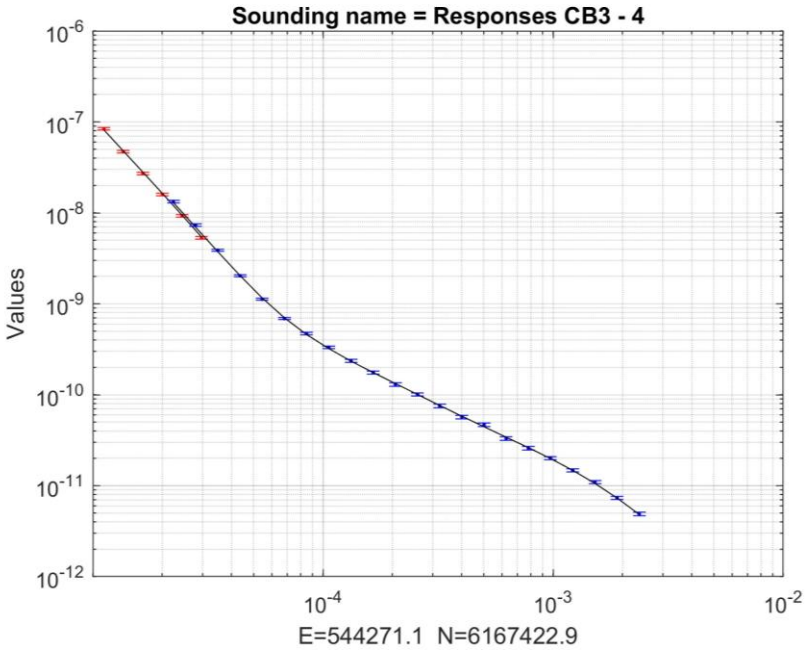


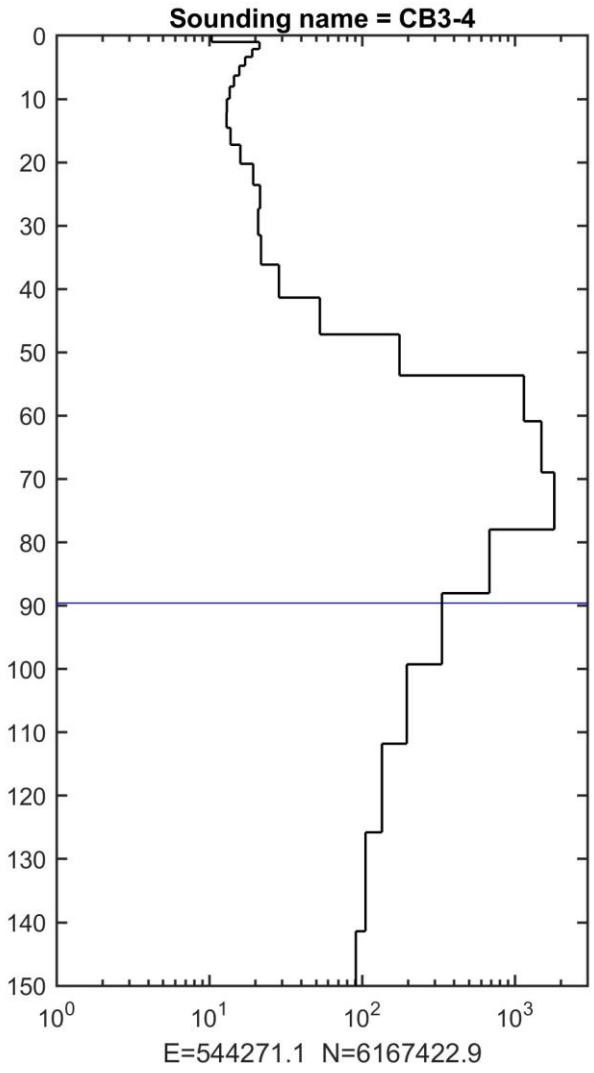
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



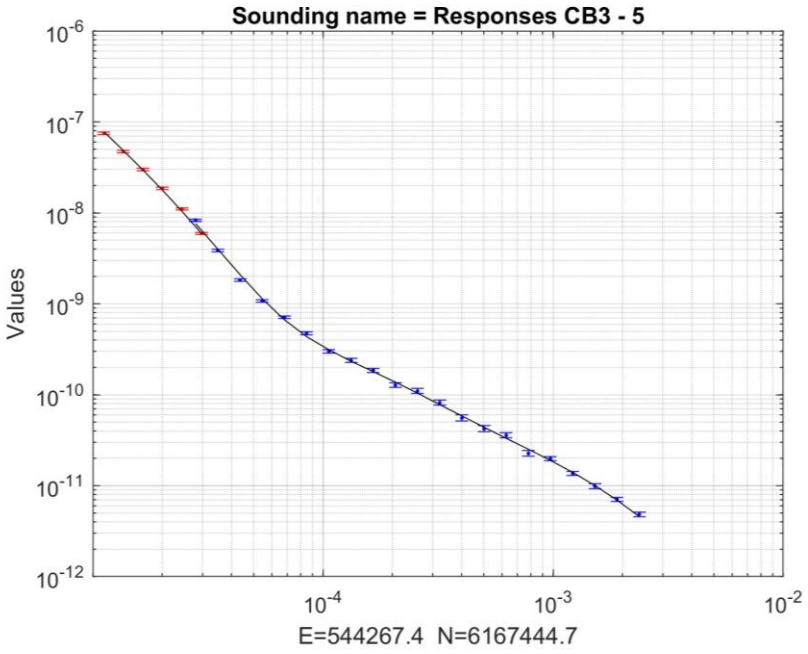


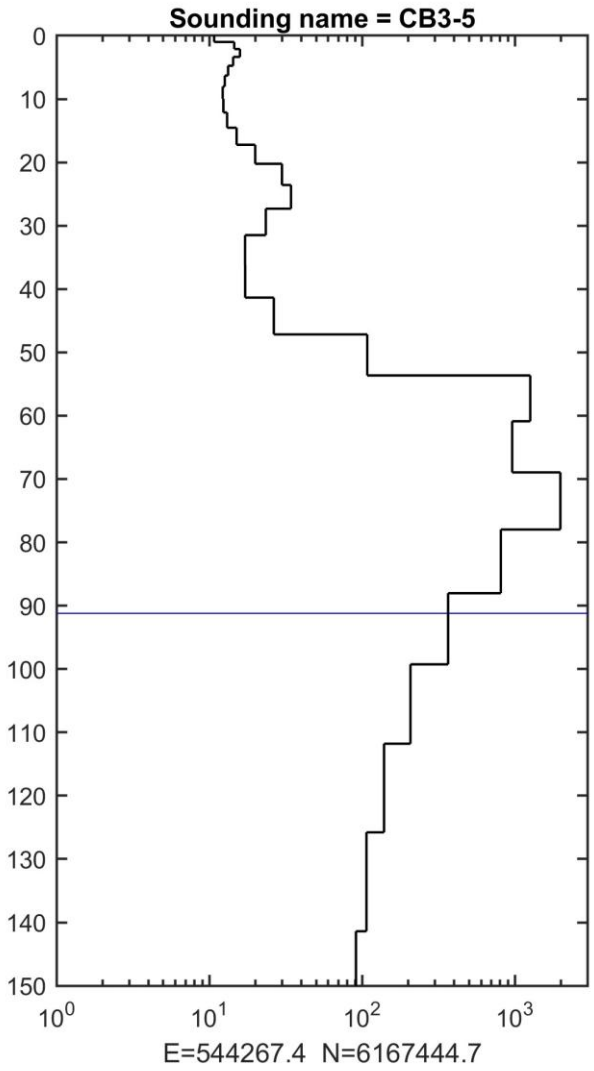
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



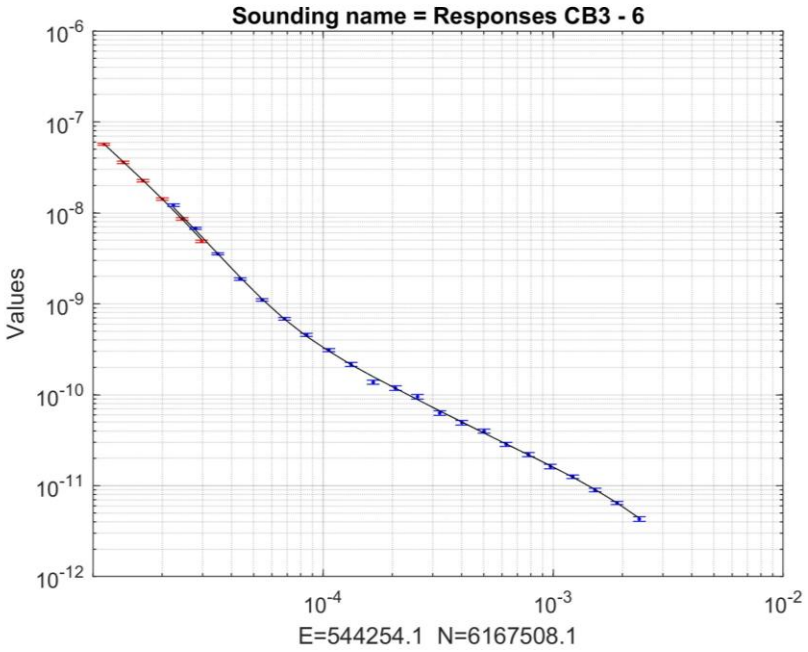


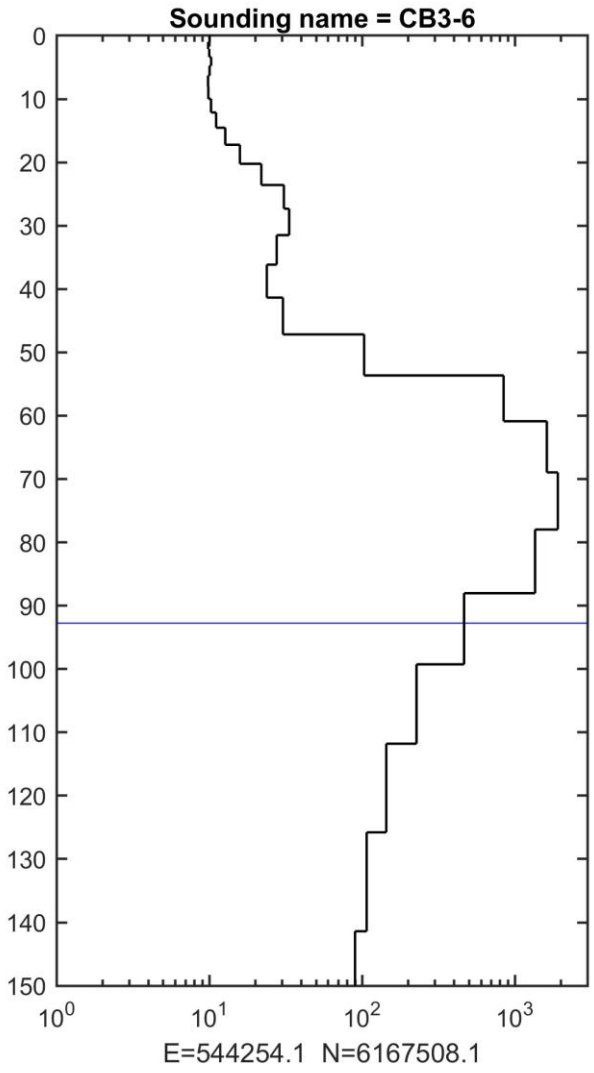
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



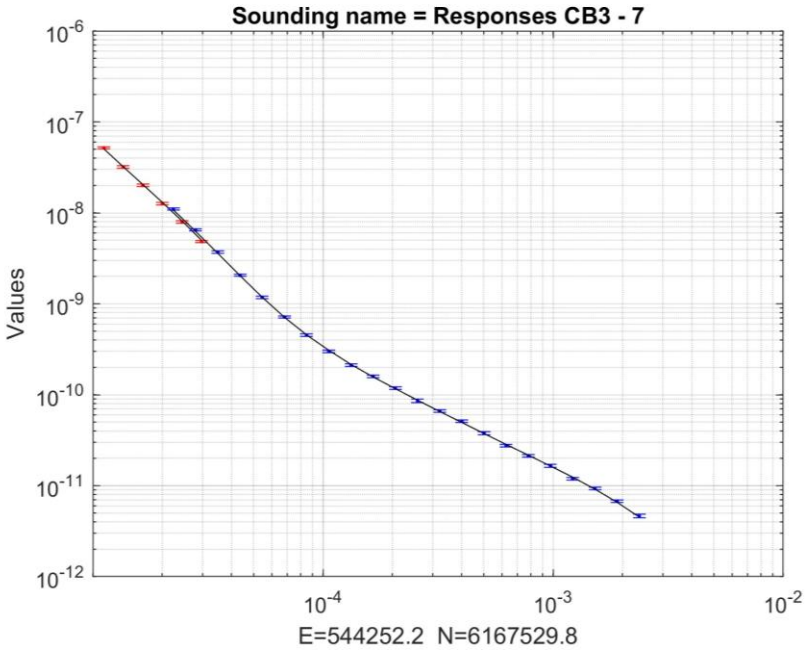


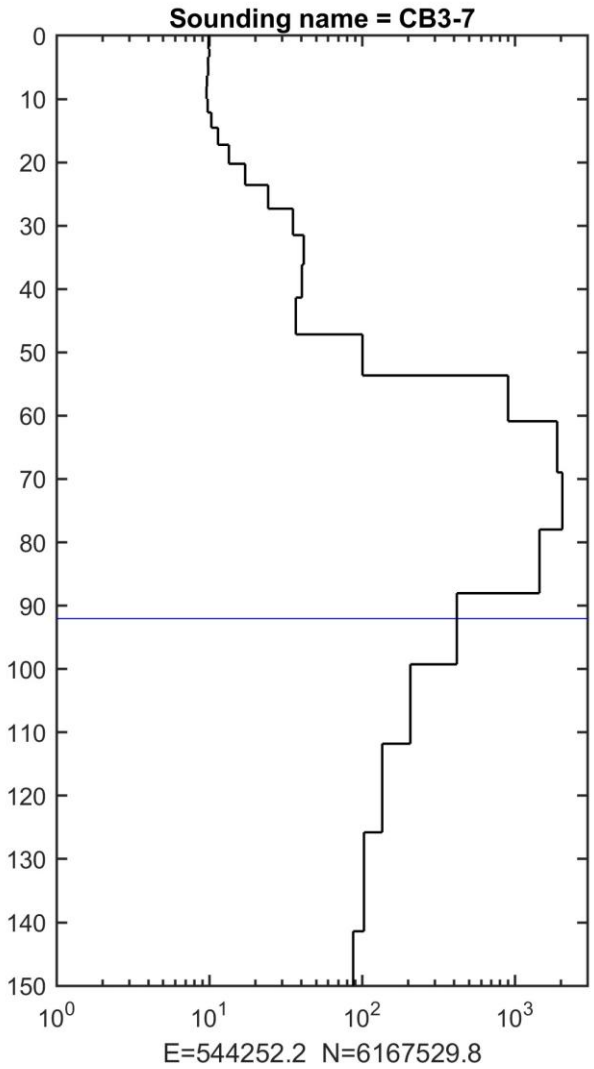
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



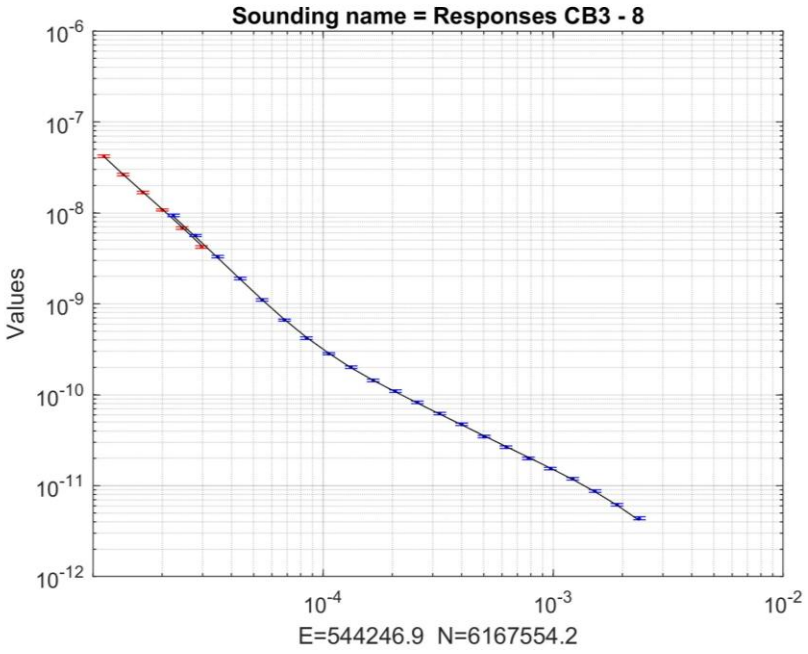


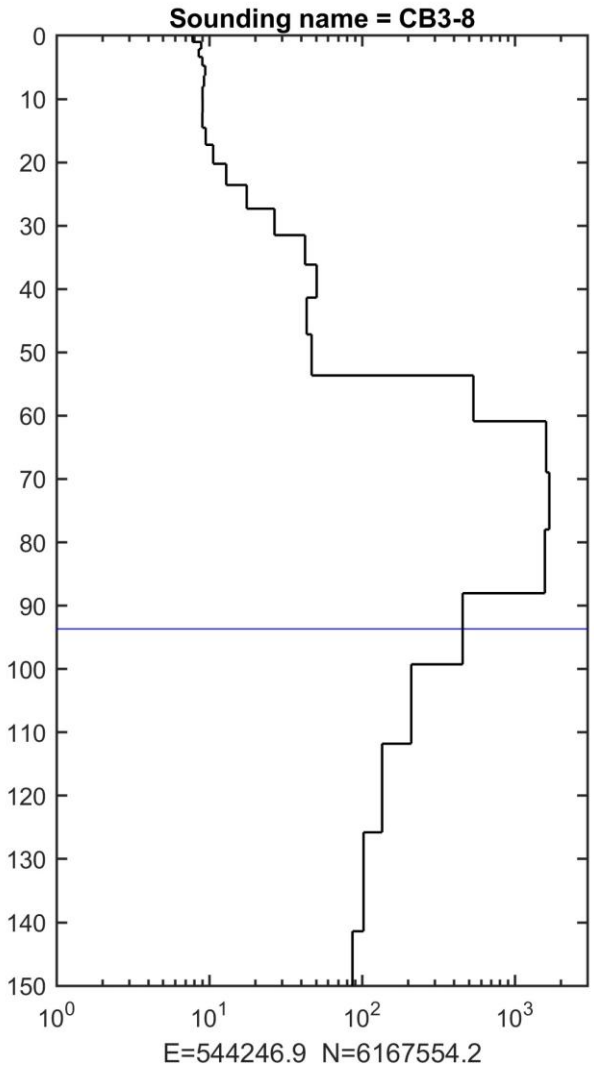
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



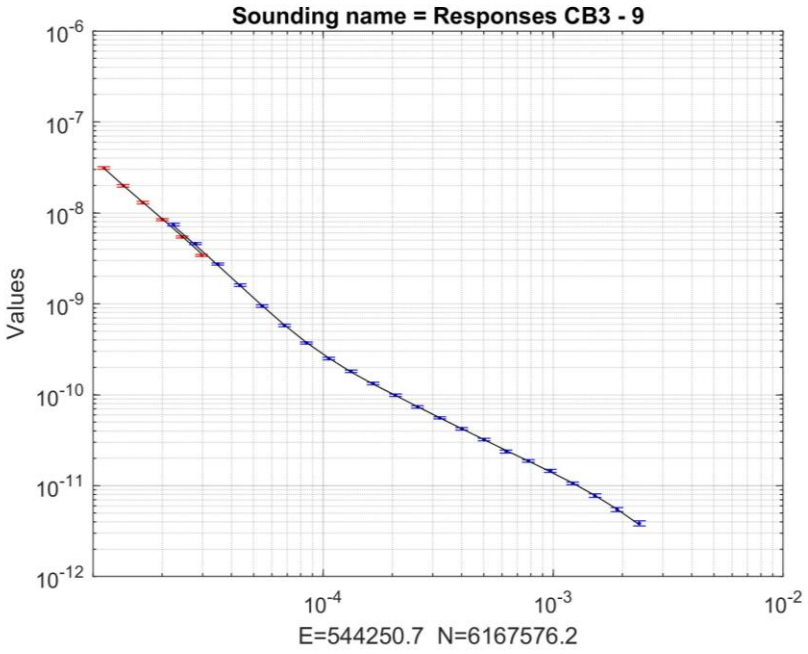


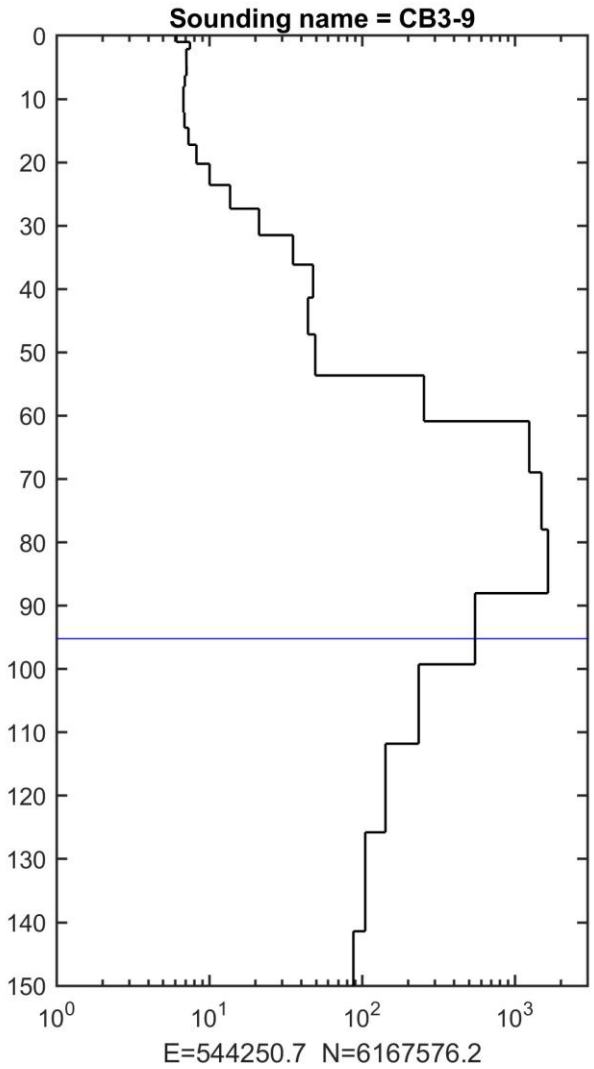
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



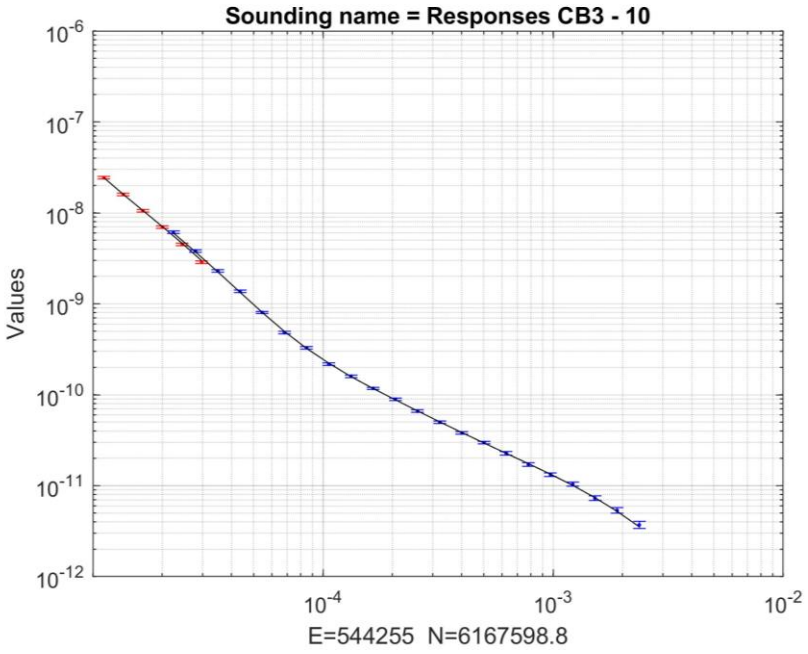


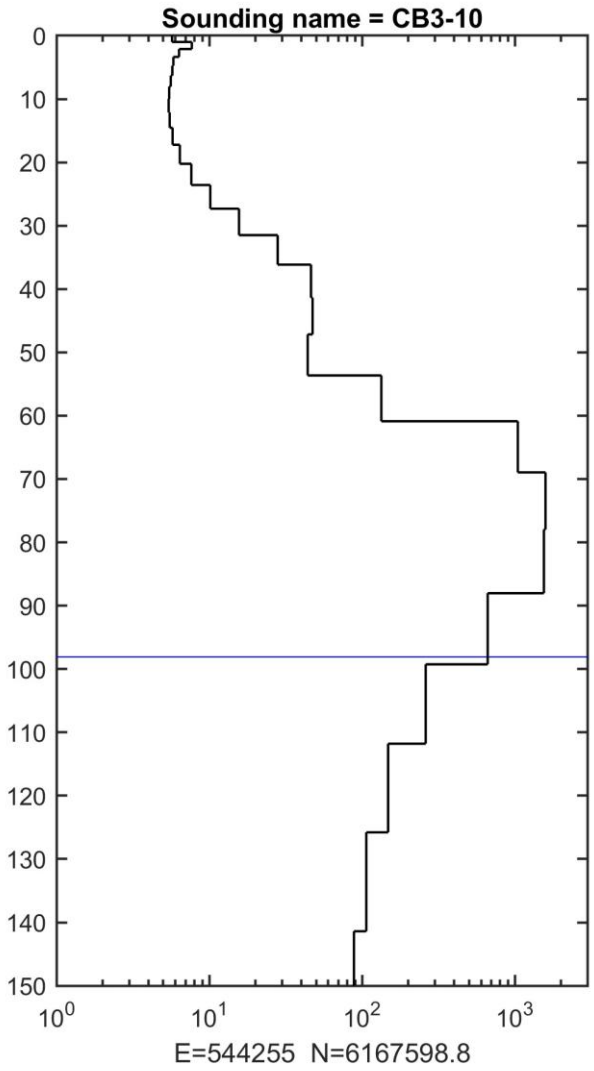
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



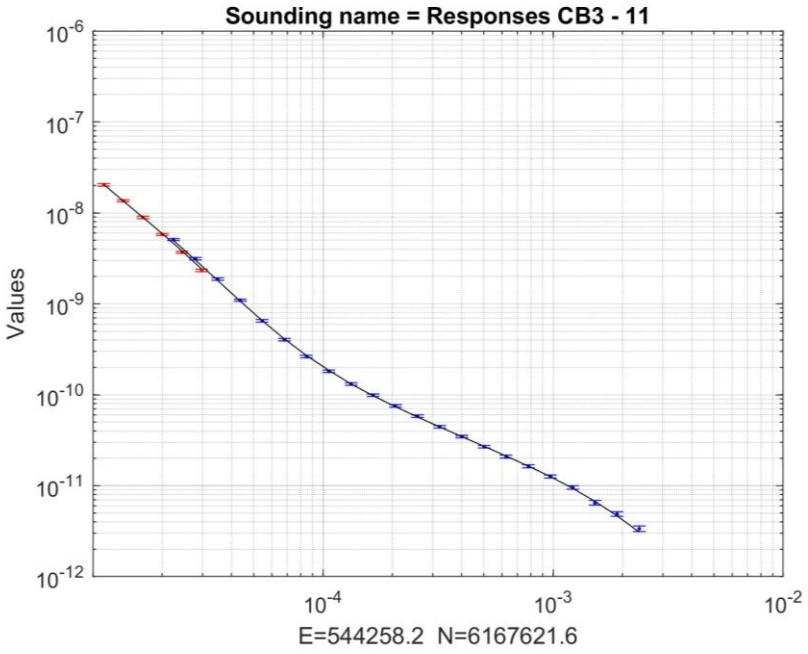


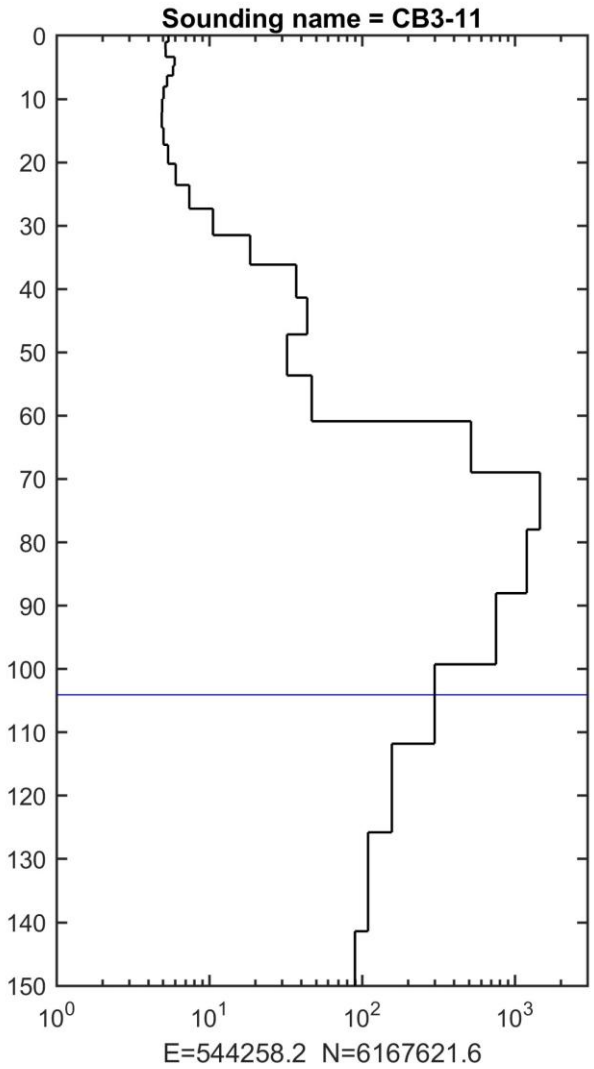
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



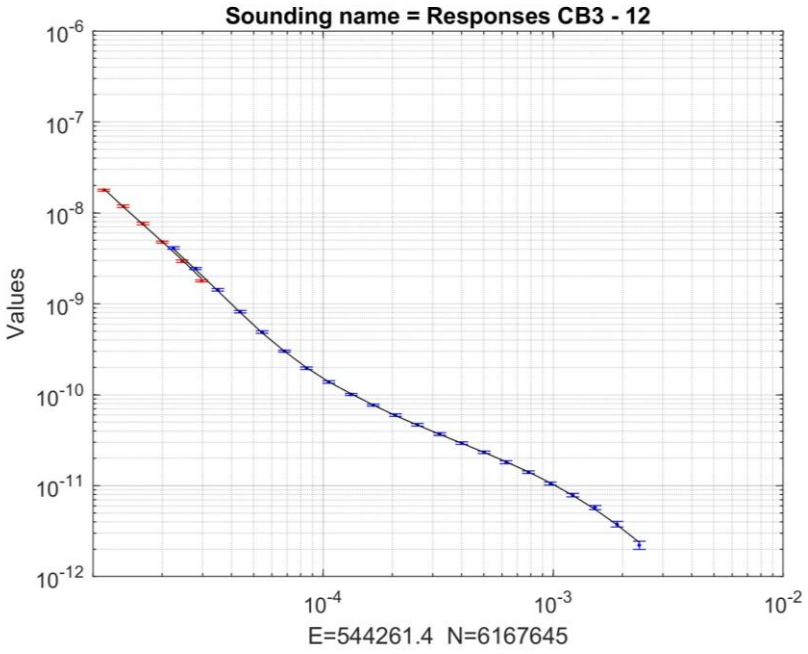


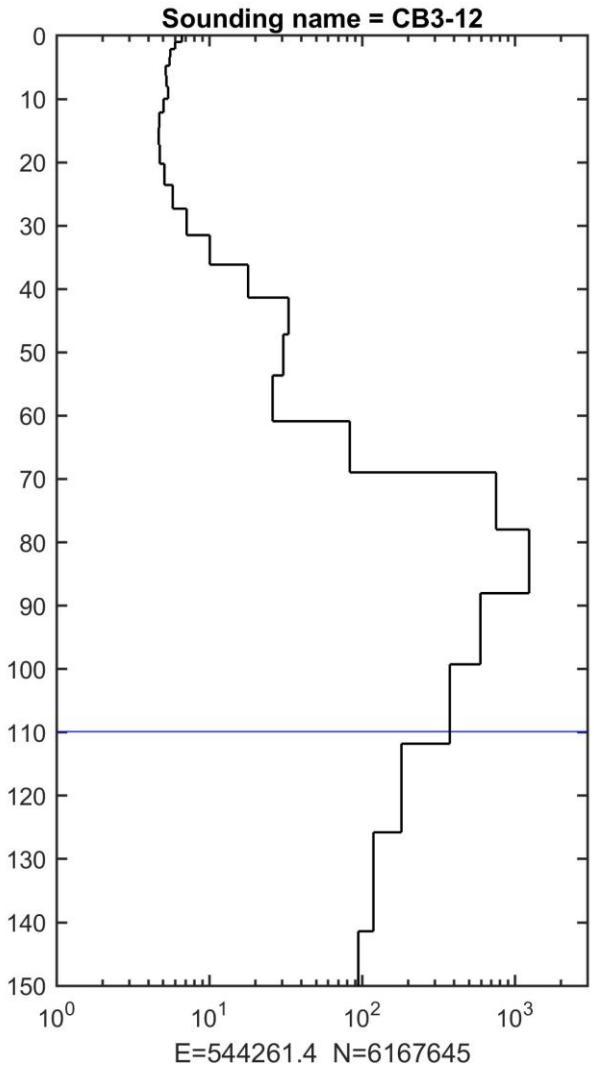
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



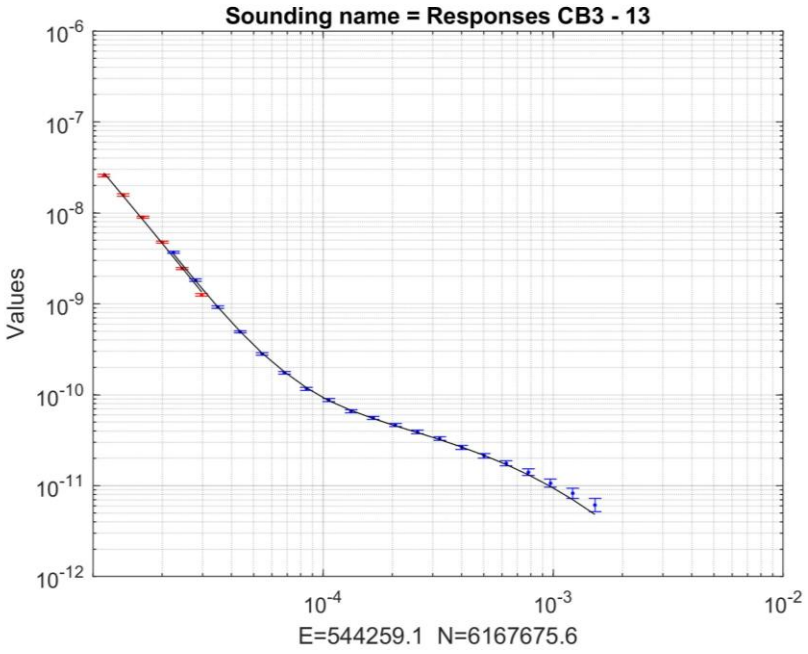


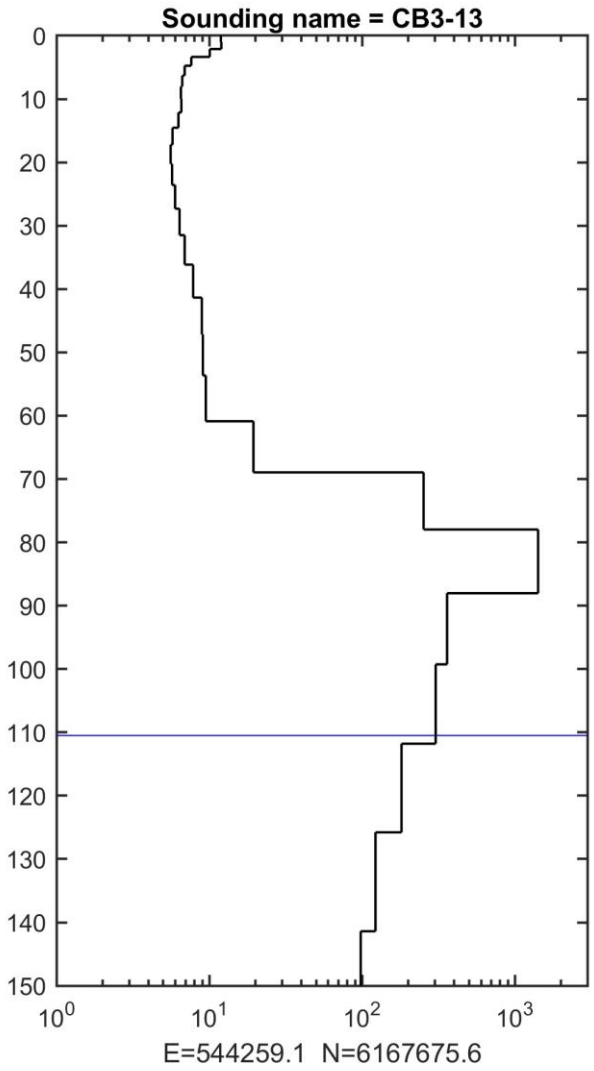
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-11. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



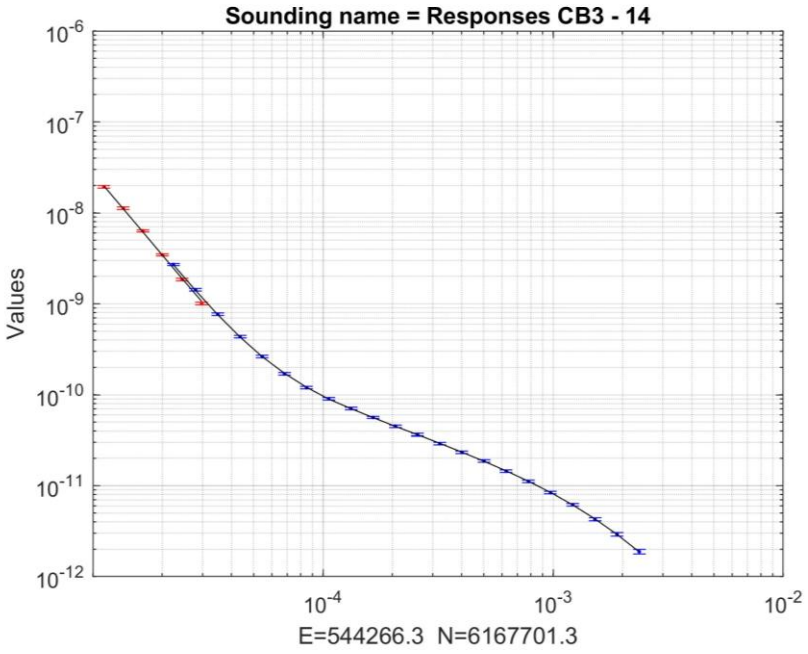


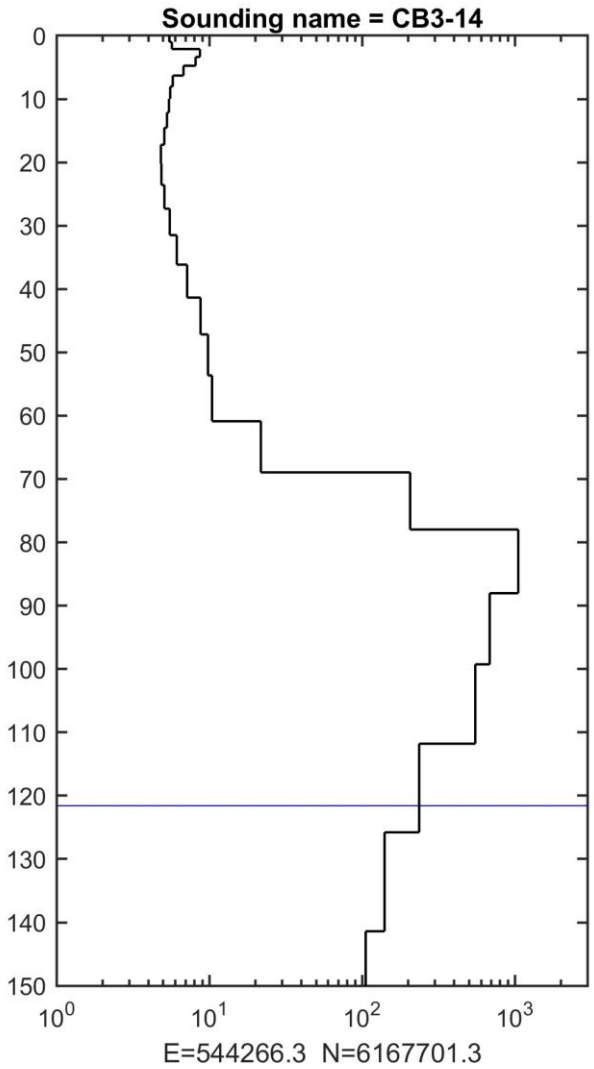
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-12. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



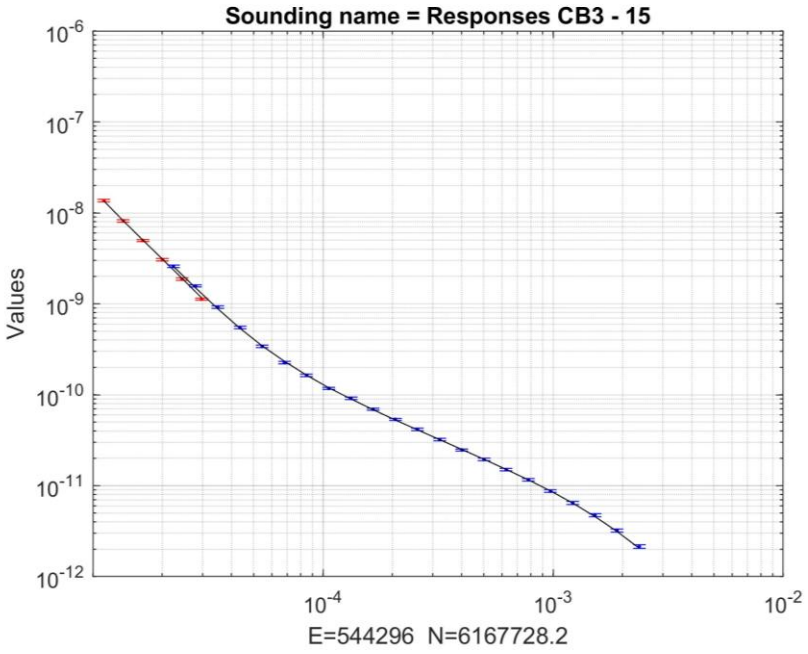


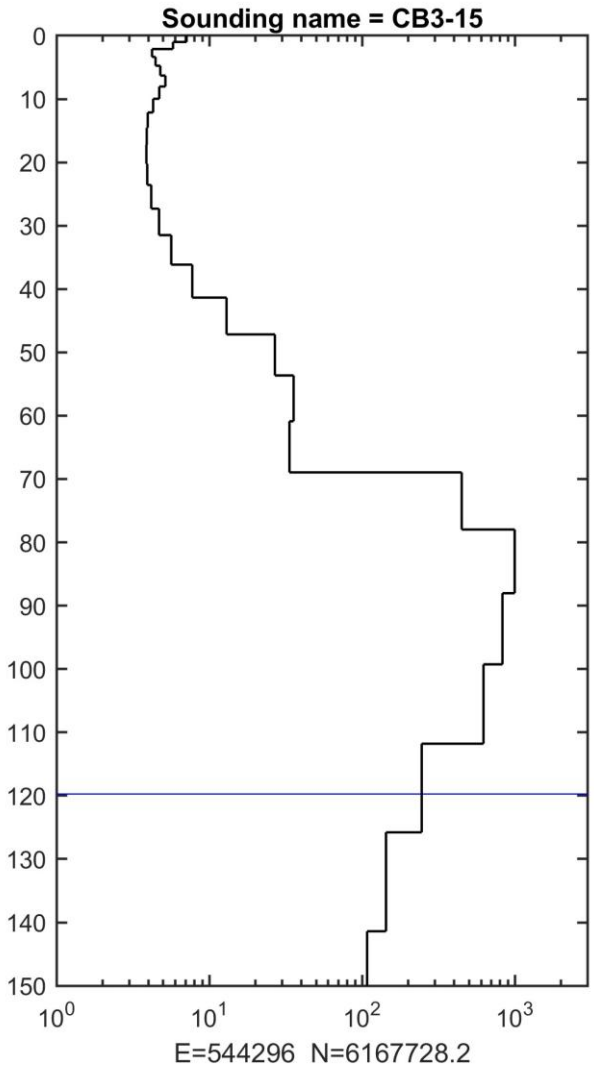
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-13. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



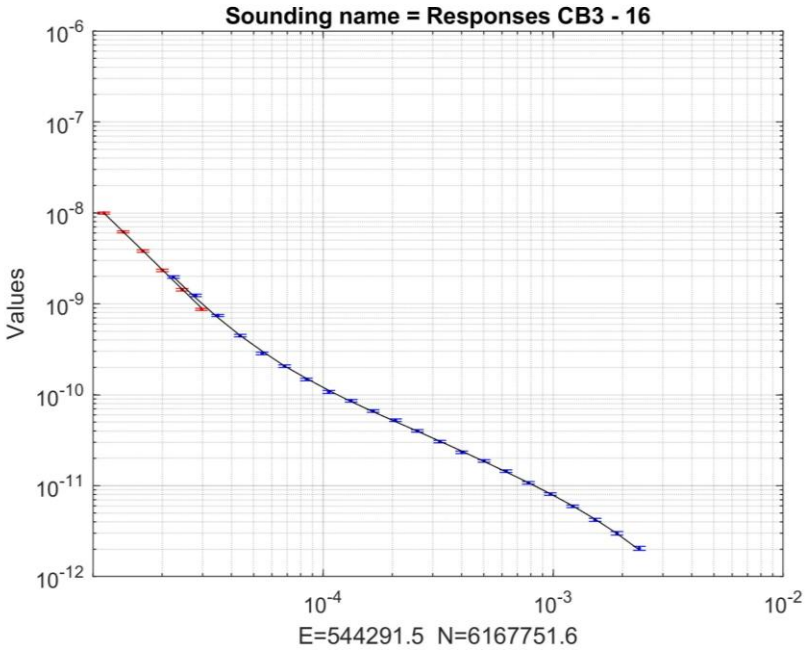


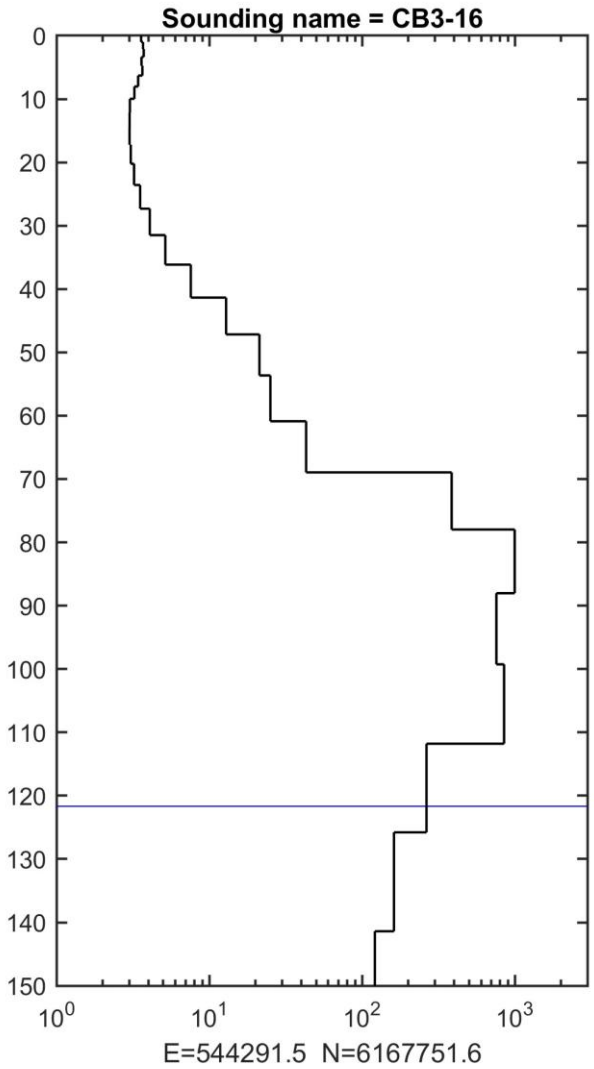
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-14. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



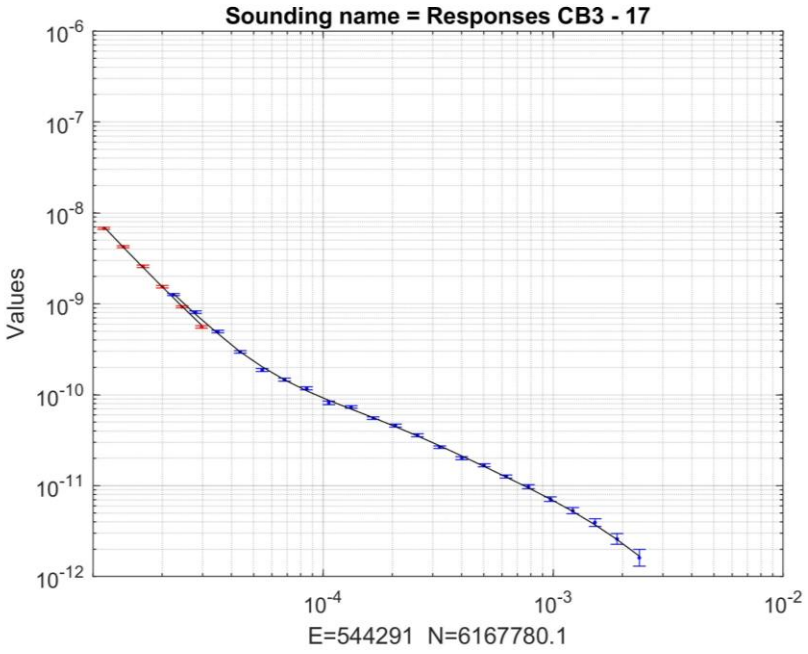


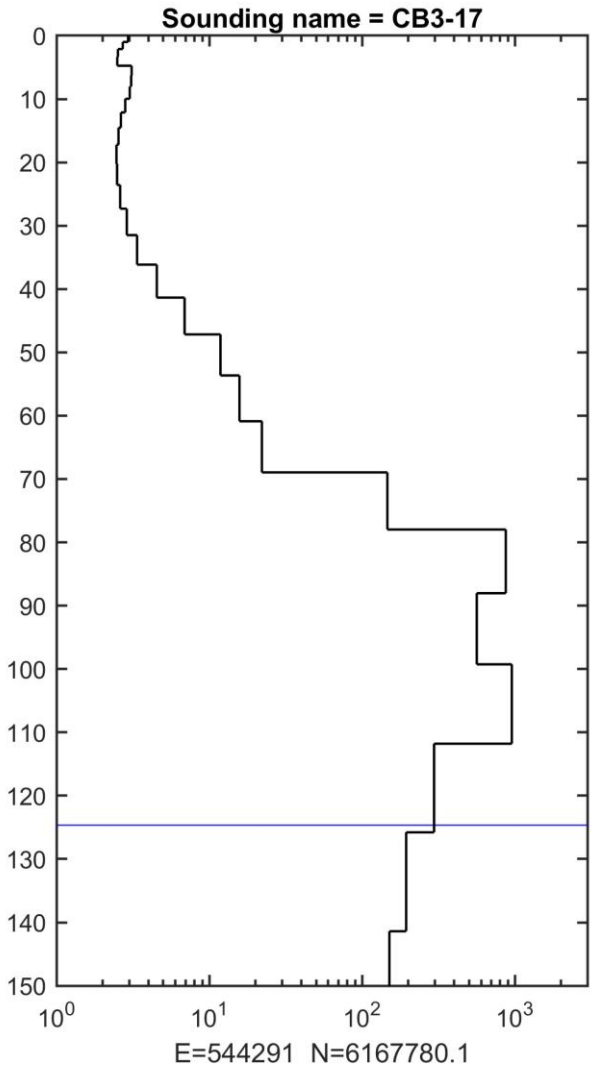
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-15. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



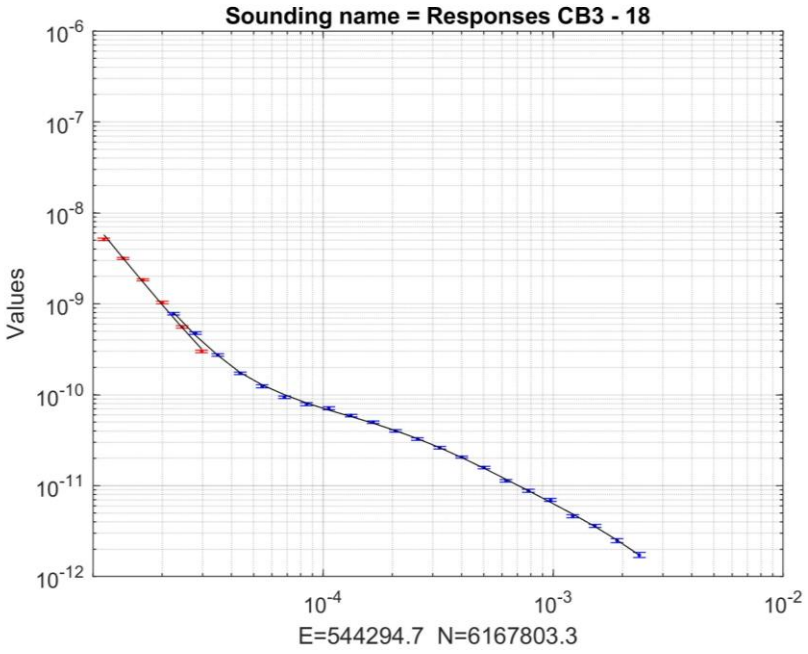


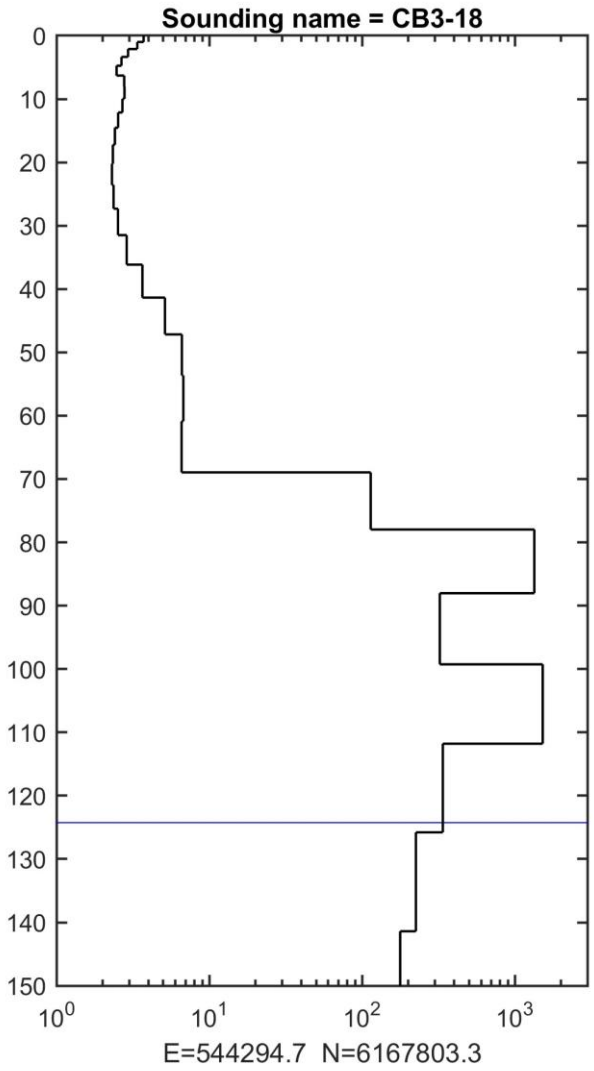
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-16. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



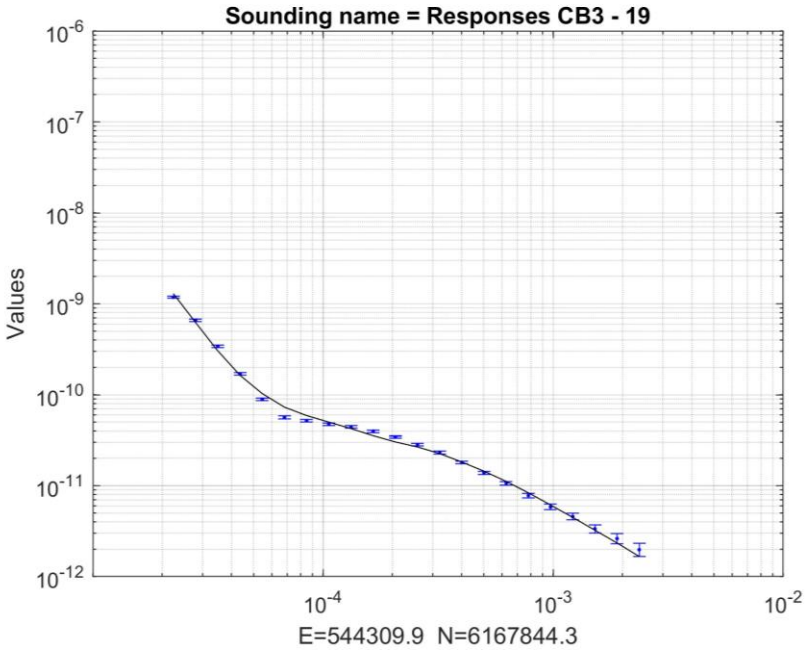


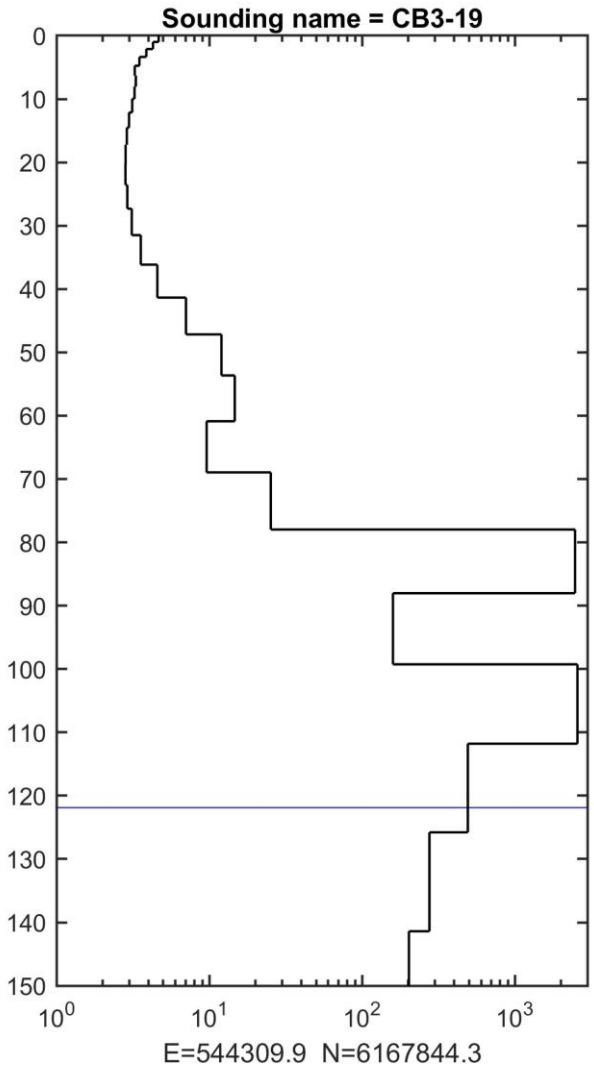
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-17. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



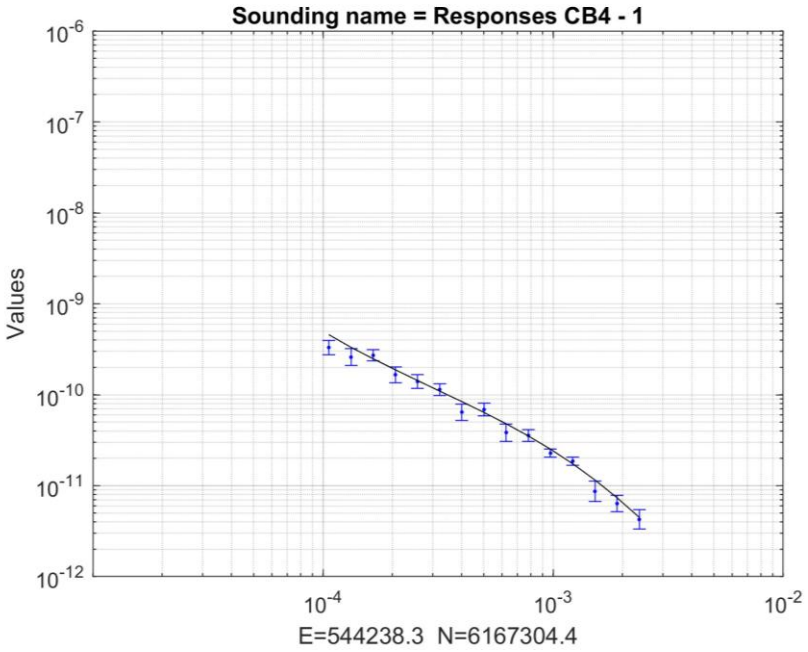


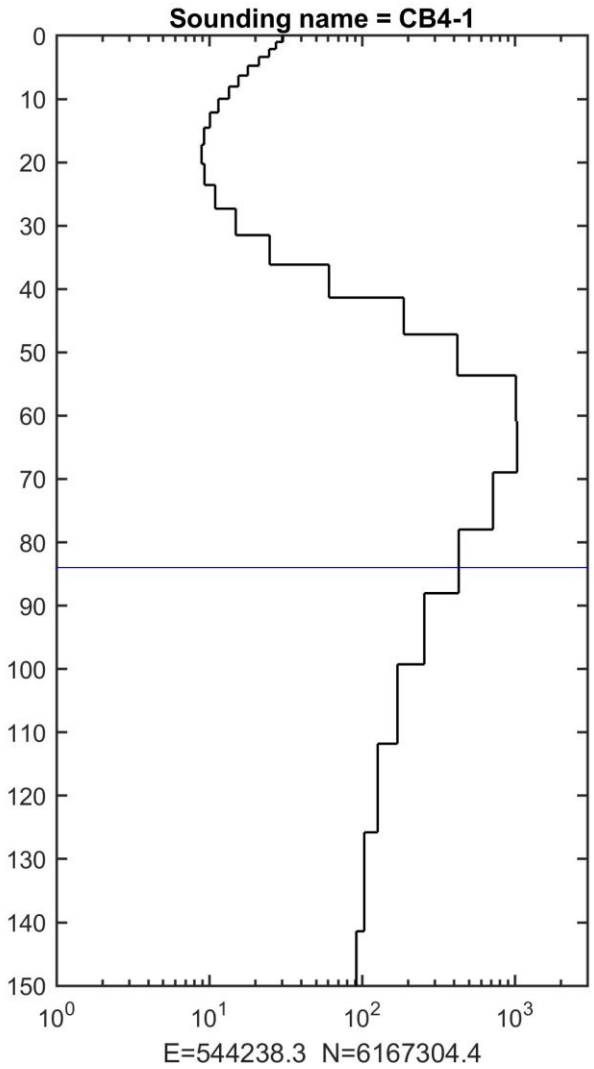
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-19. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



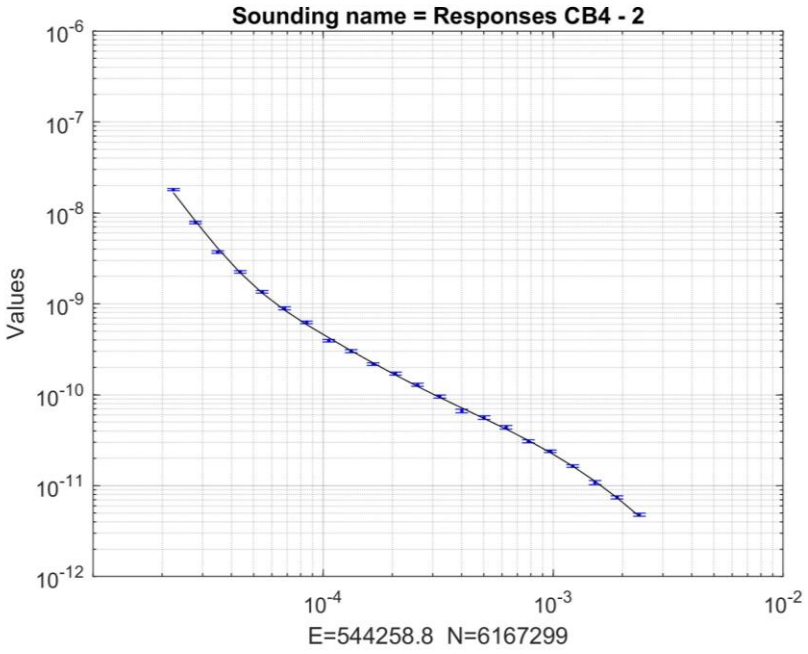


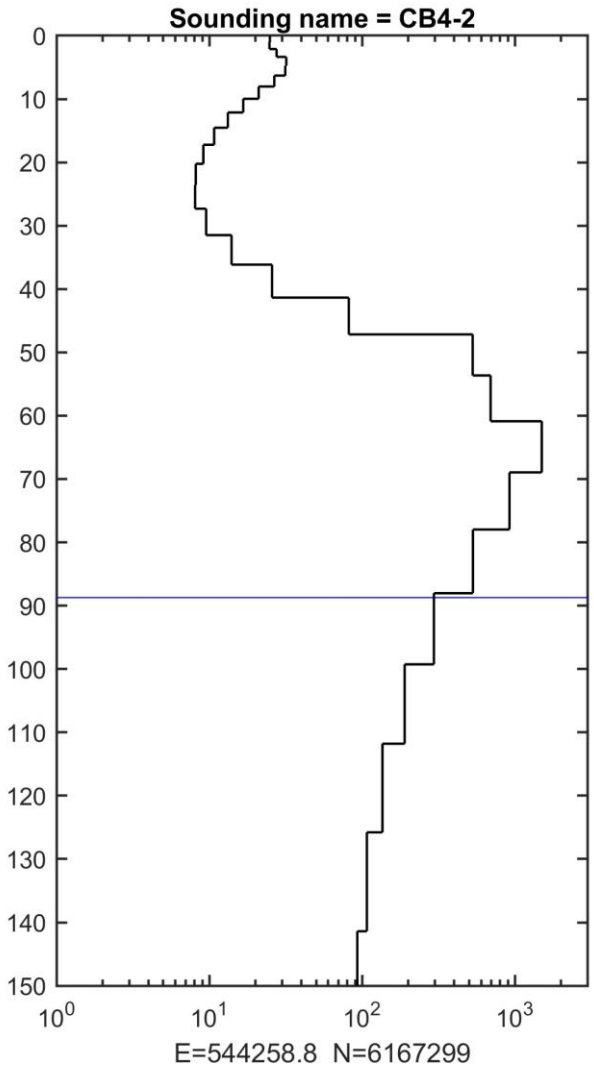
Transect 3: Observed responses – low and high moments (top panel) for Sounding CB3-19. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



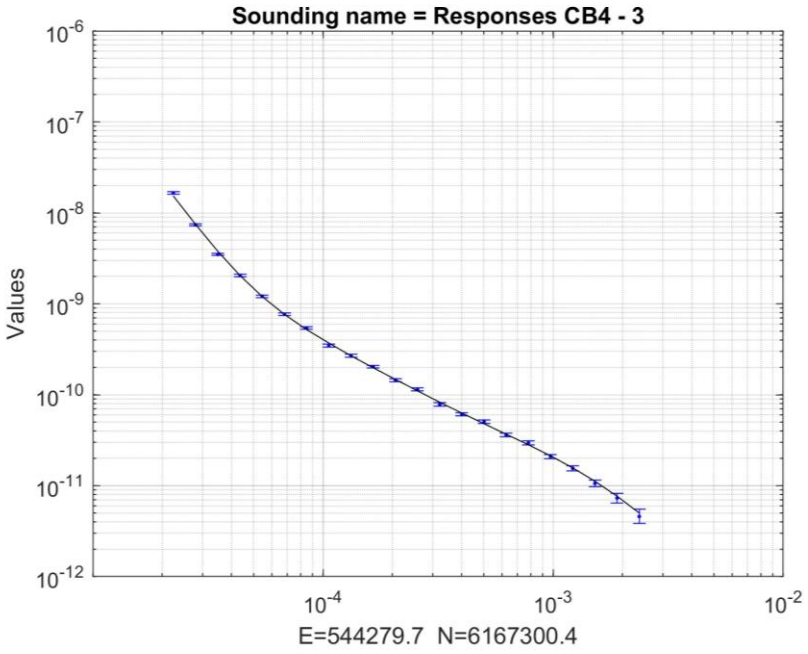


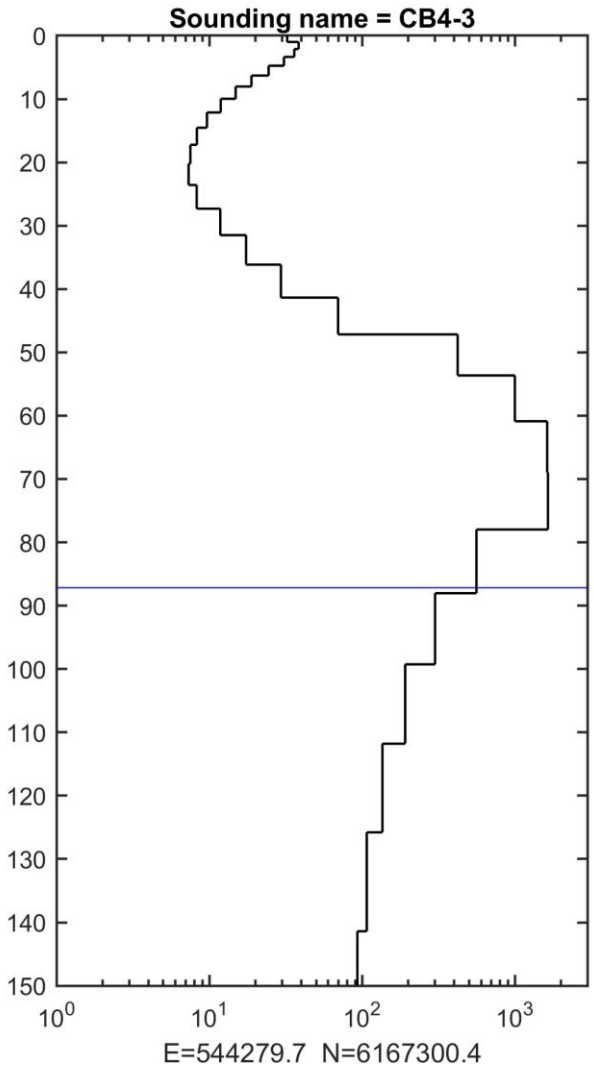
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



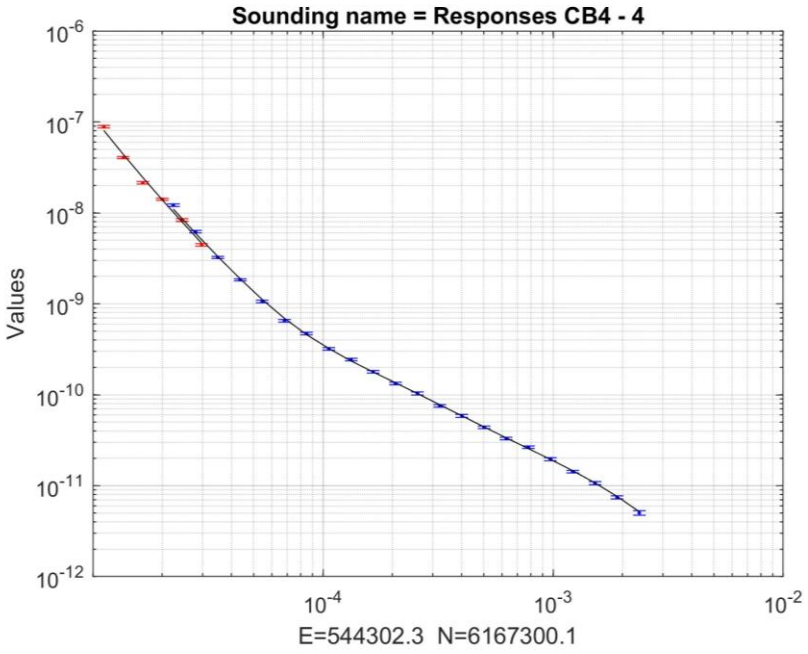


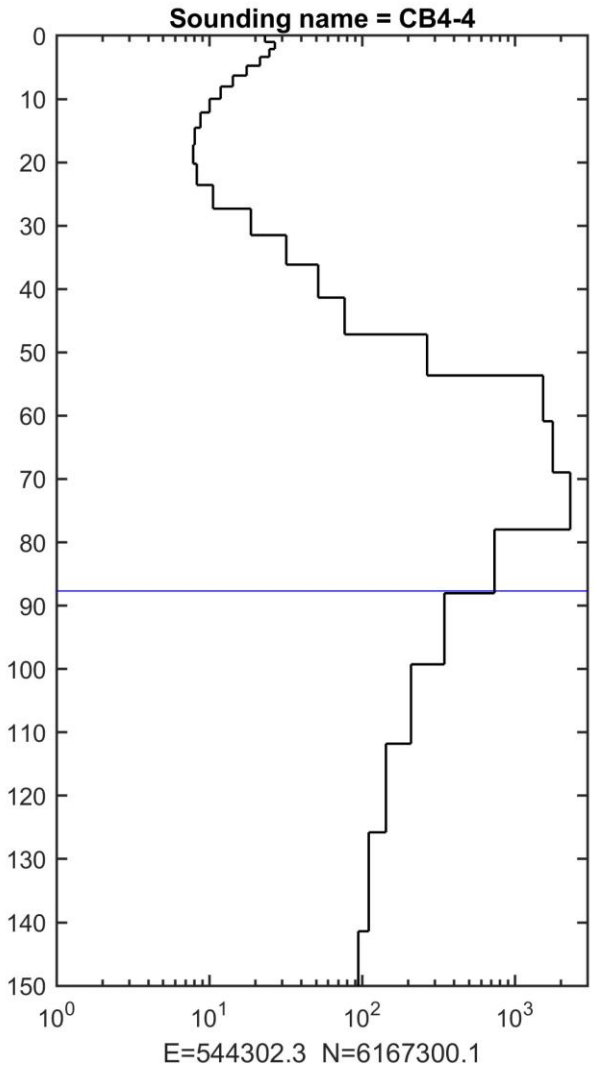
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



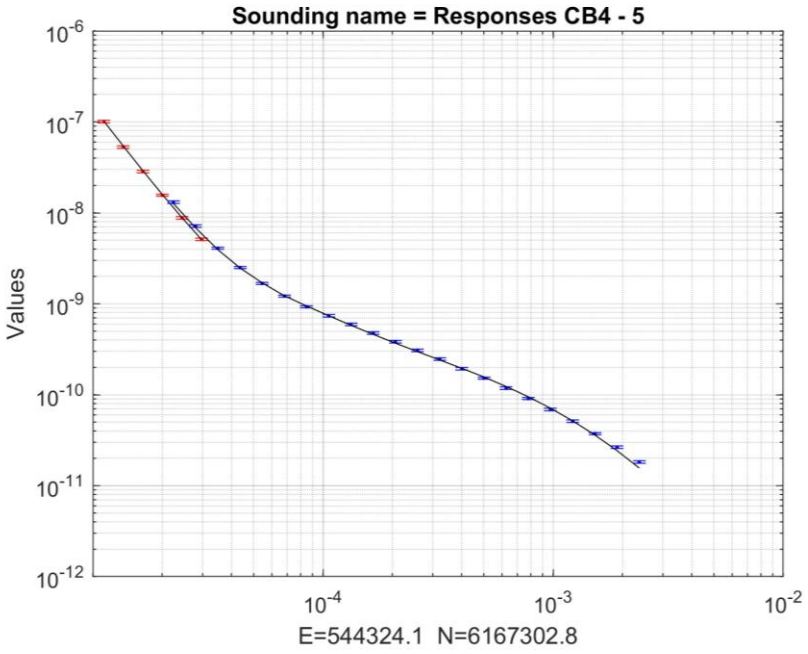


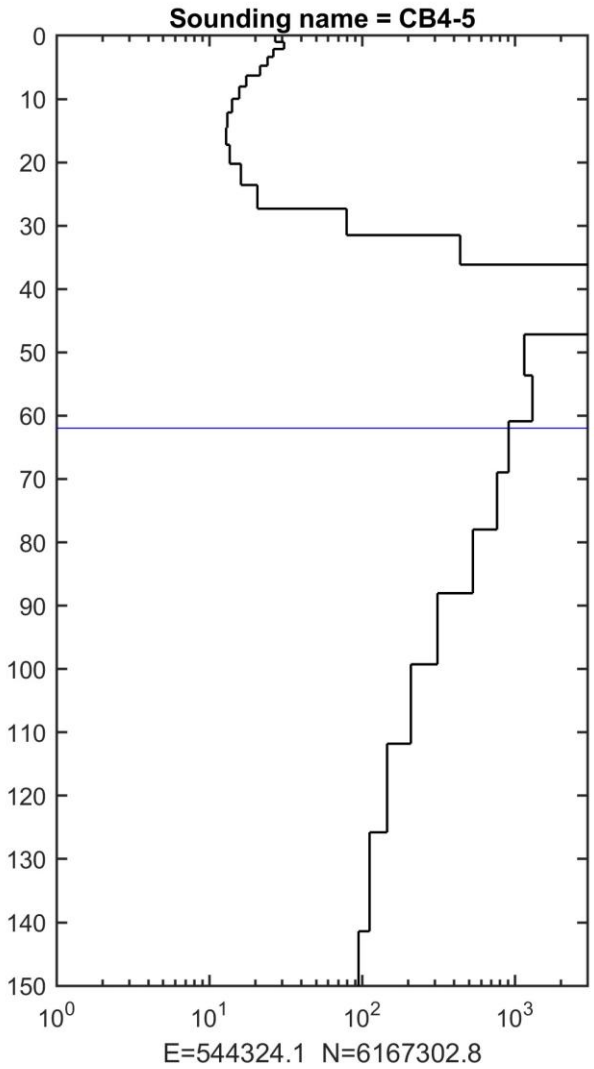
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



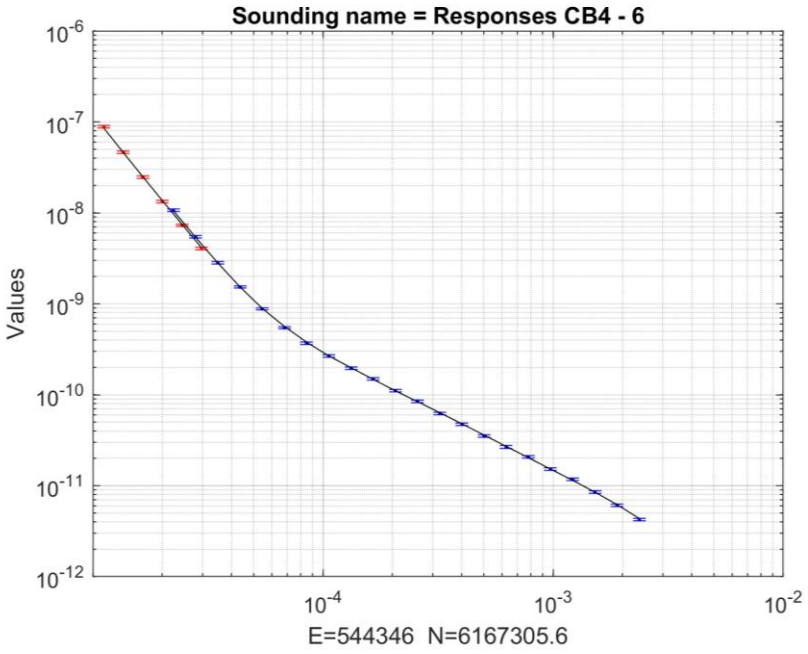


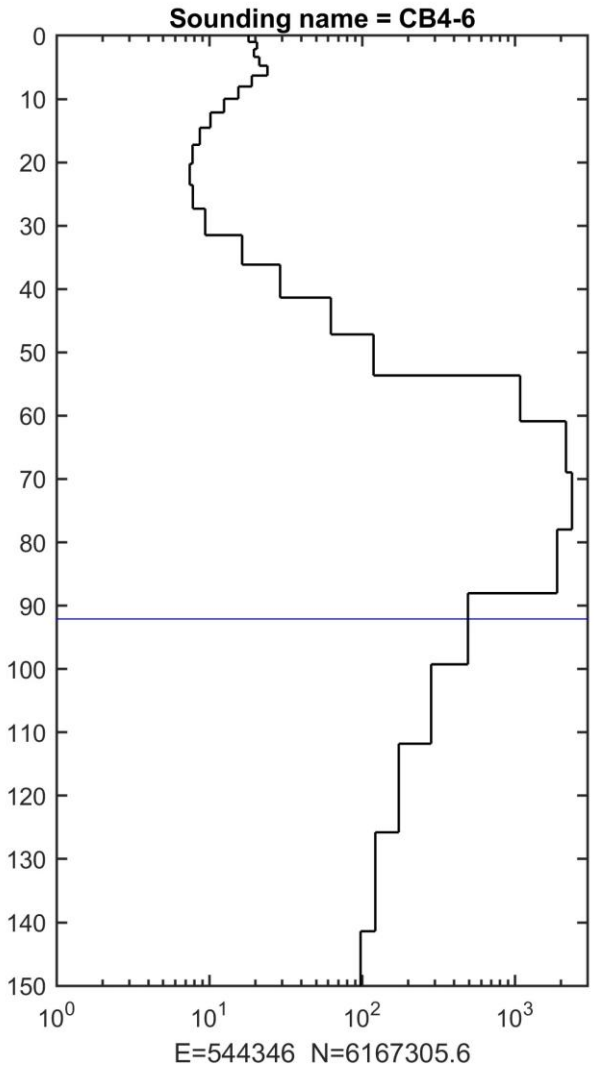
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



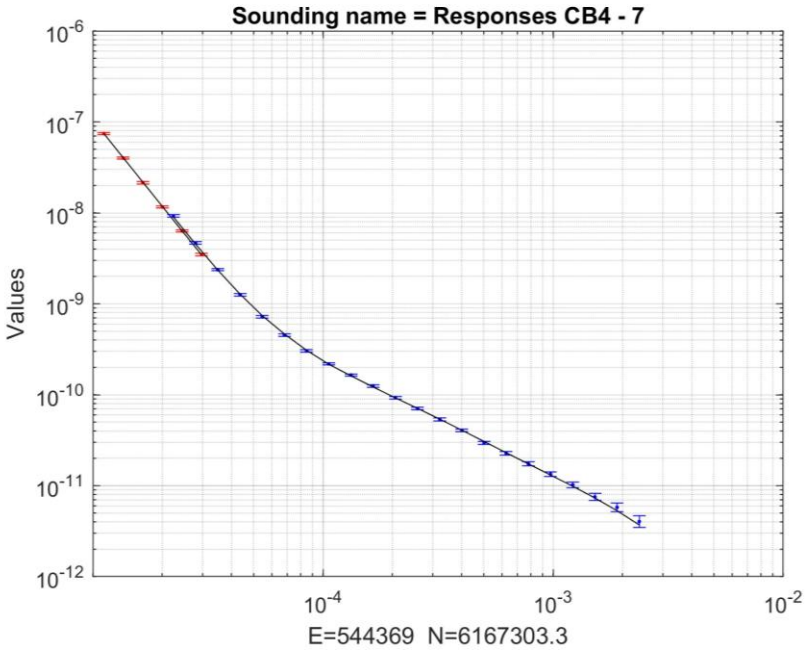


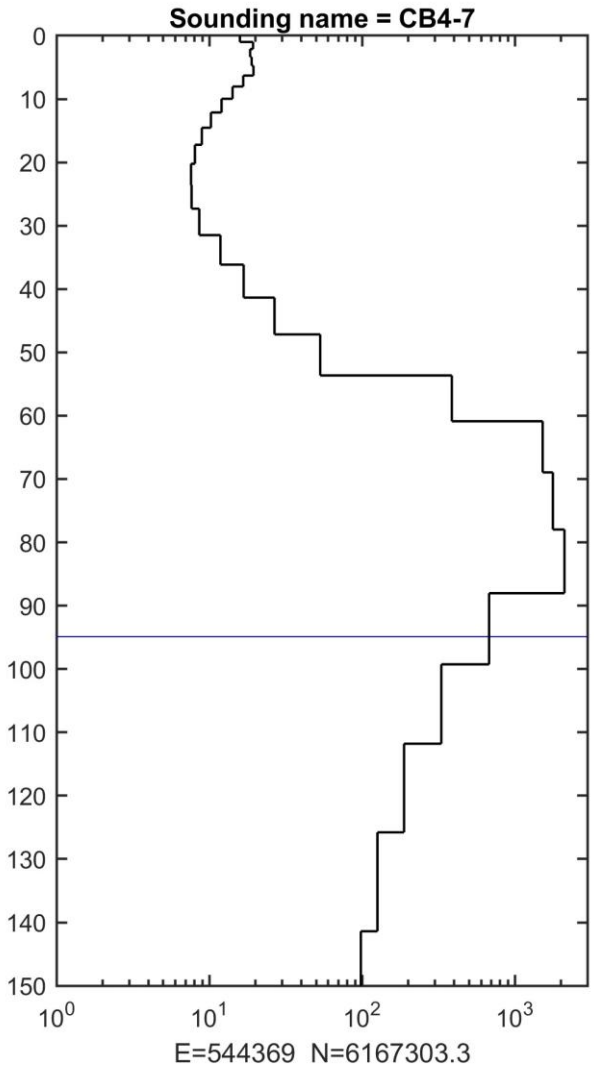
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



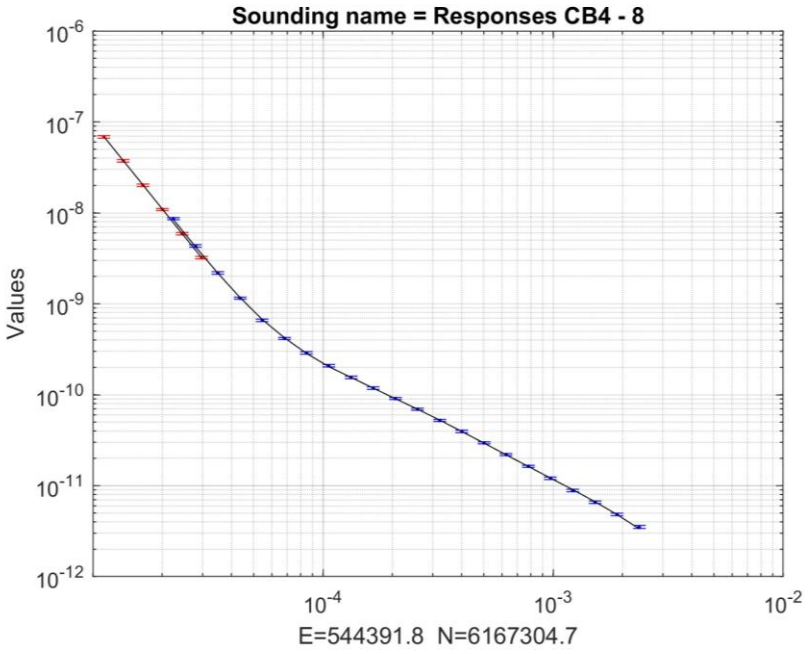


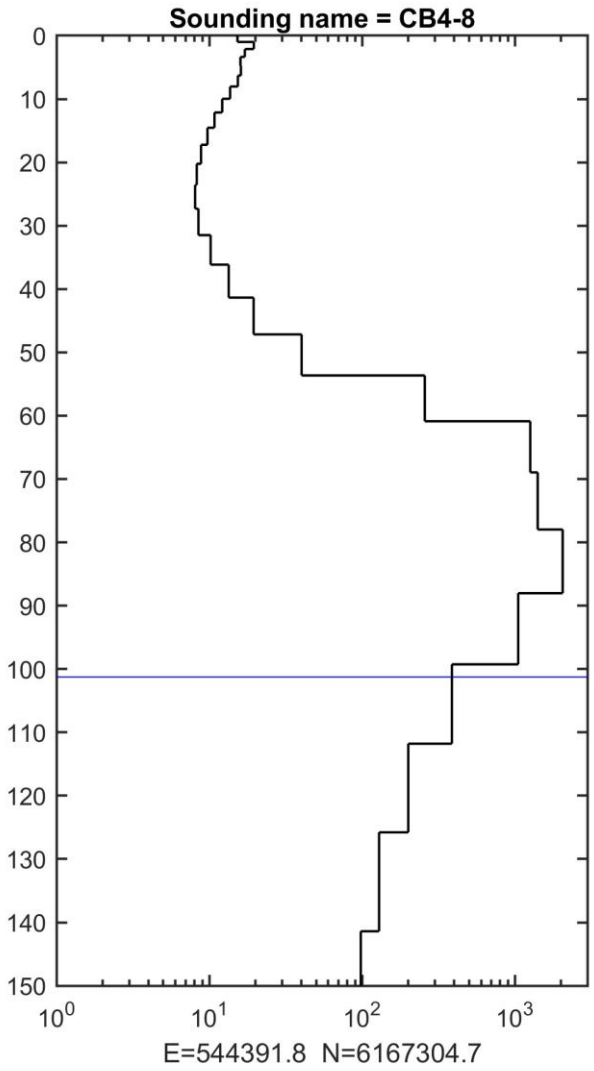
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



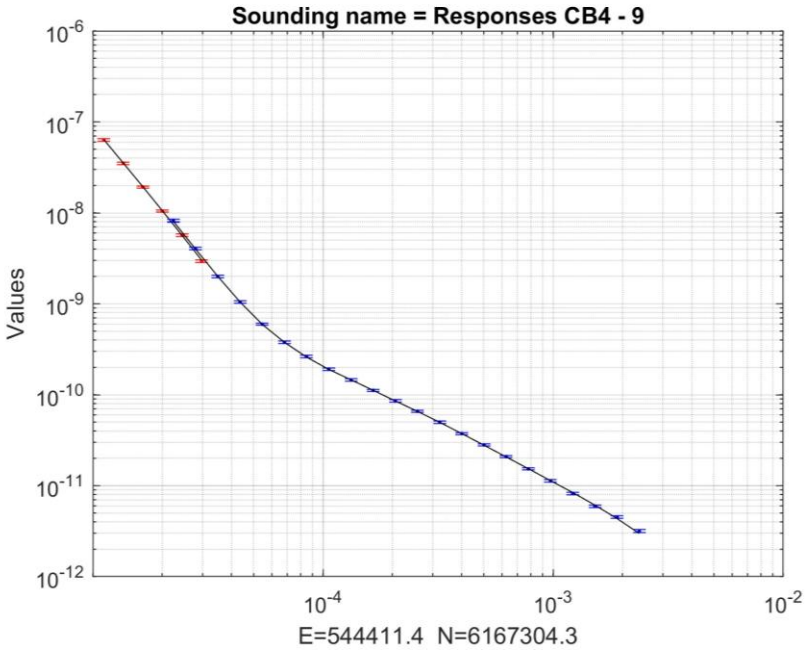


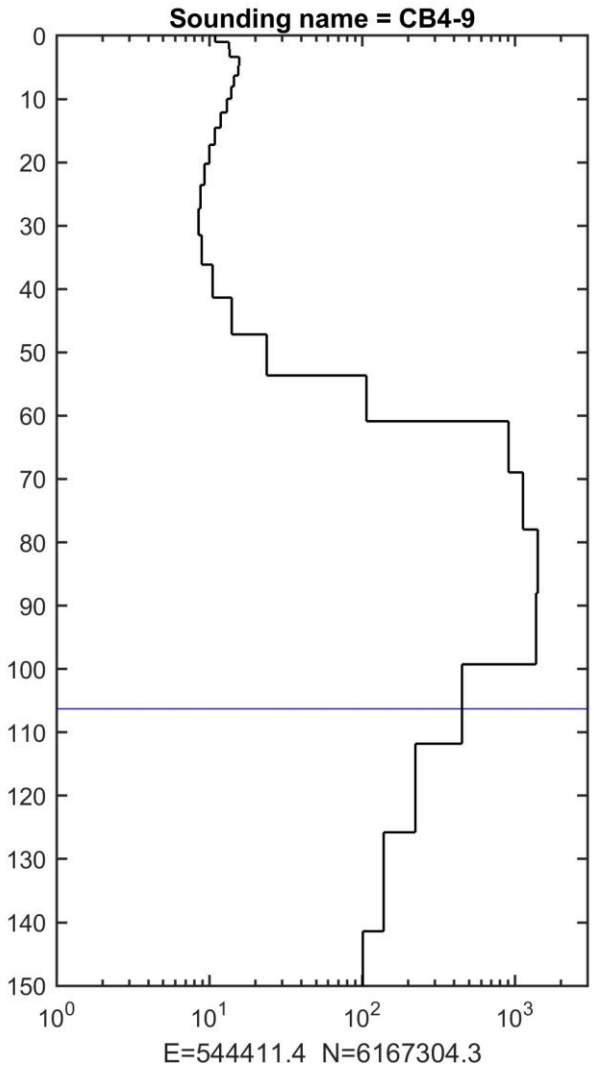
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



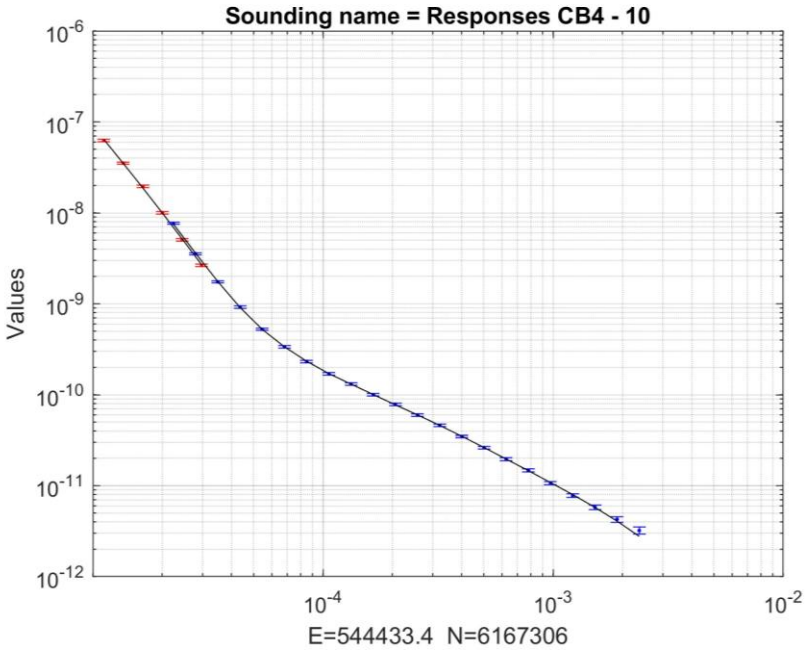


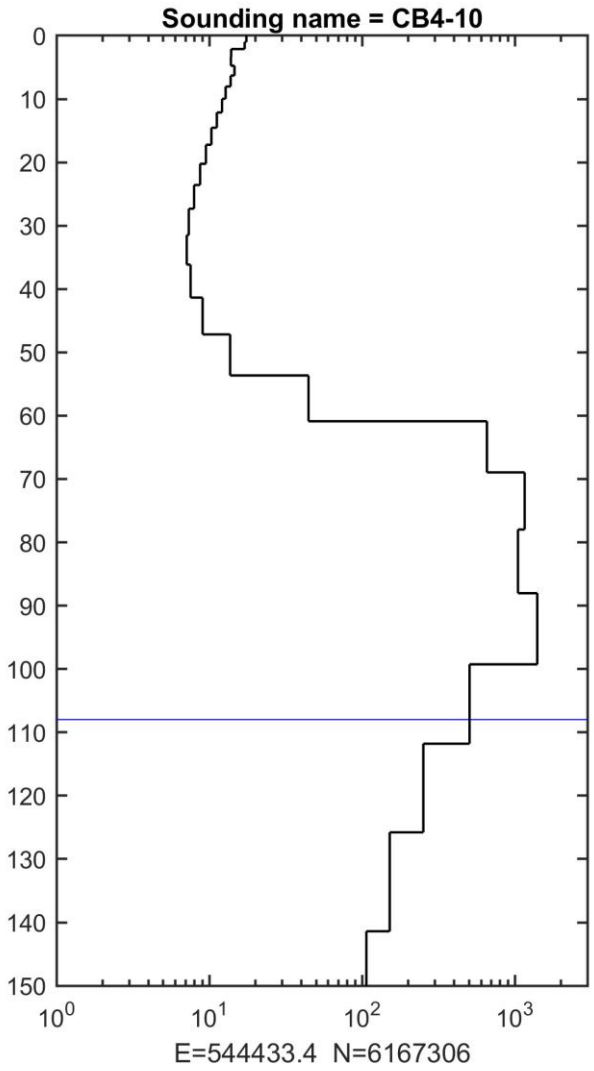
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



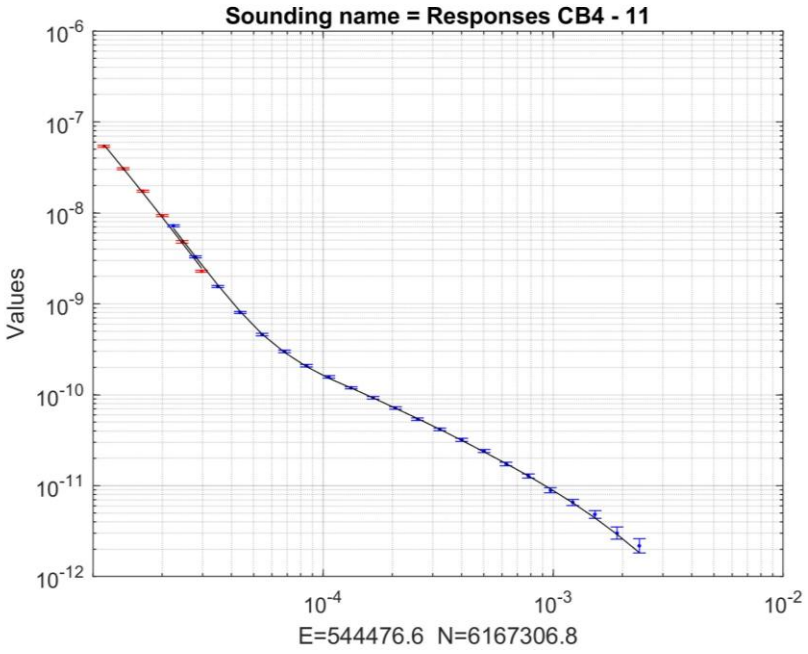


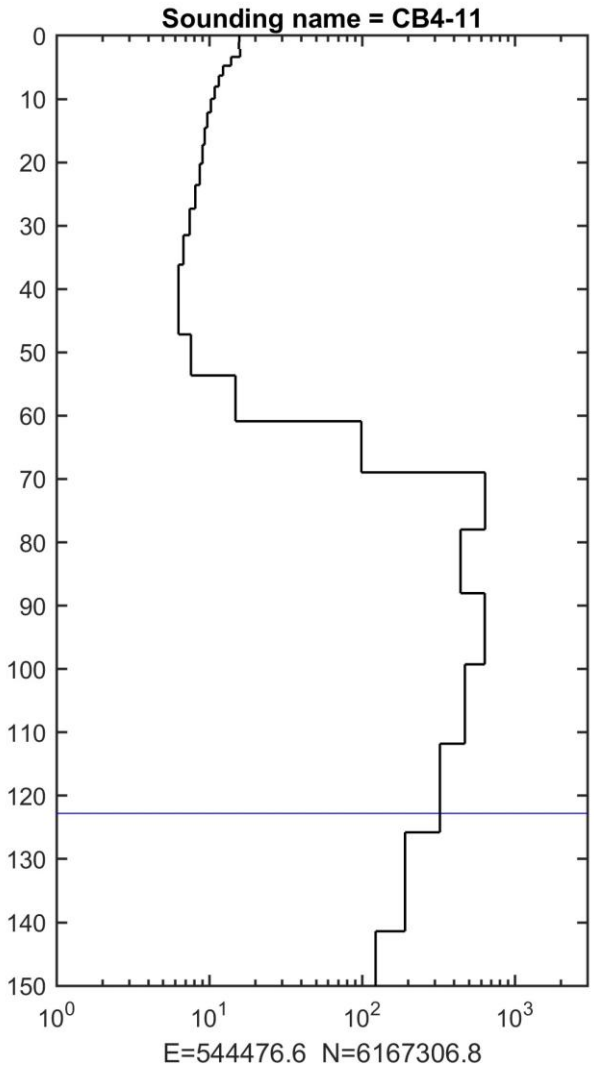
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



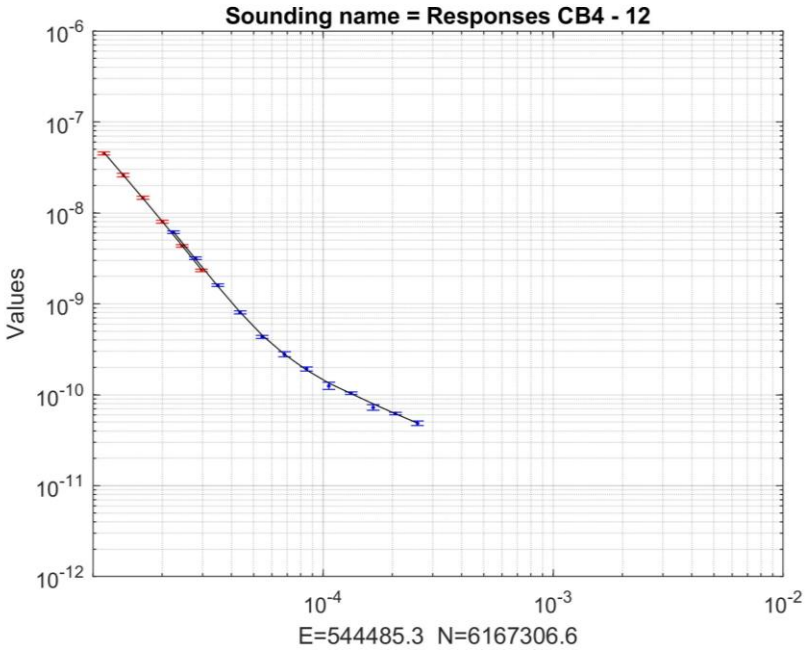


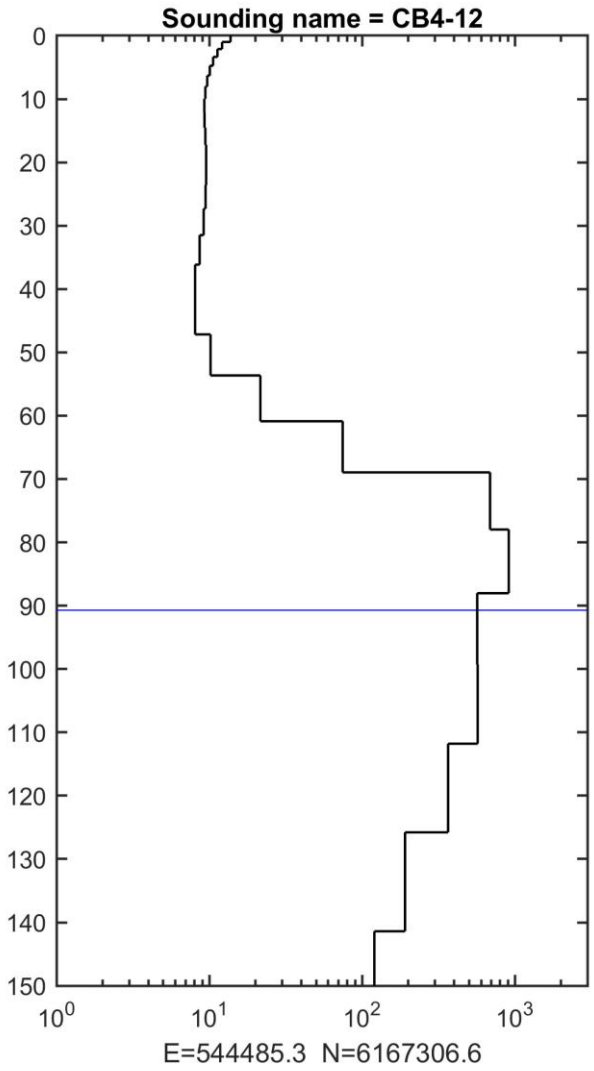
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



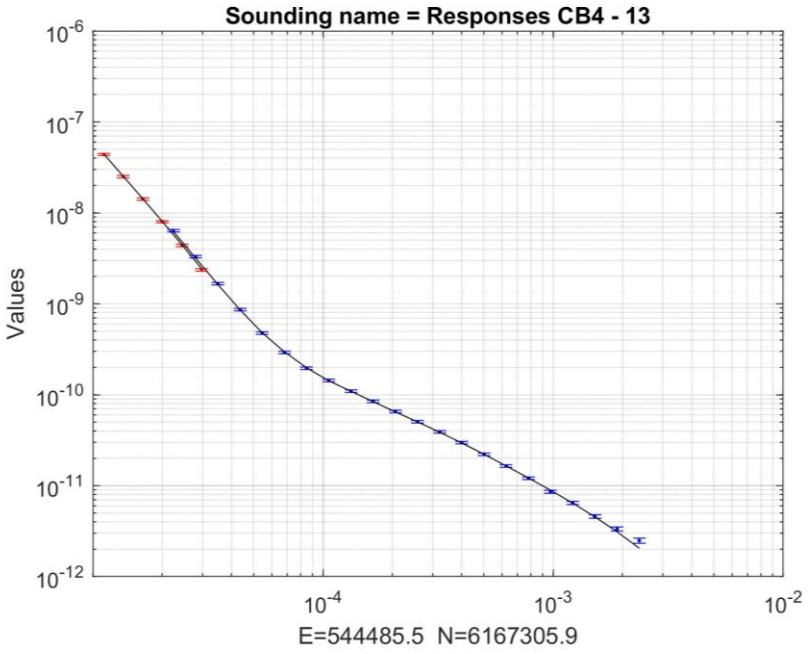


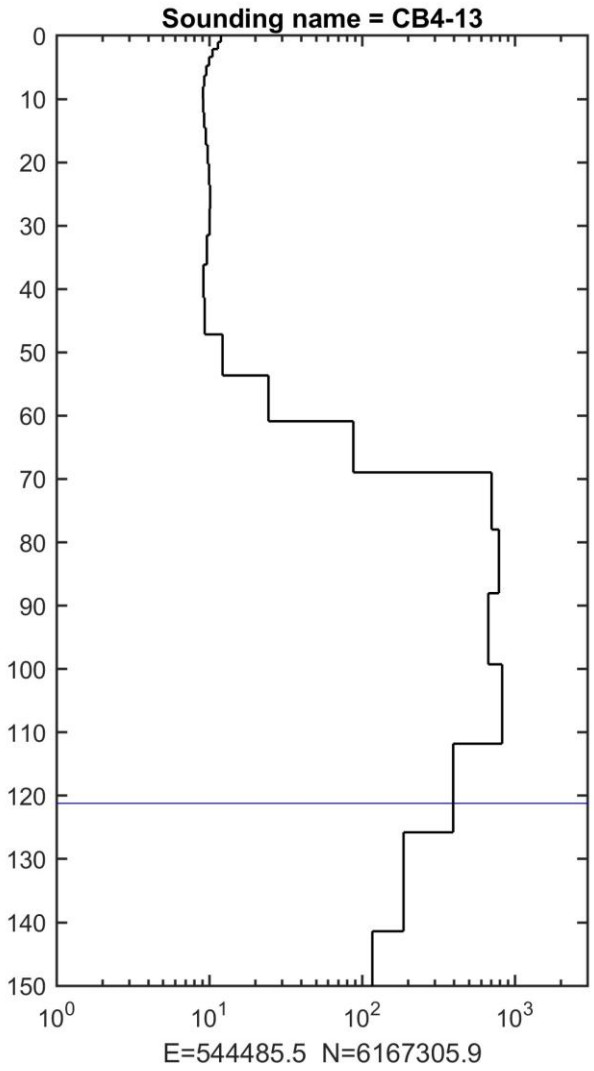
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-11. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



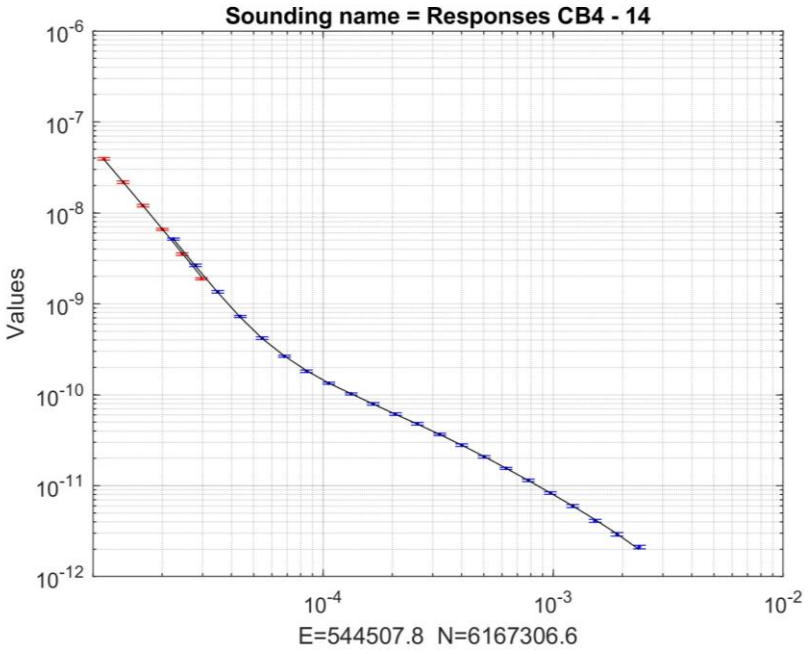


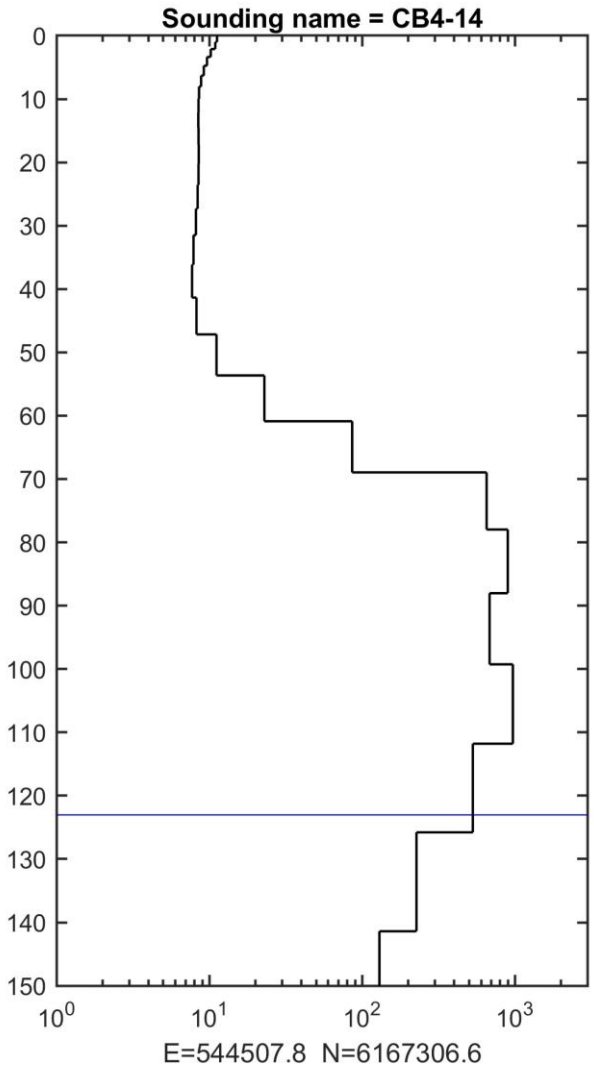
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-12. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



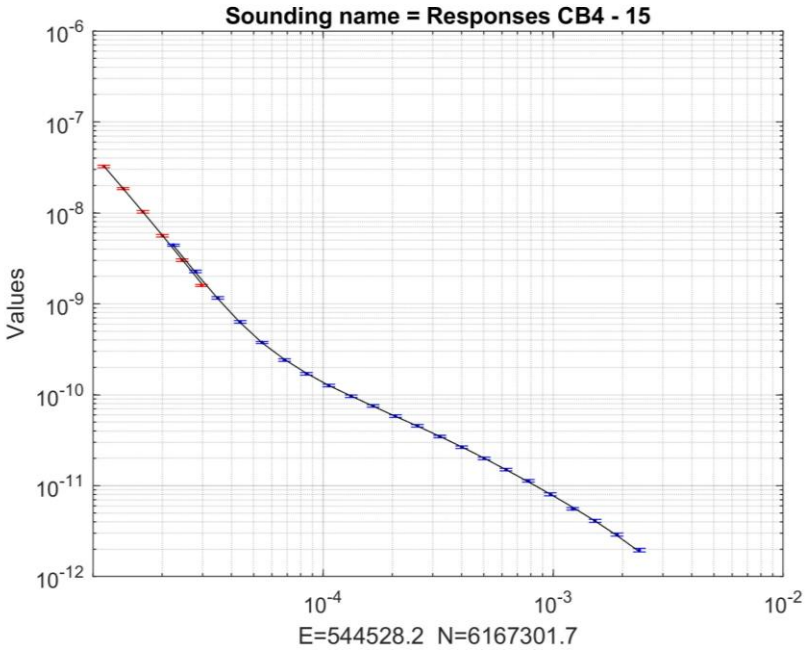


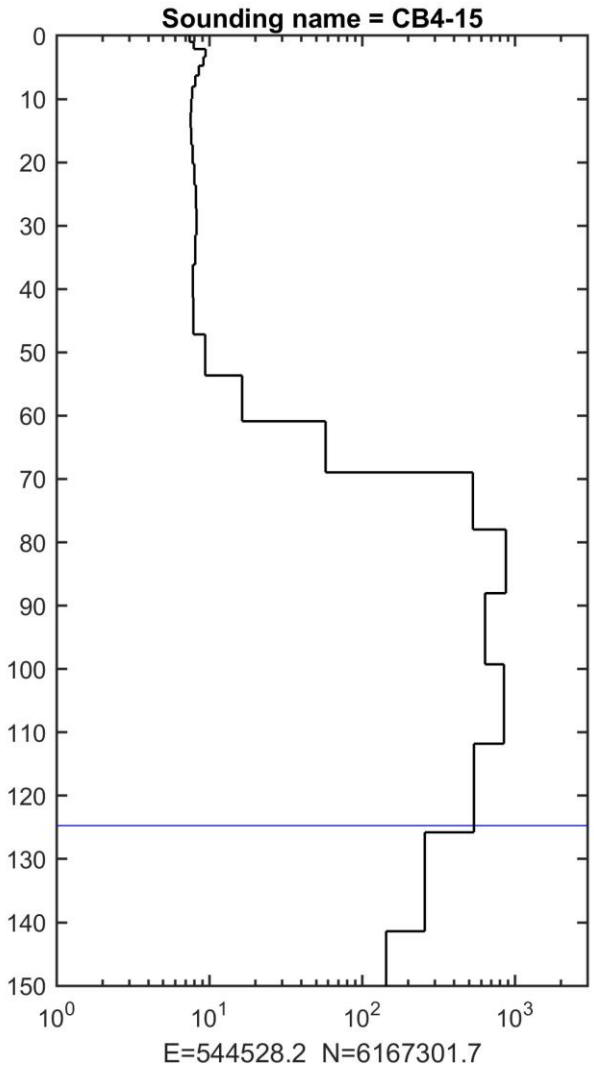
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-13. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



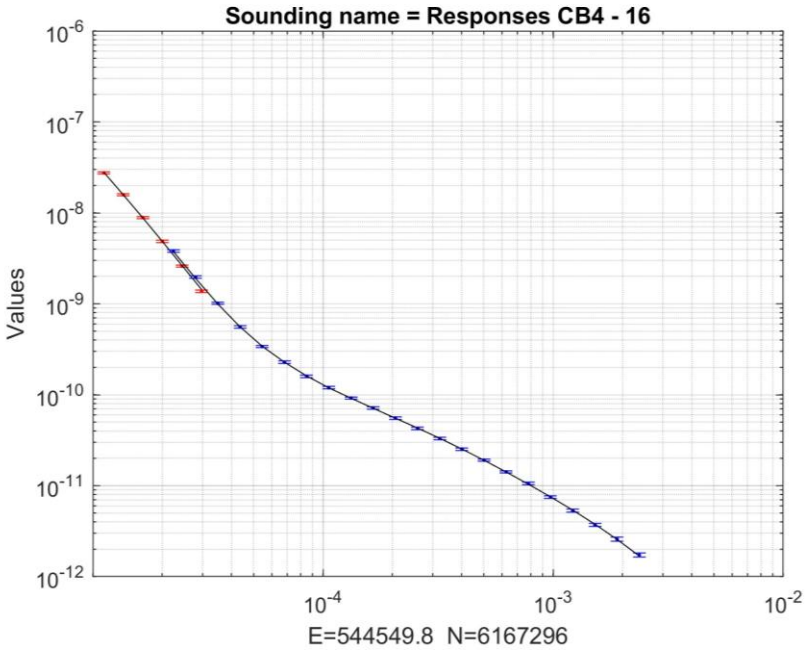


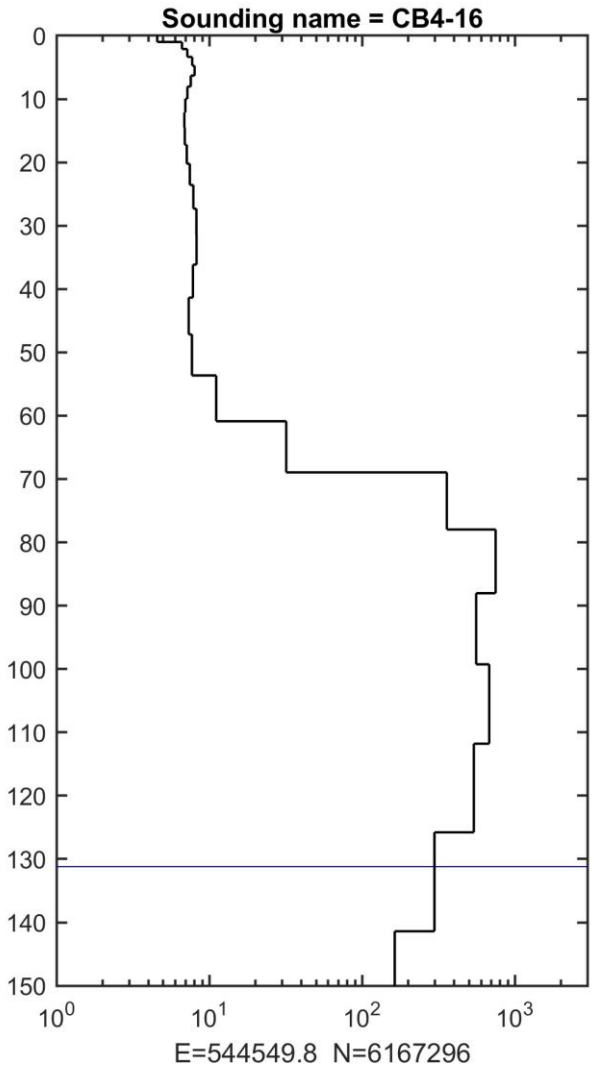
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-14. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



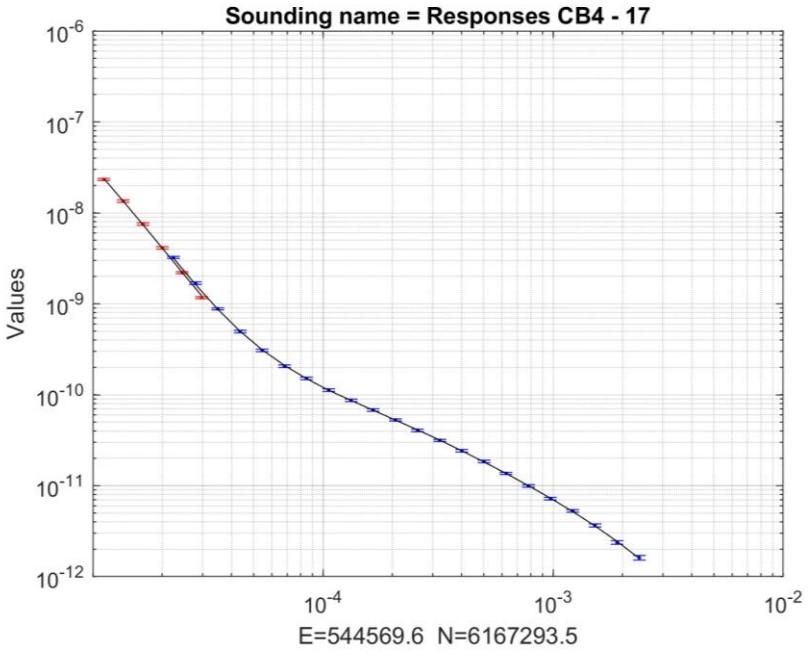


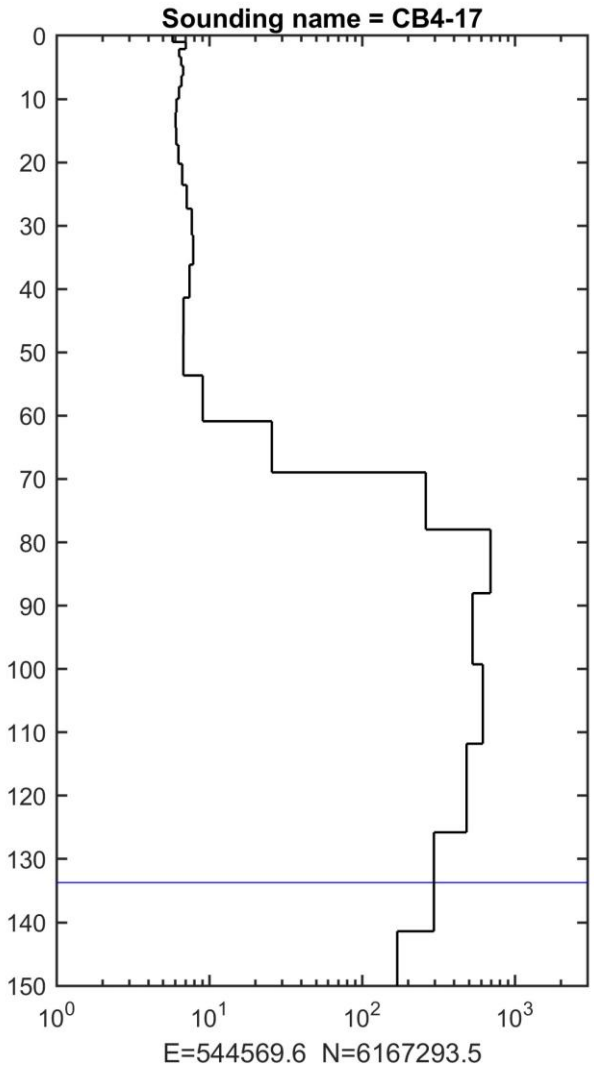
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-15. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



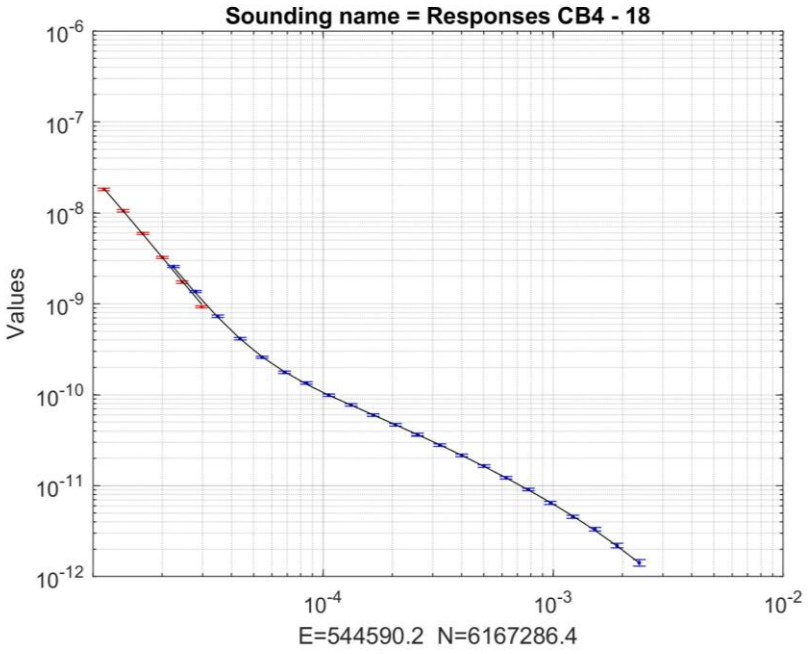


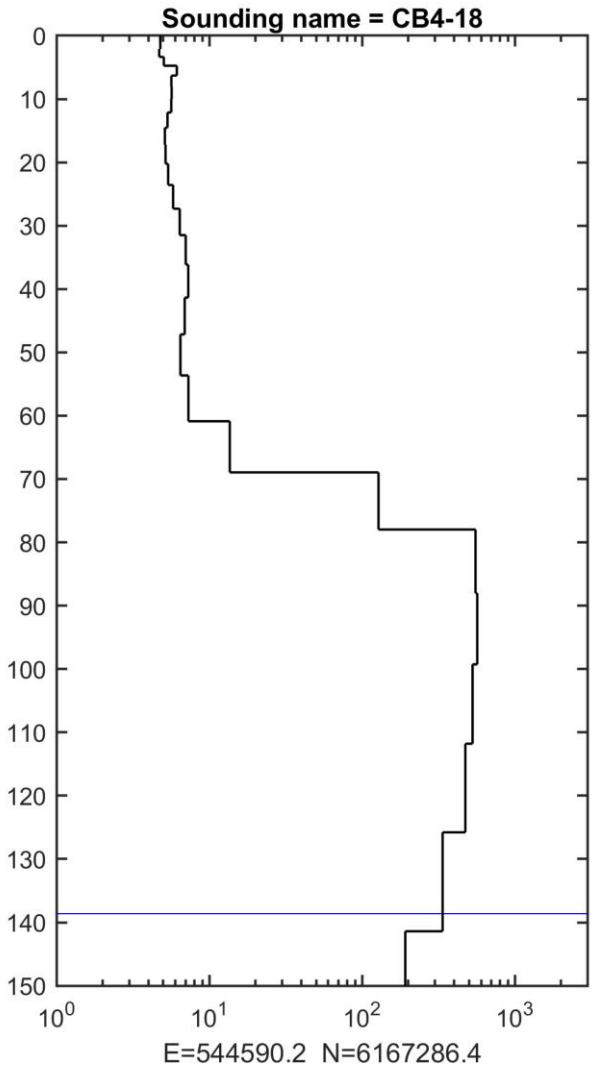
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-16. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



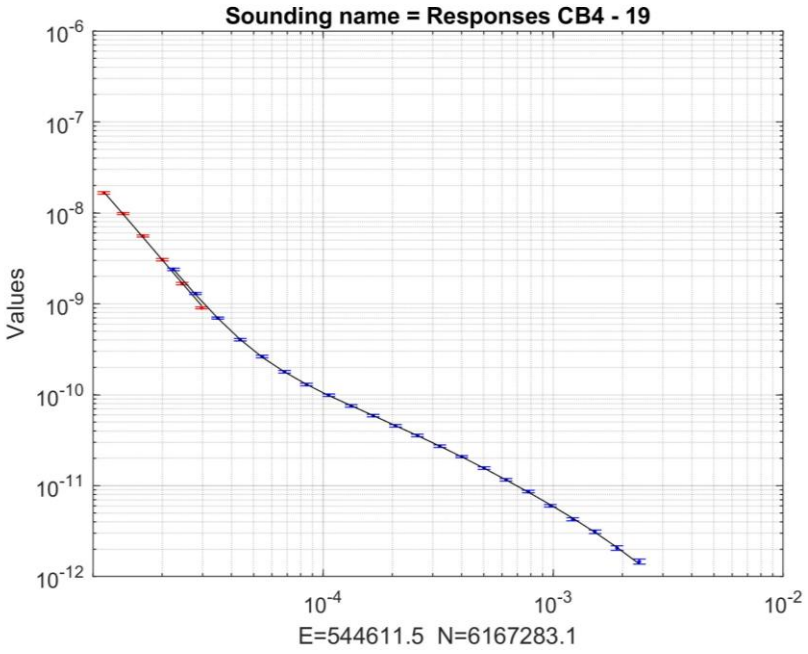


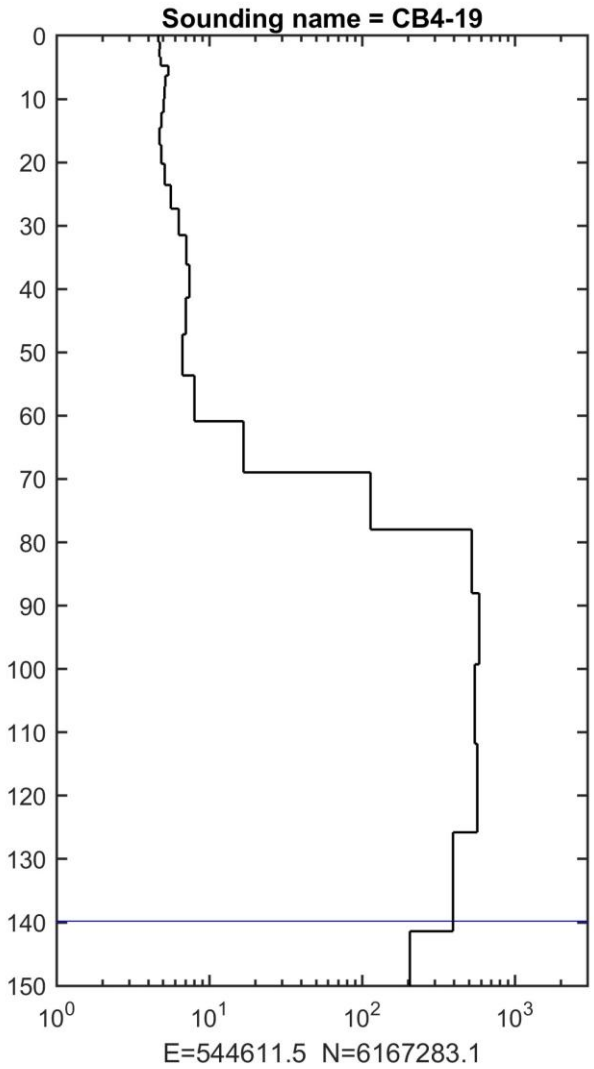
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-17. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



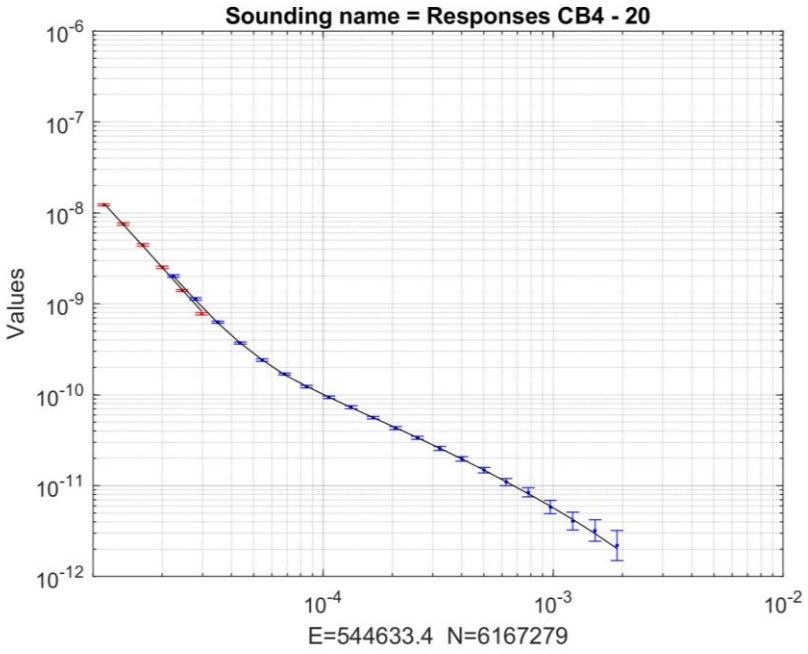


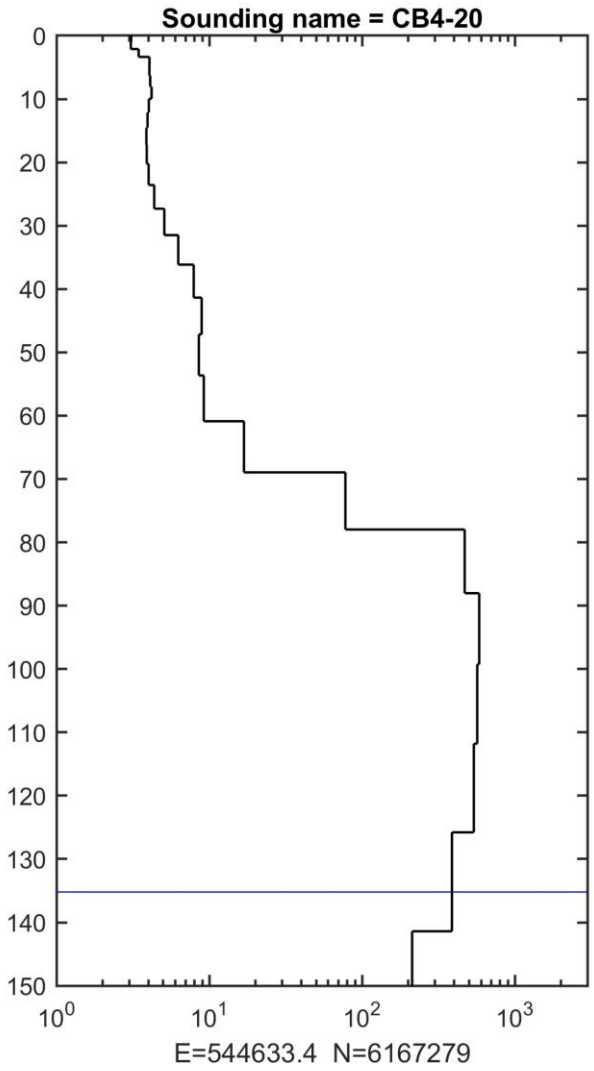
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-18. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



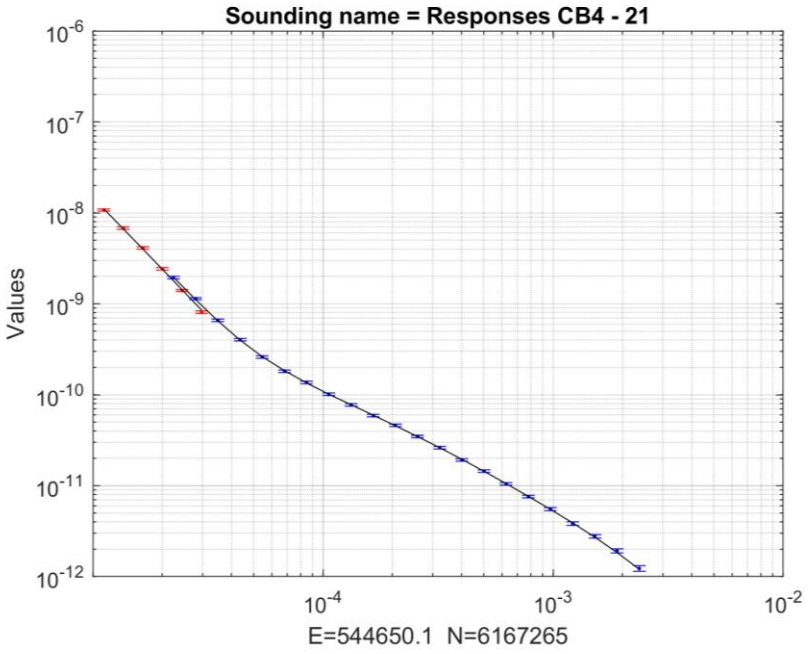


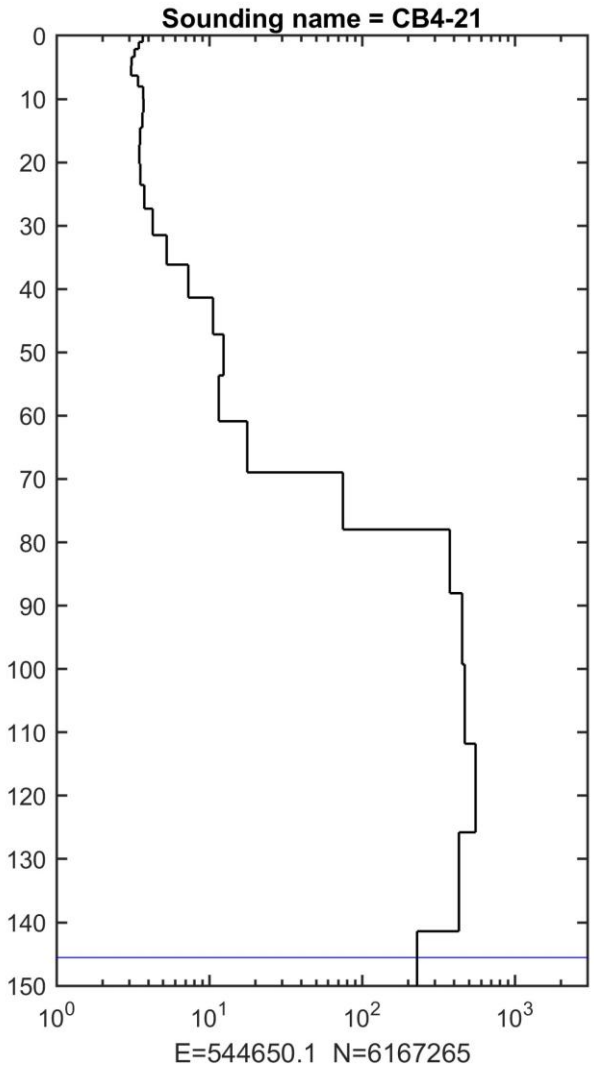
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-19. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



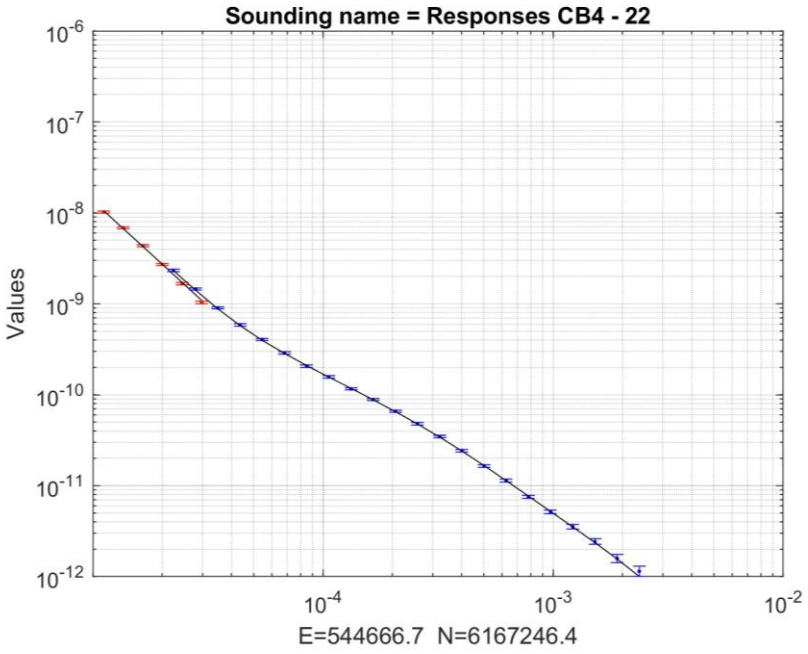


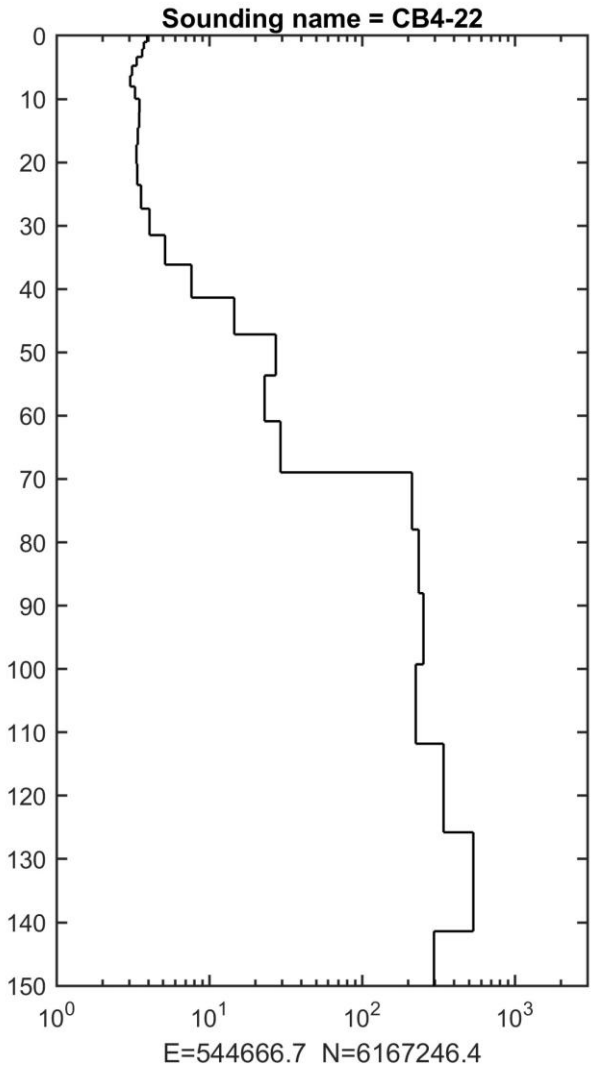
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-20. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



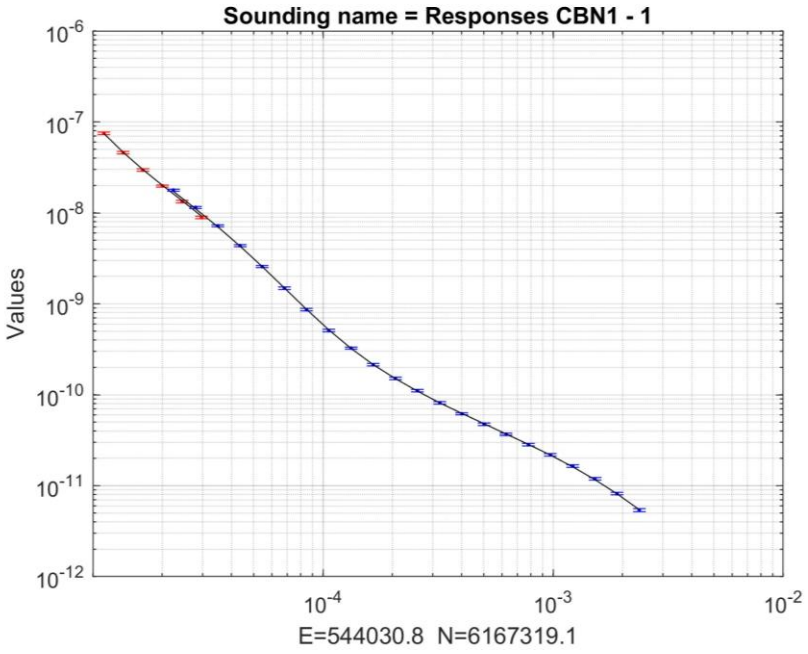


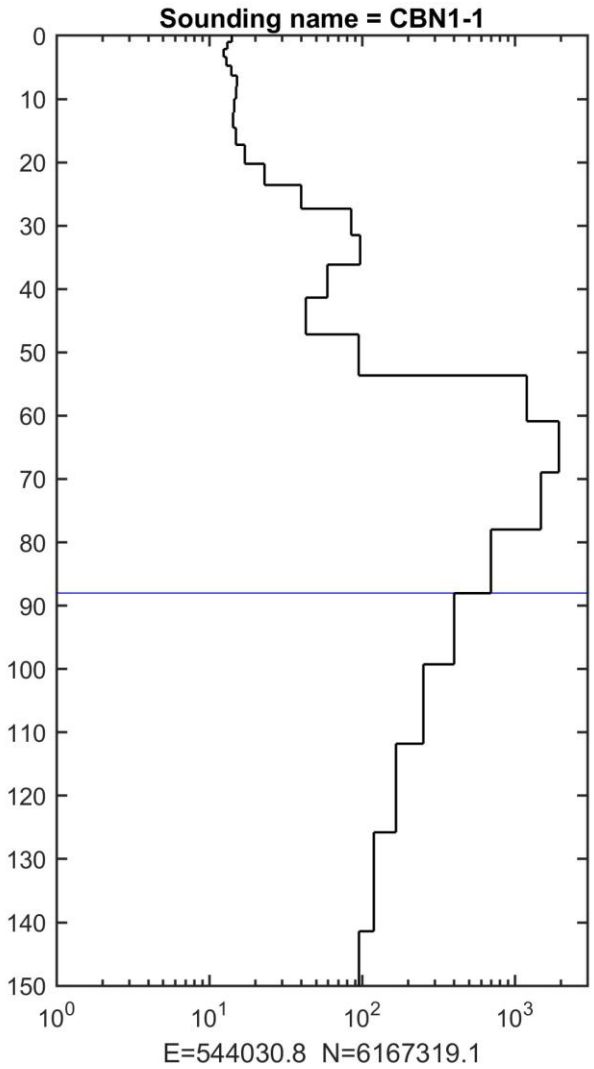
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-21. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



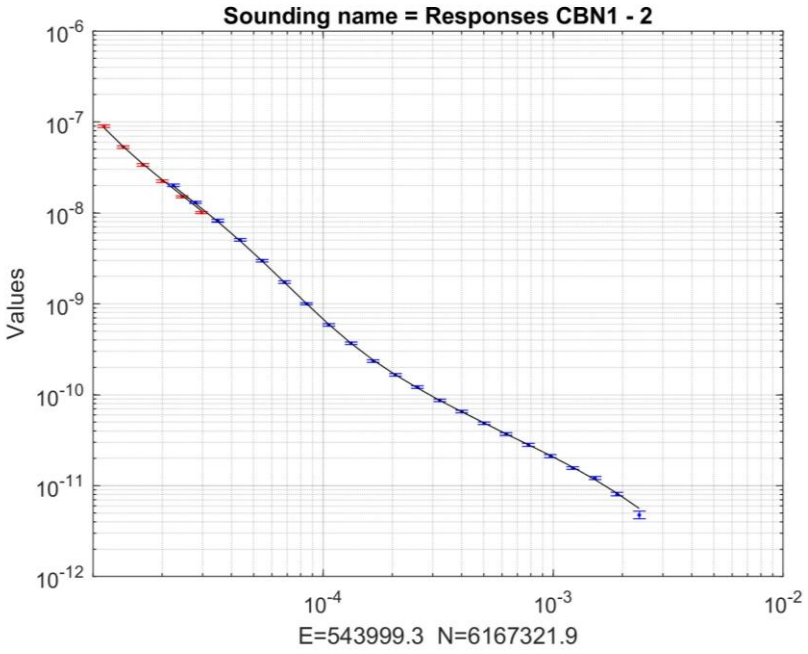


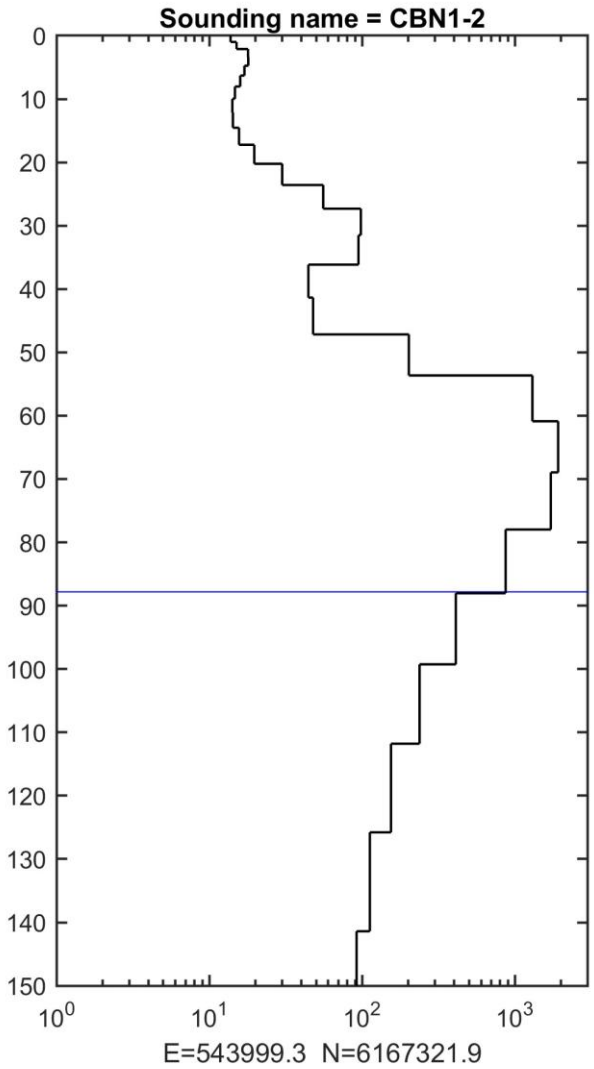
Transect 4: Observed responses – low and high moments (top panel) for Sounding CB4-22. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



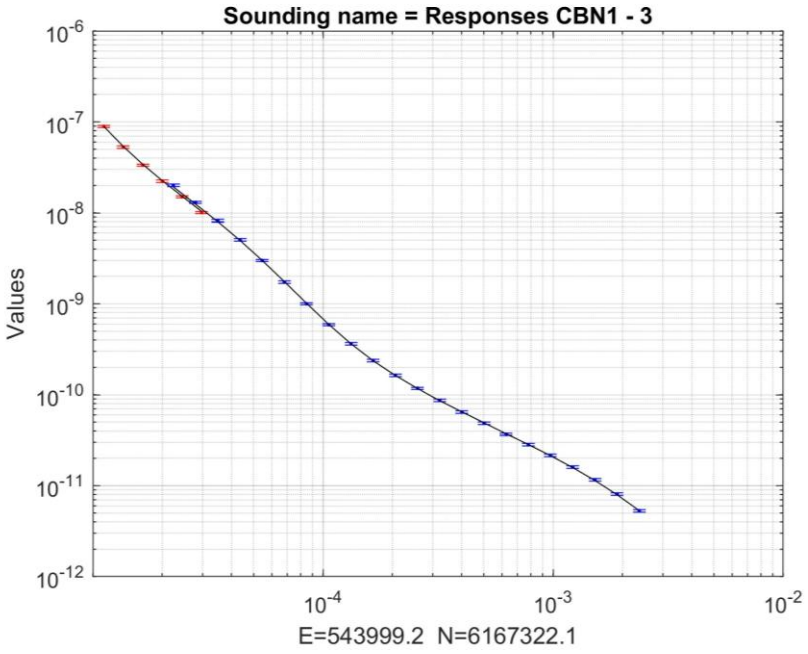


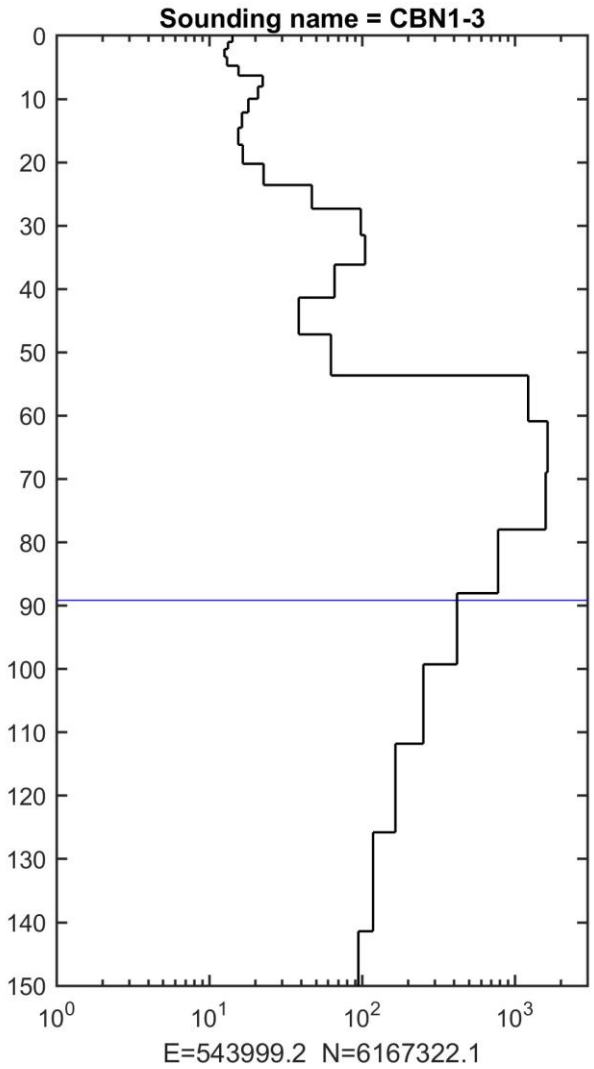
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



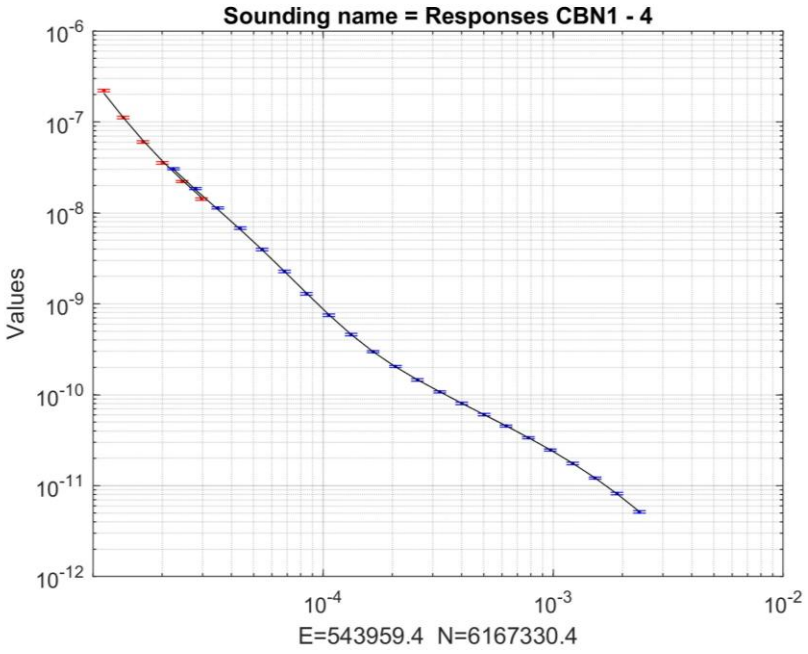


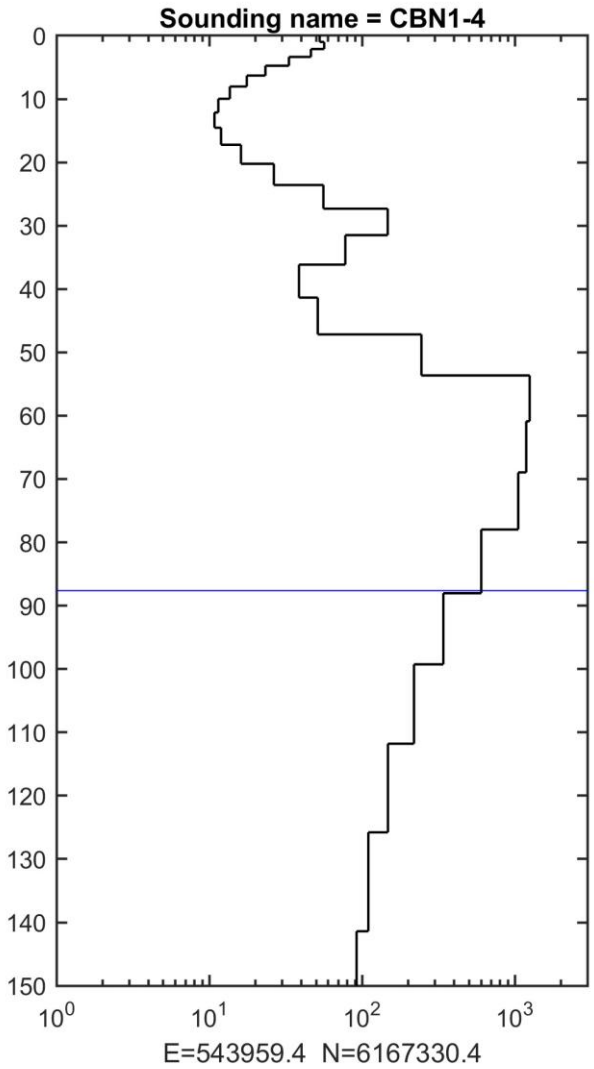
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



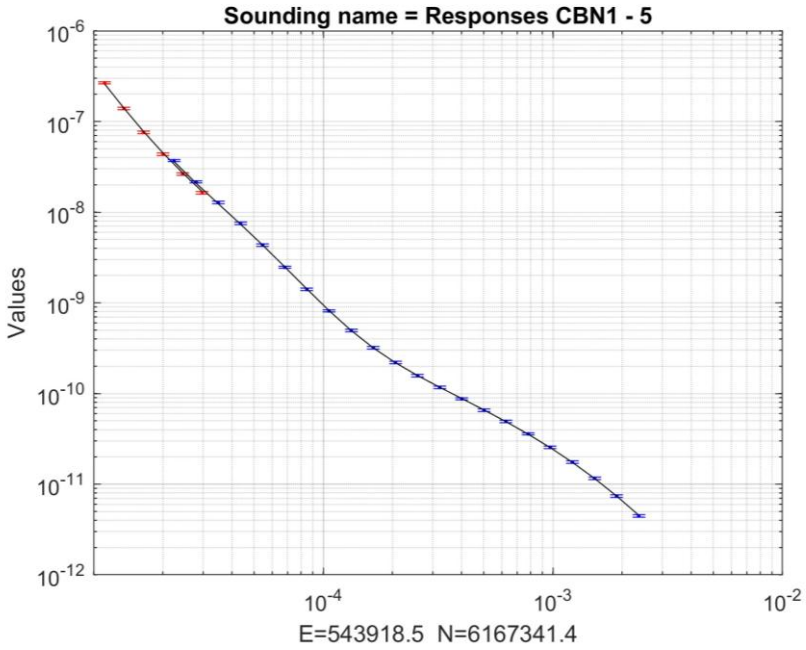


Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

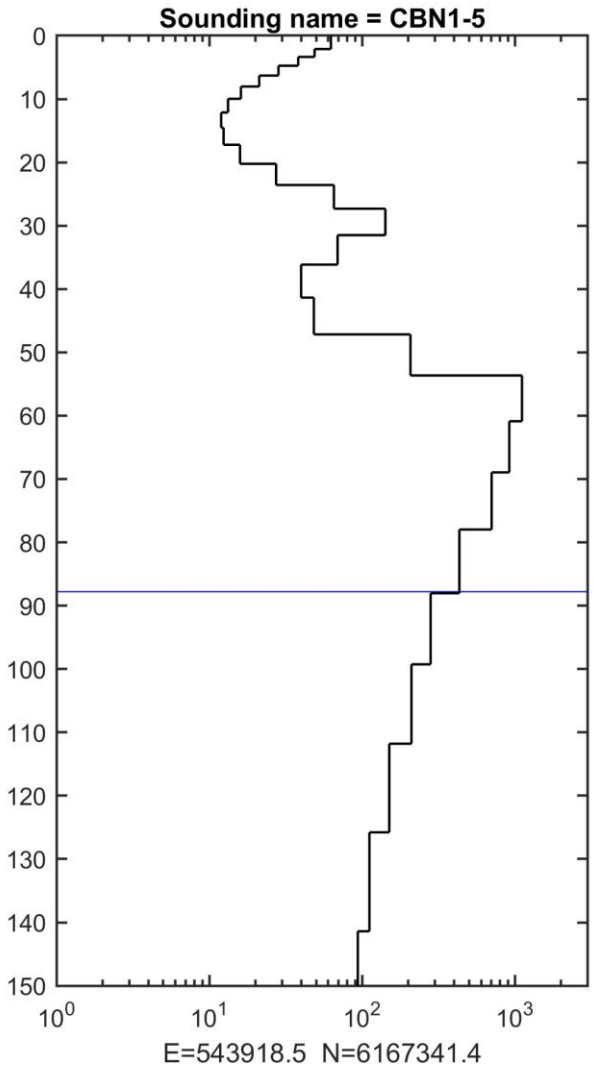


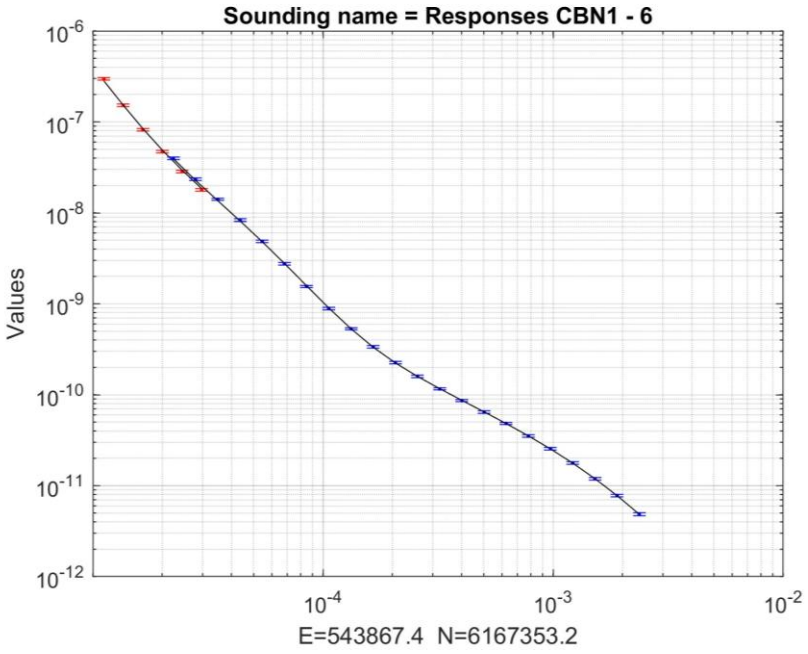


Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

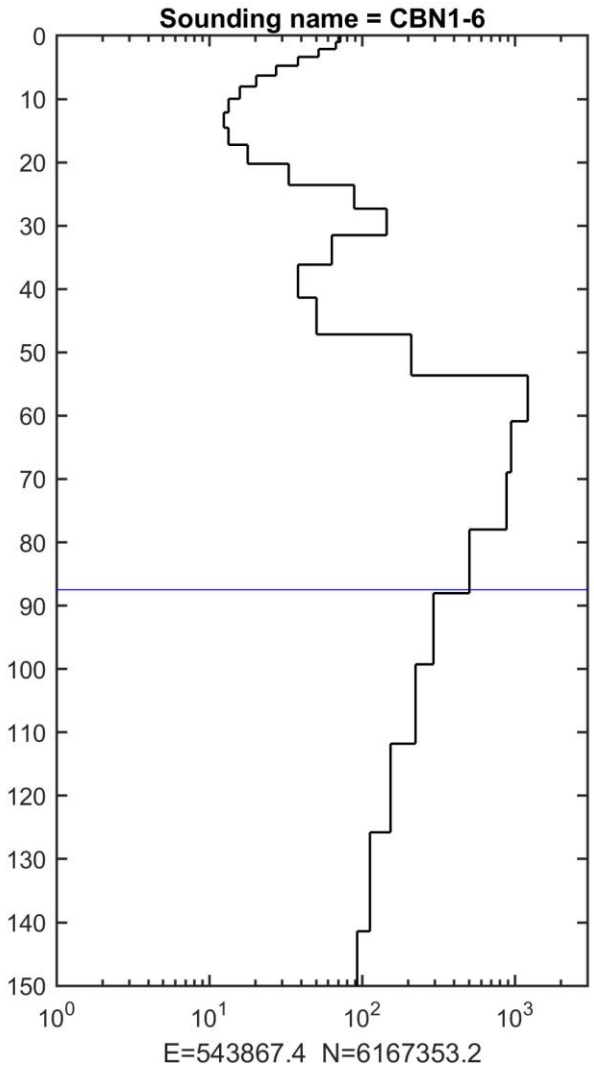


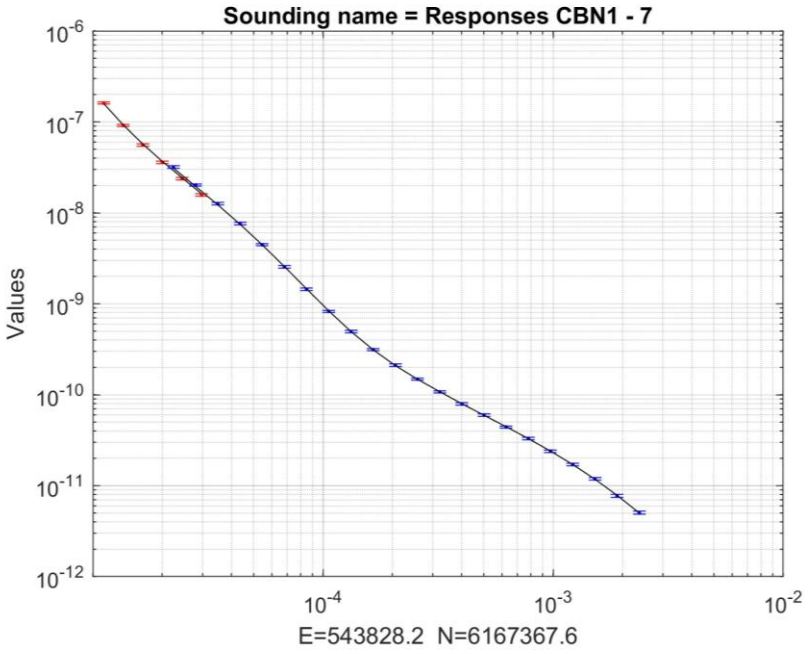
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

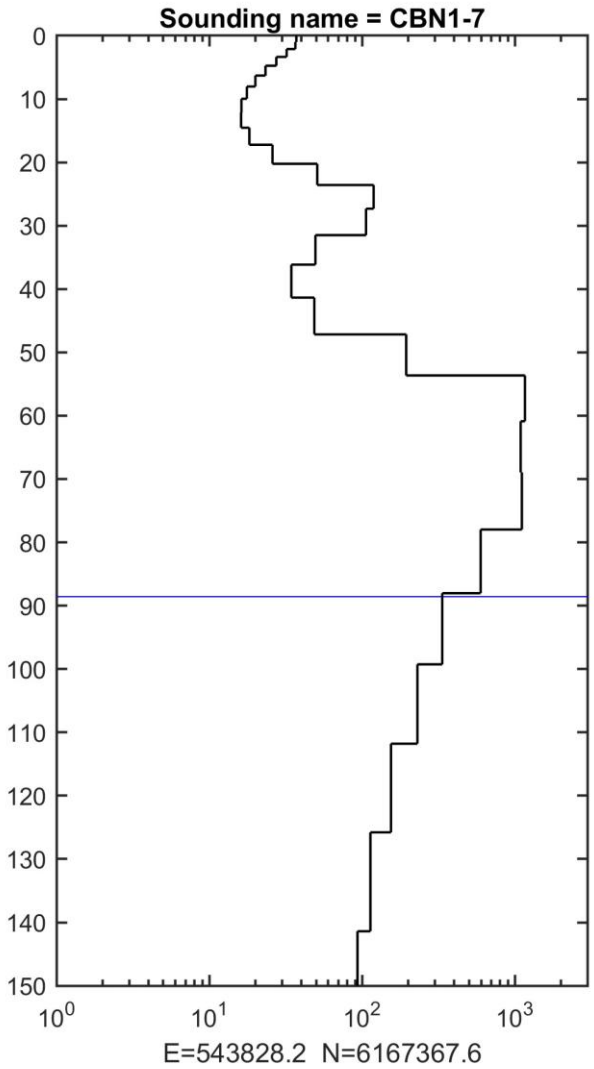




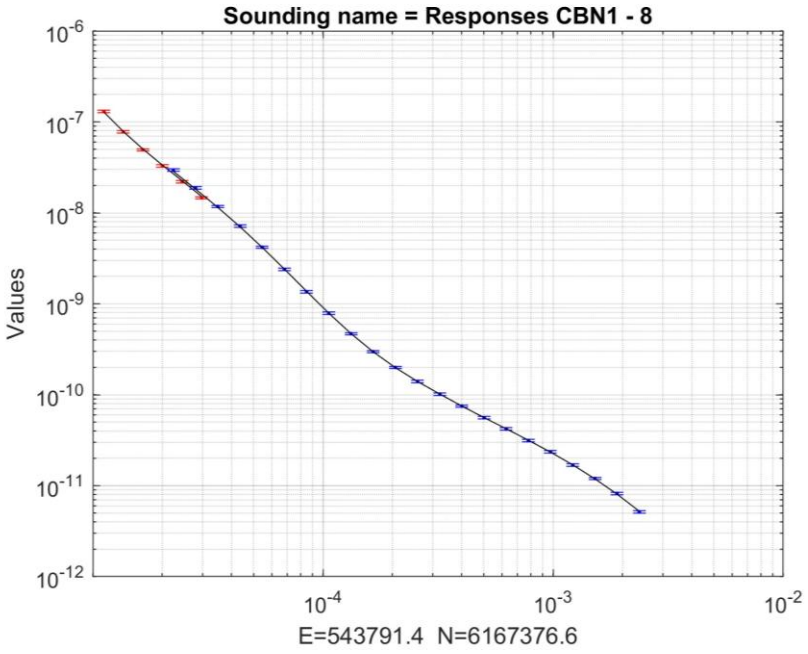
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

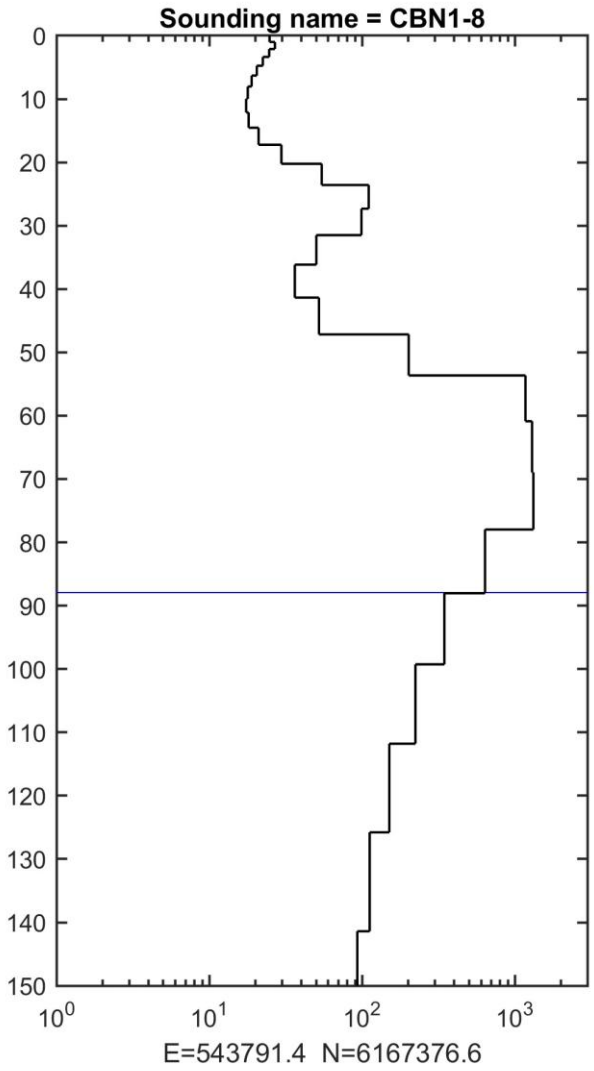




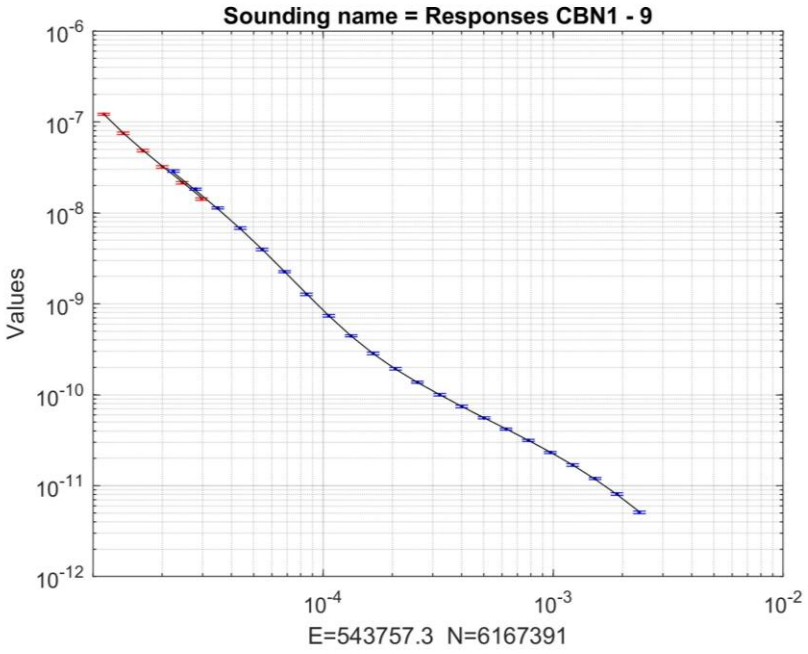


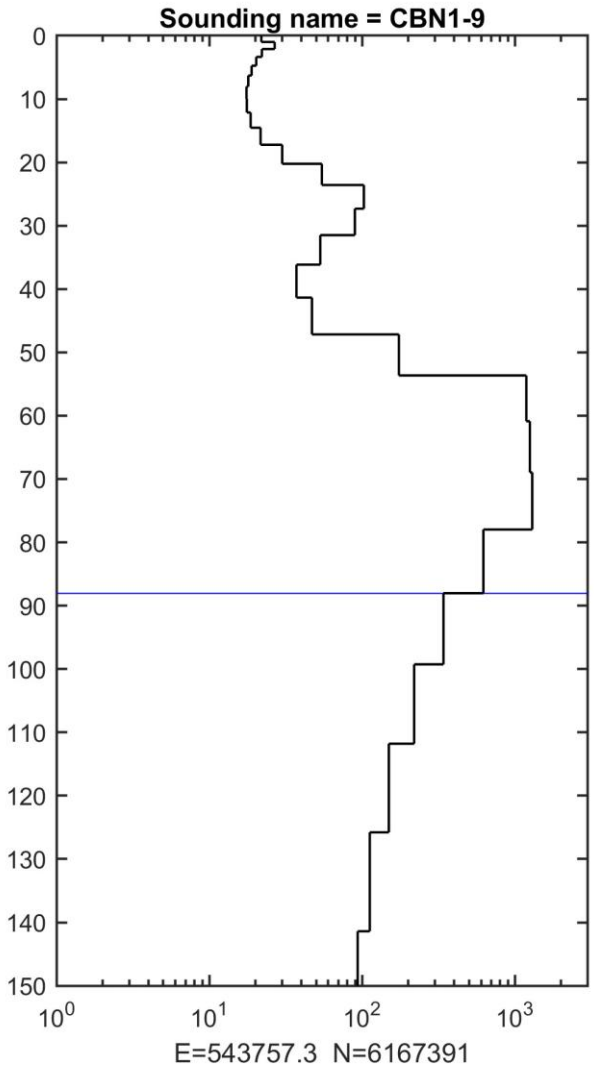
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



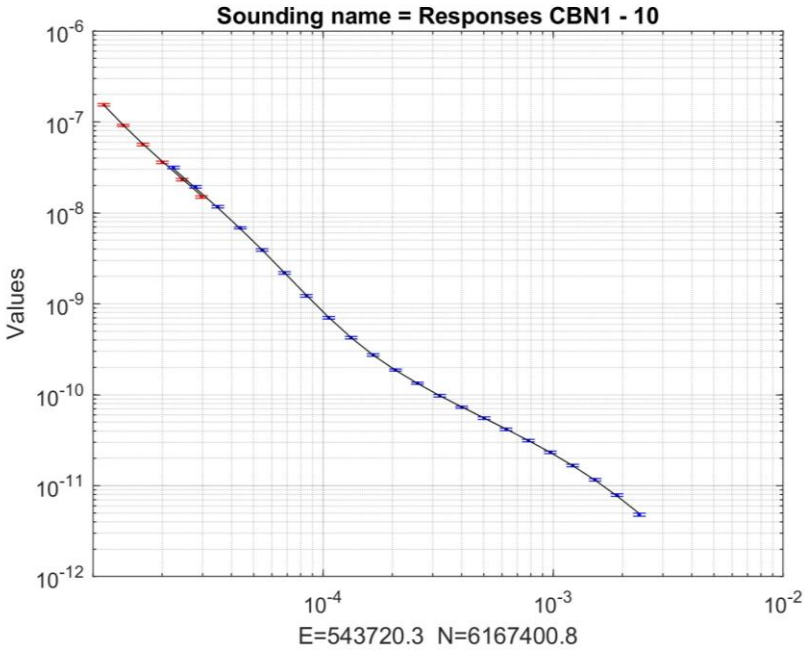


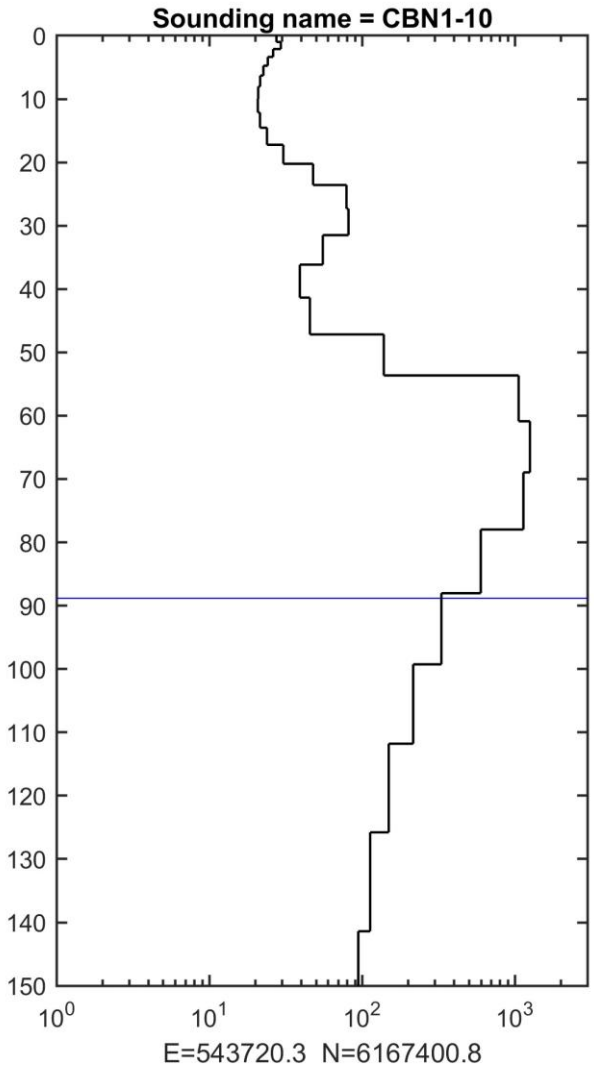
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



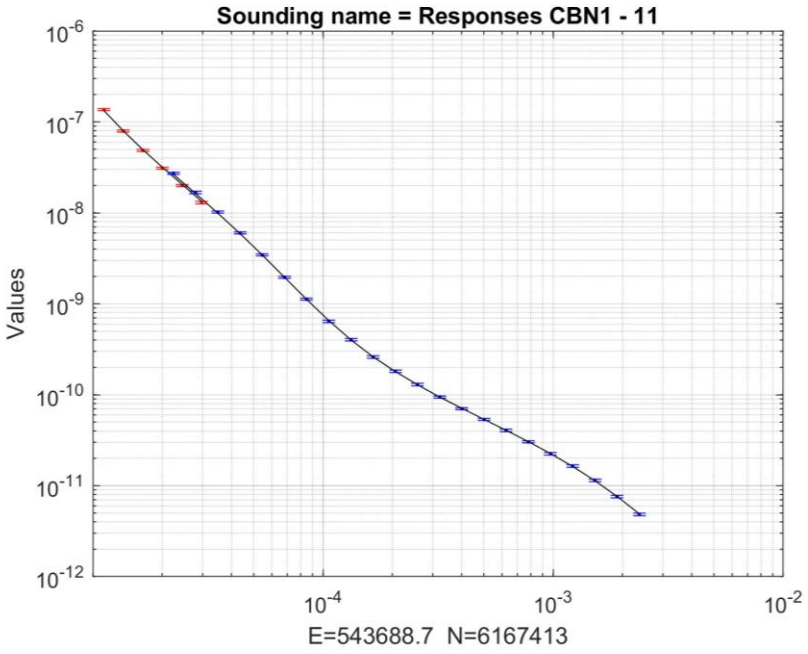


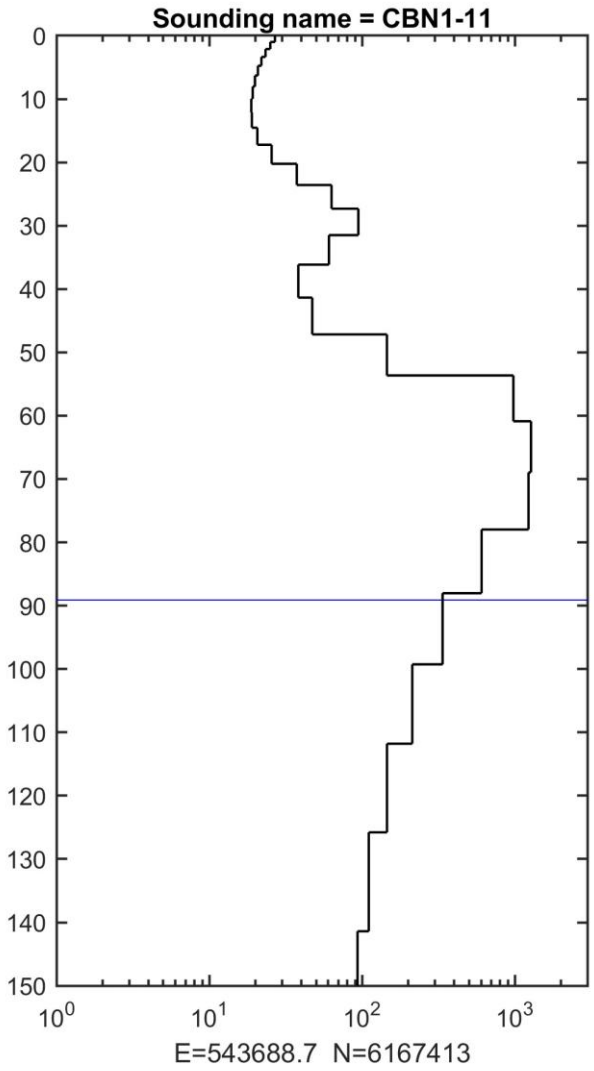
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



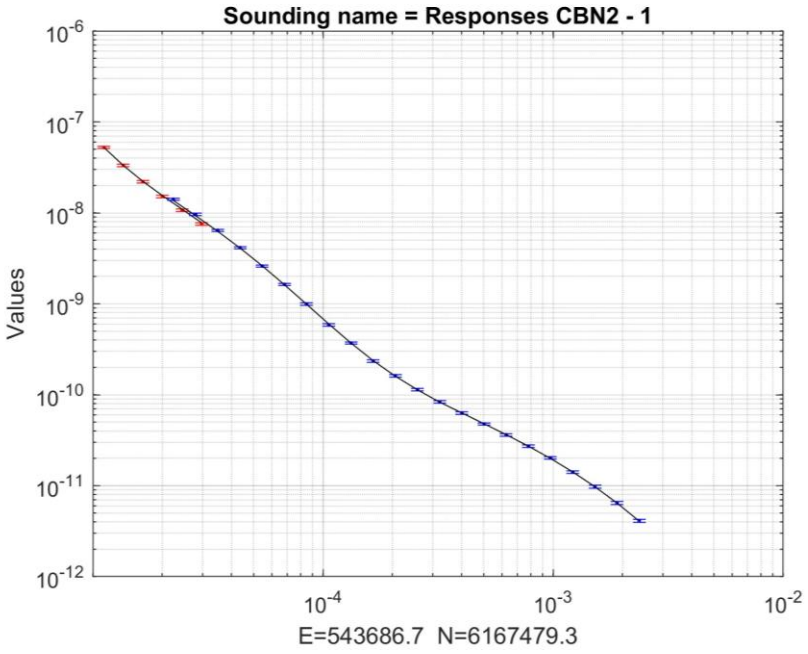


Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

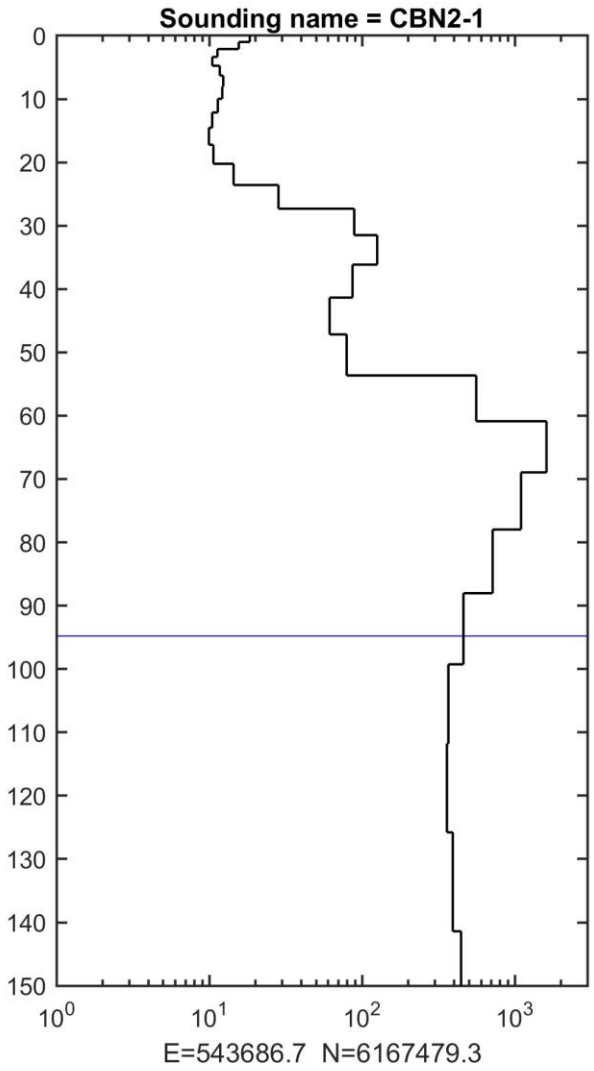


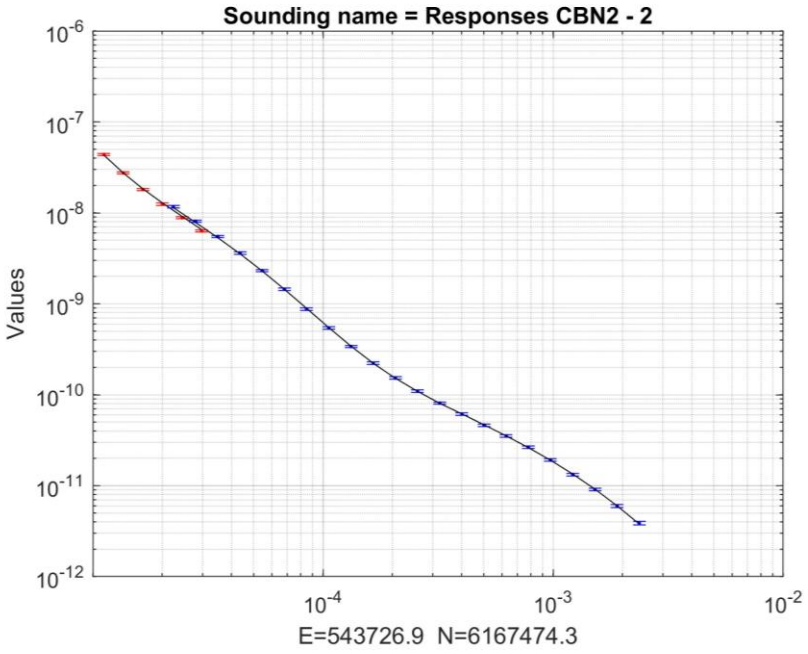


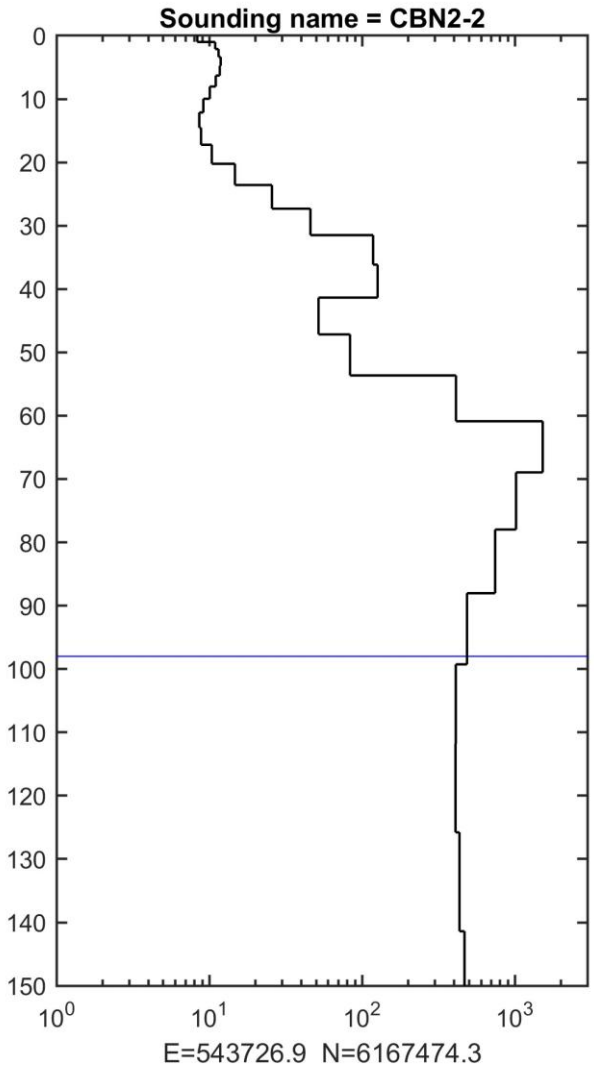
Transect N1: Observed responses – low and high moments (top panel) for Sounding CBN1-11. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



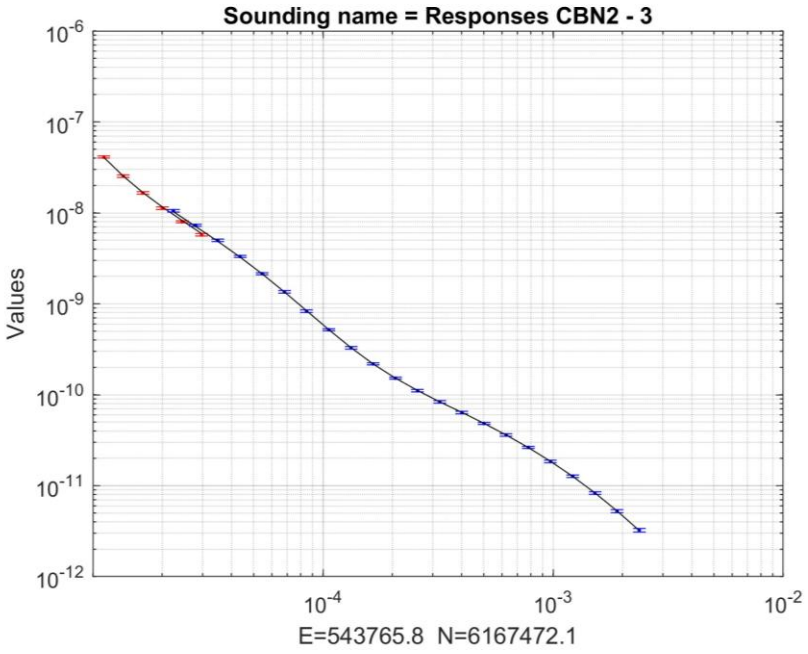
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

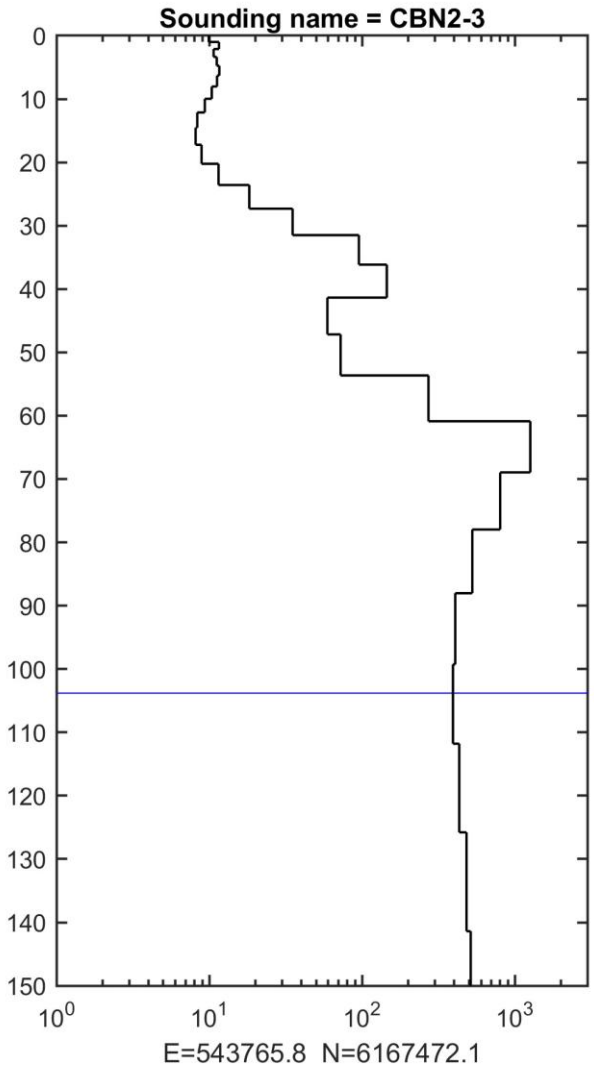




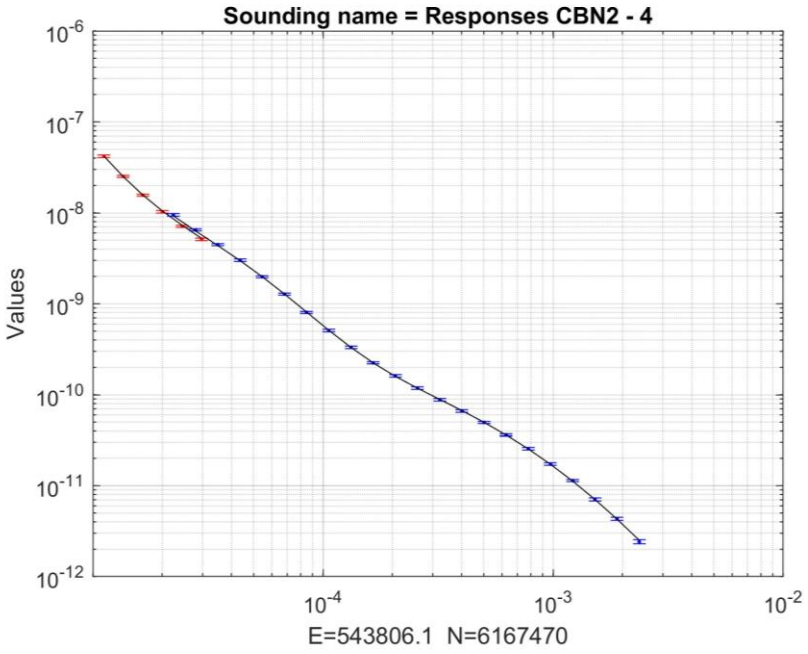


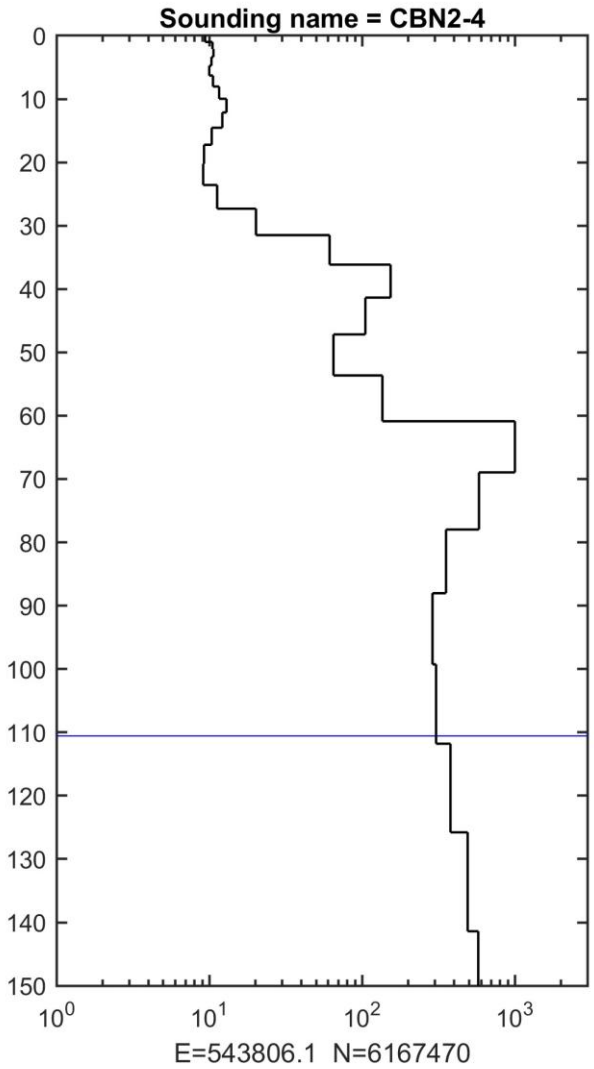
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



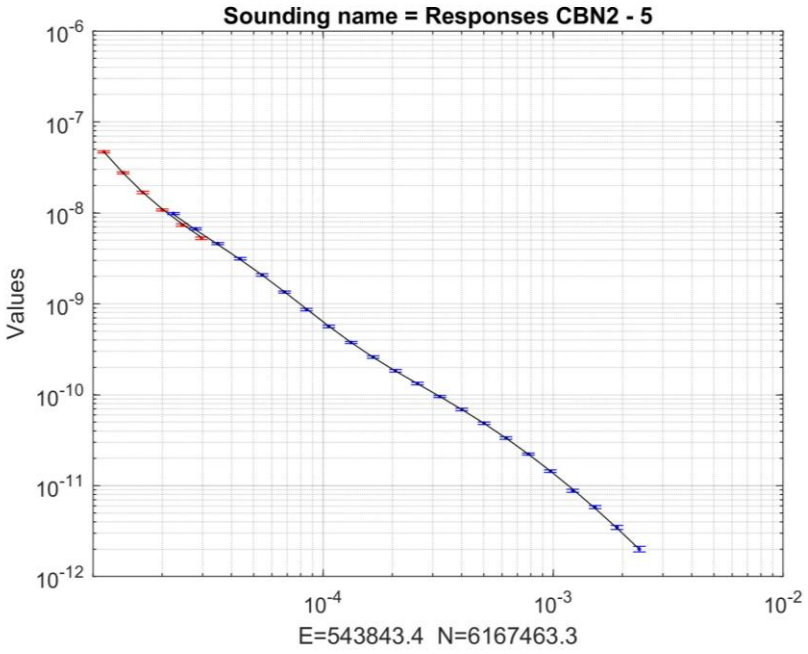


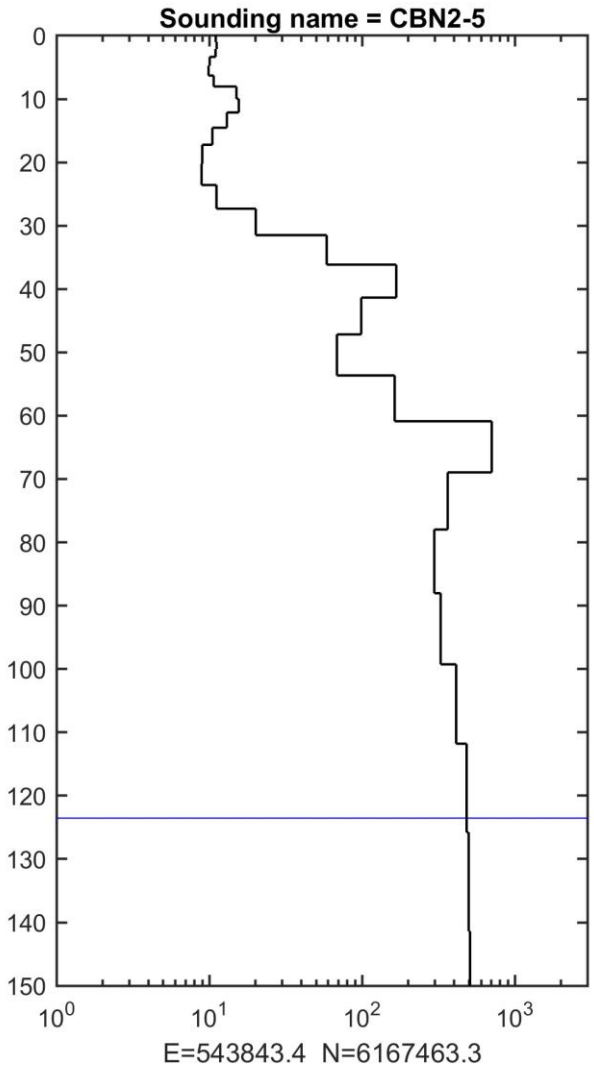
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



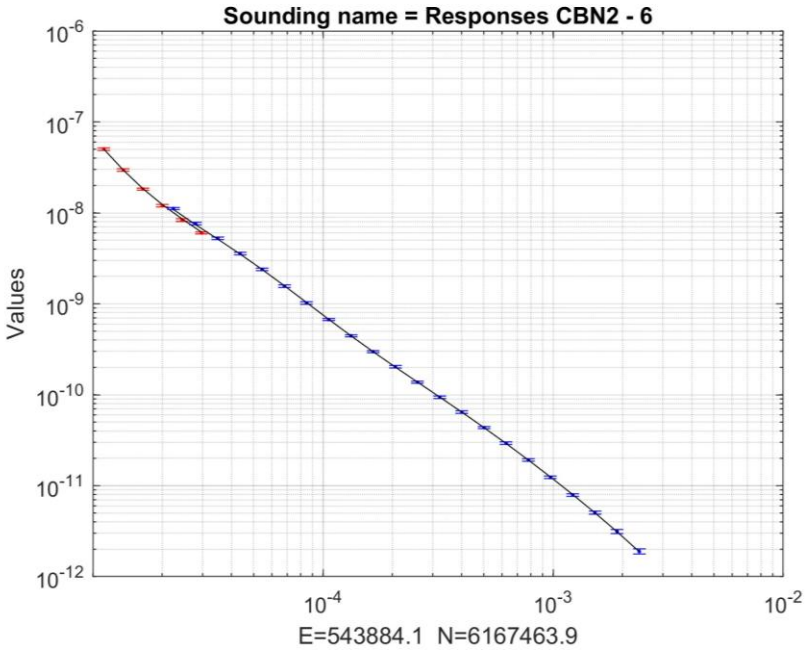


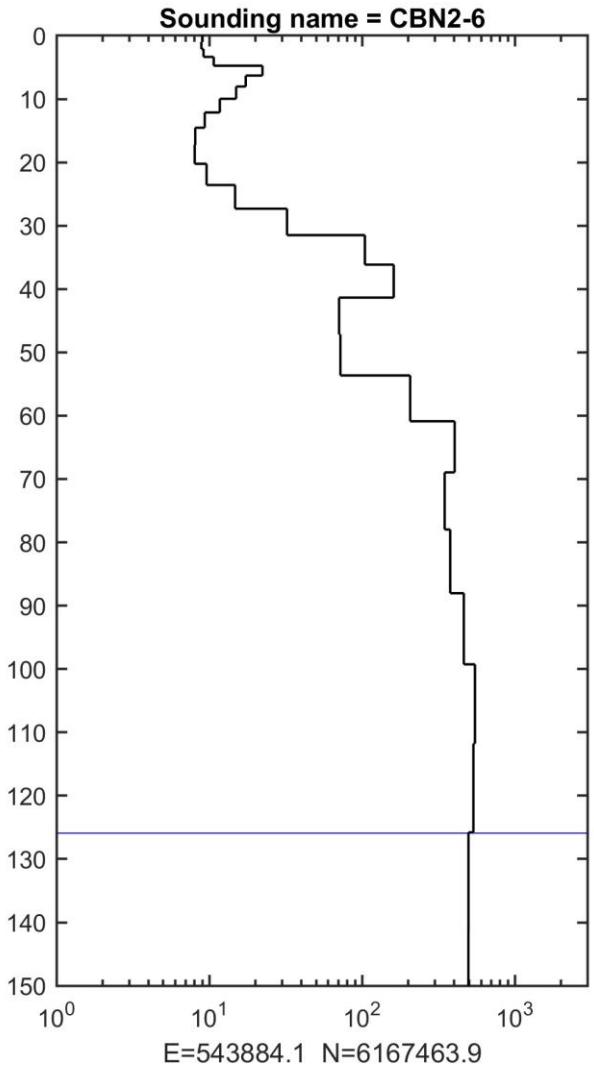
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



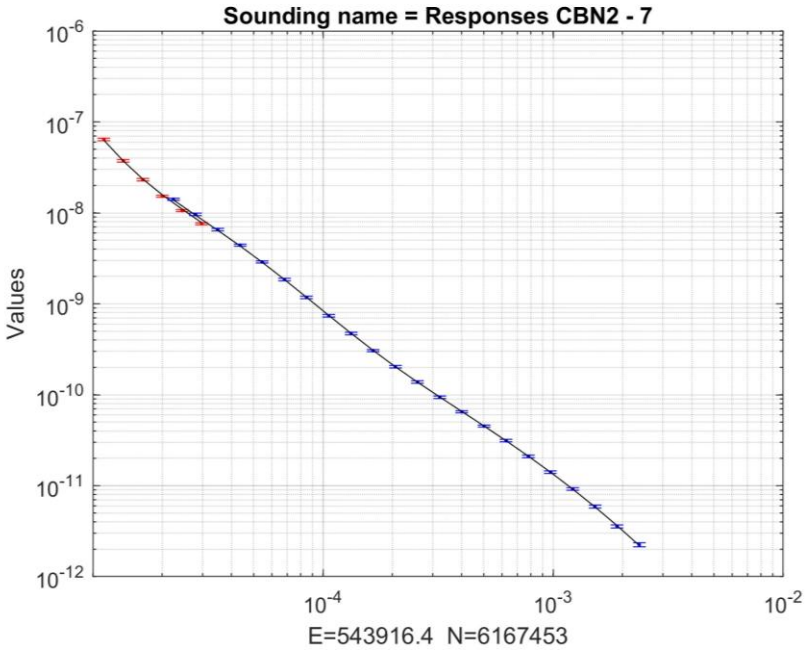


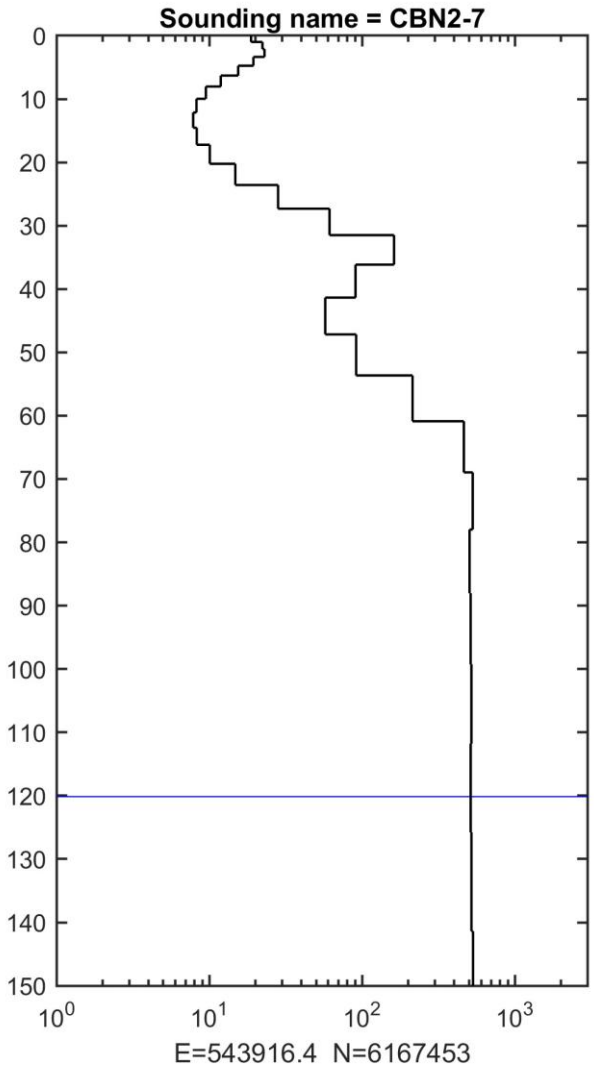
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



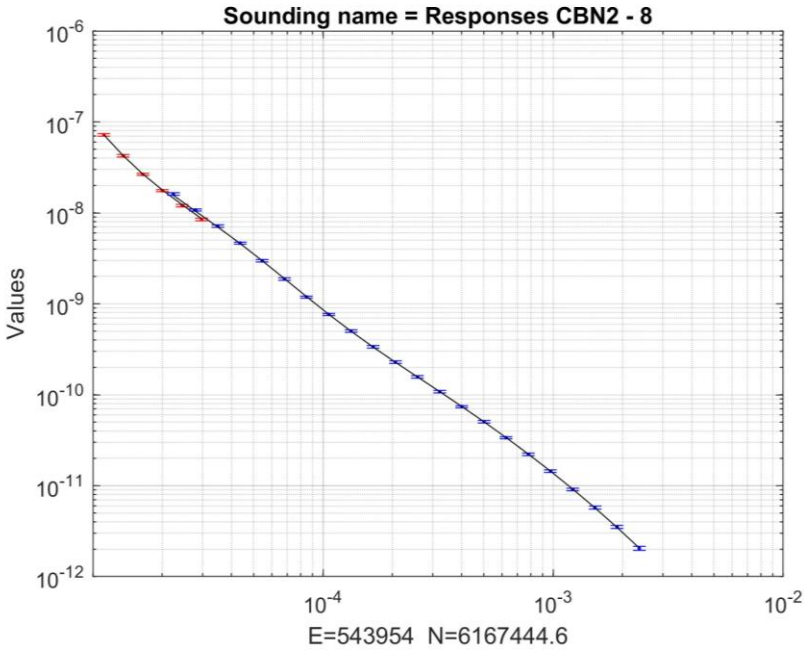


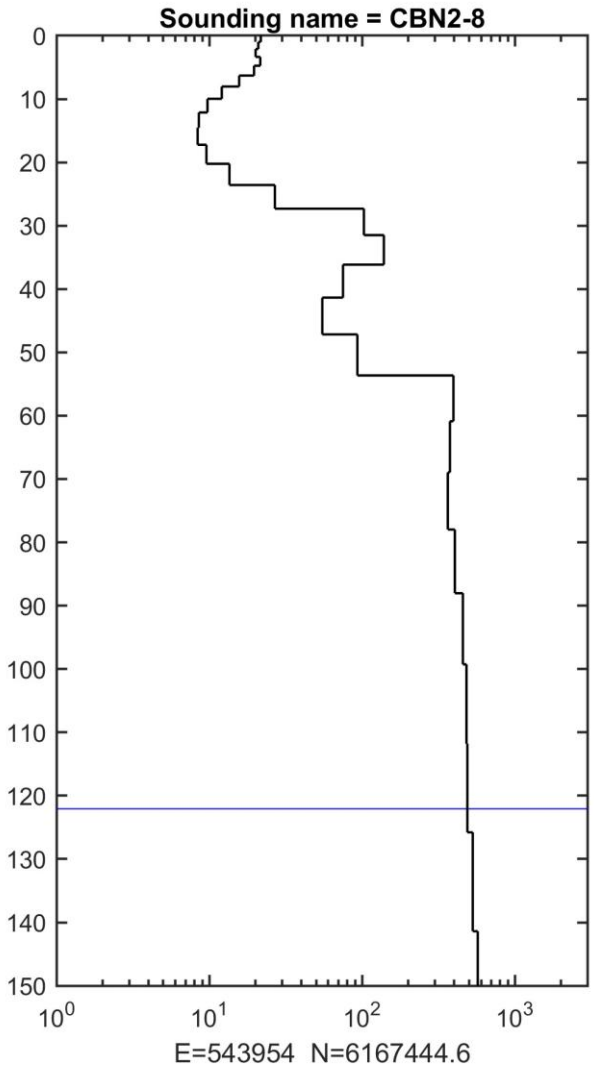
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



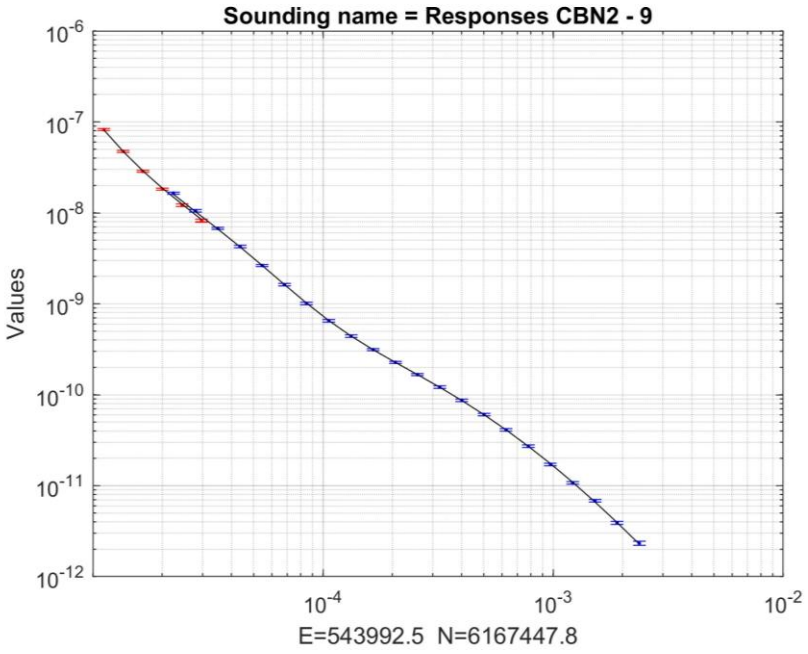


Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

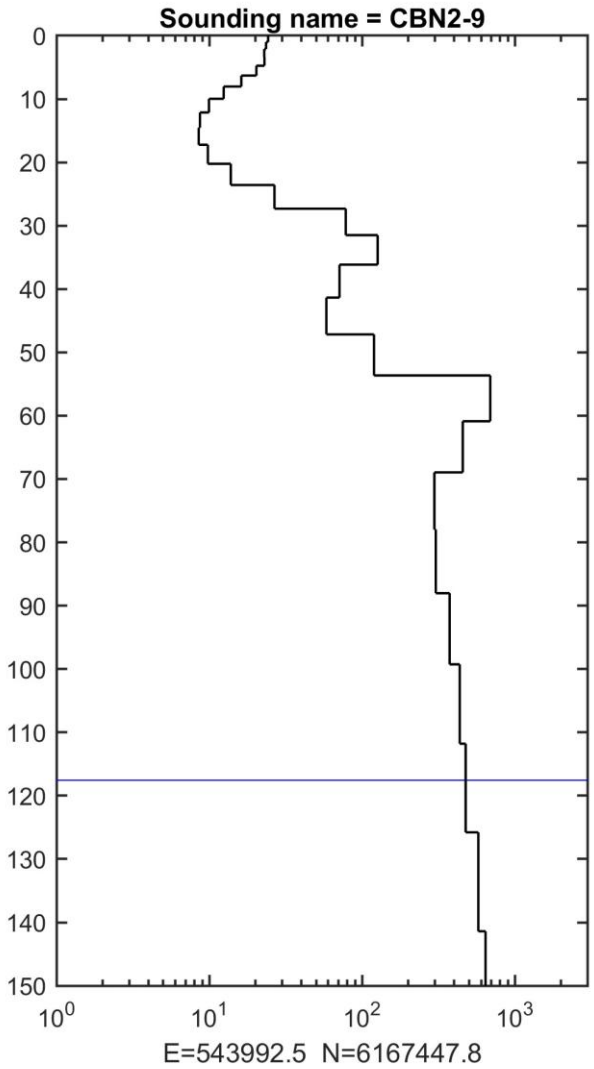


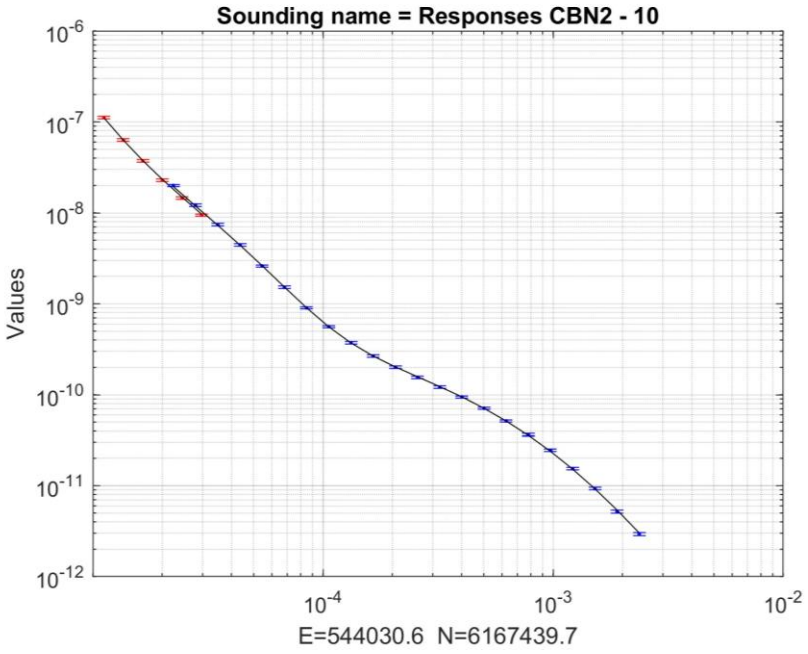


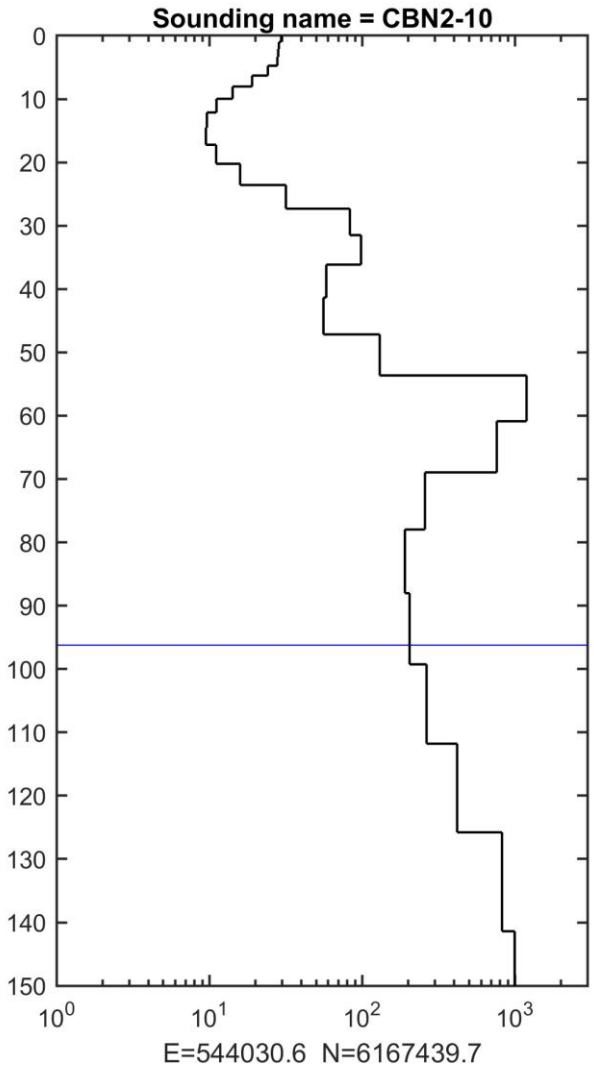
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



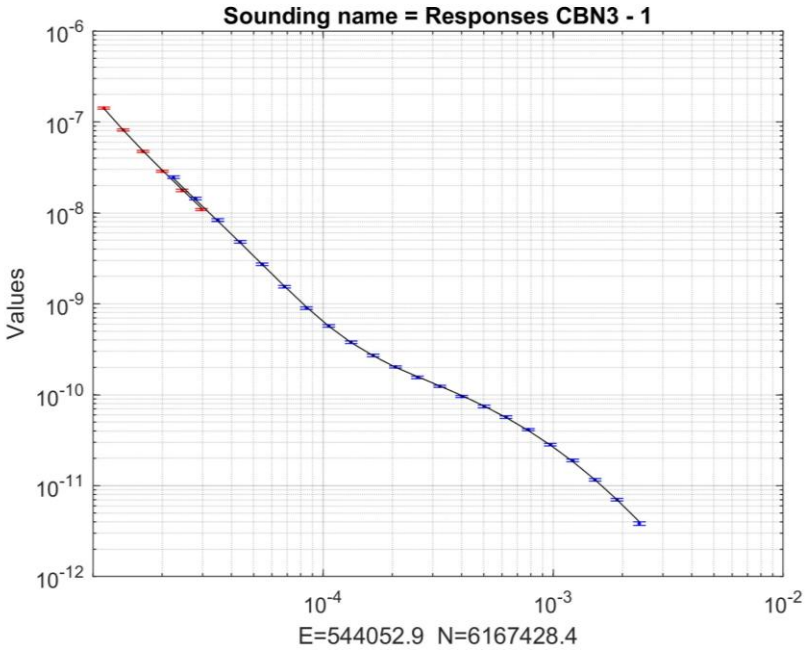
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

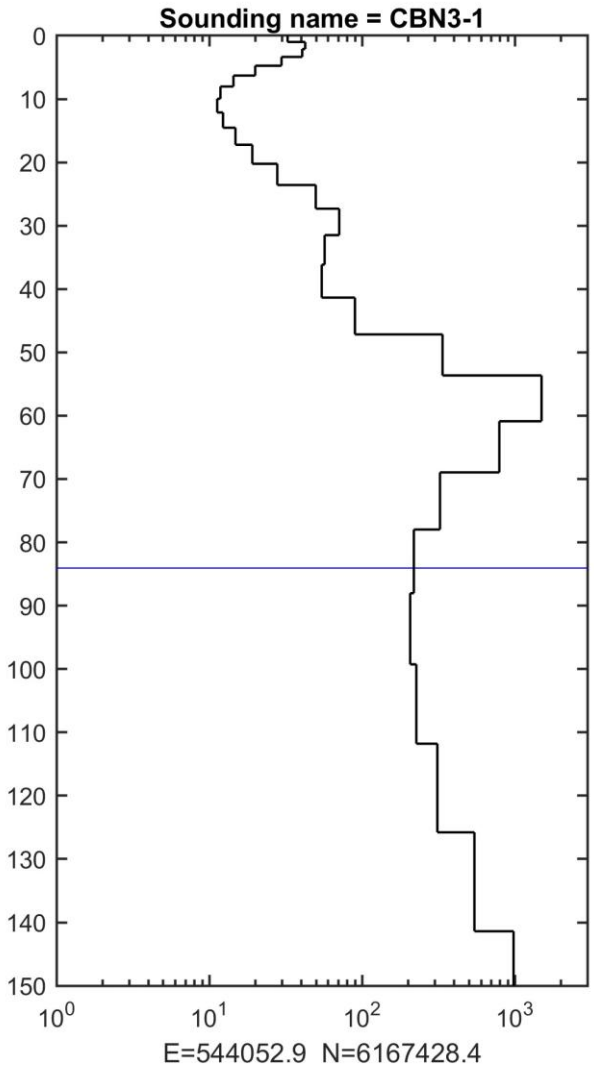




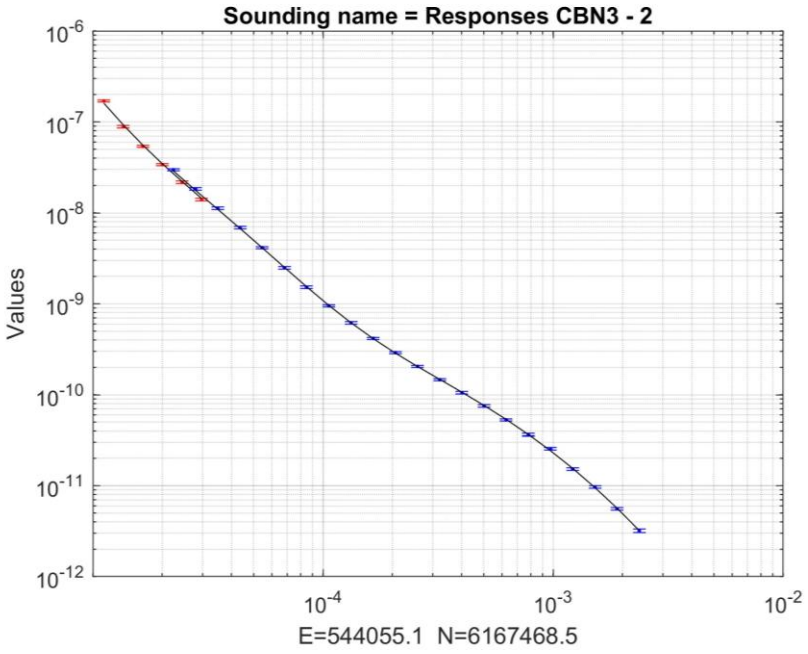


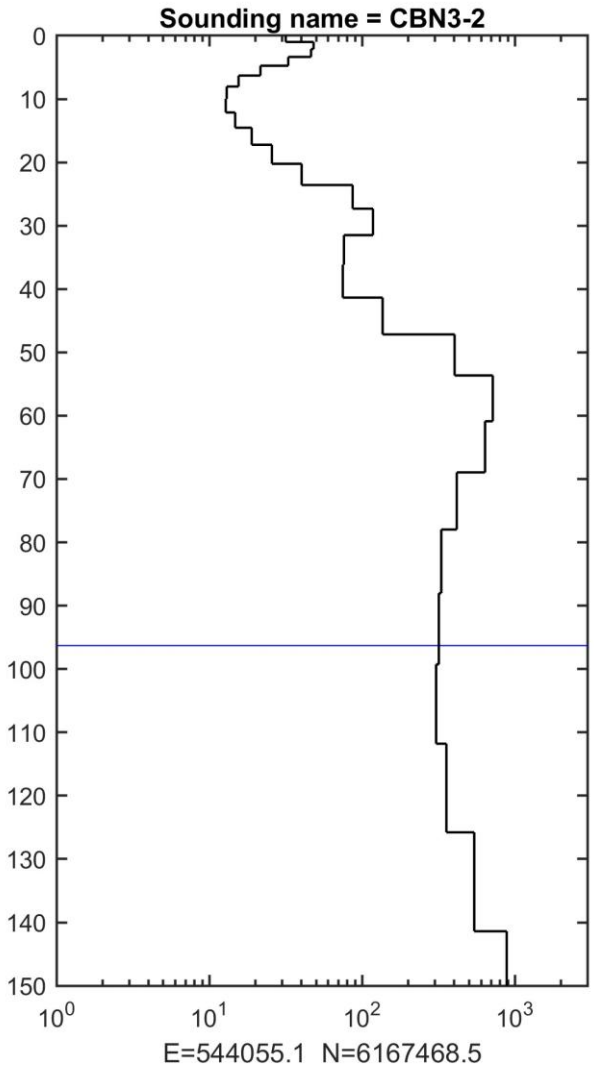
Transect N2: Observed responses – low and high moments (top panel) for Sounding CBN2-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



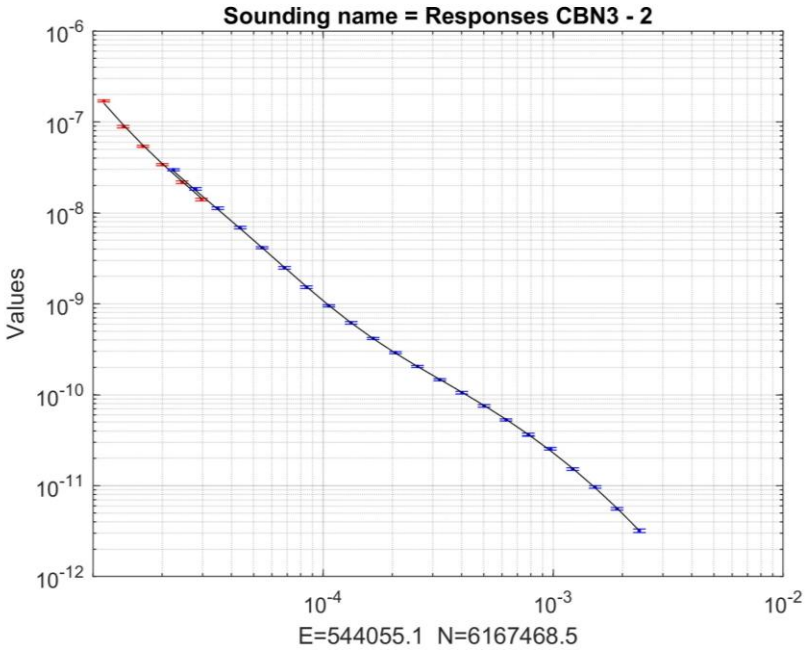


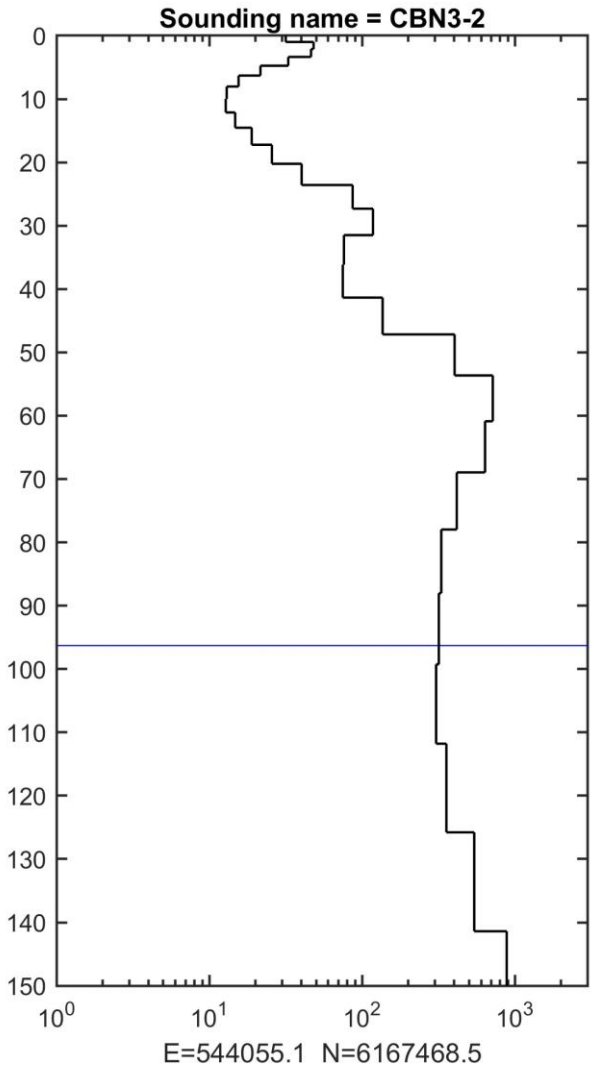
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-1. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



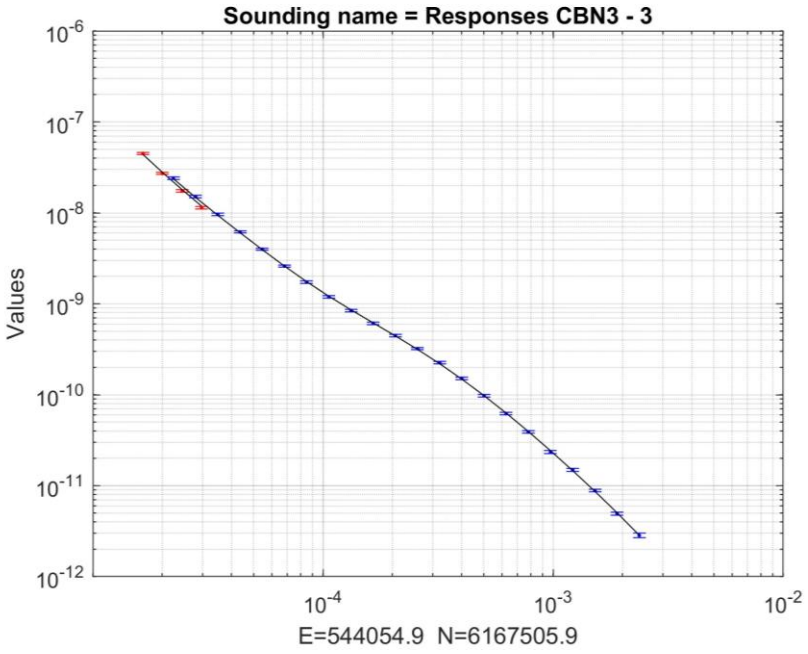


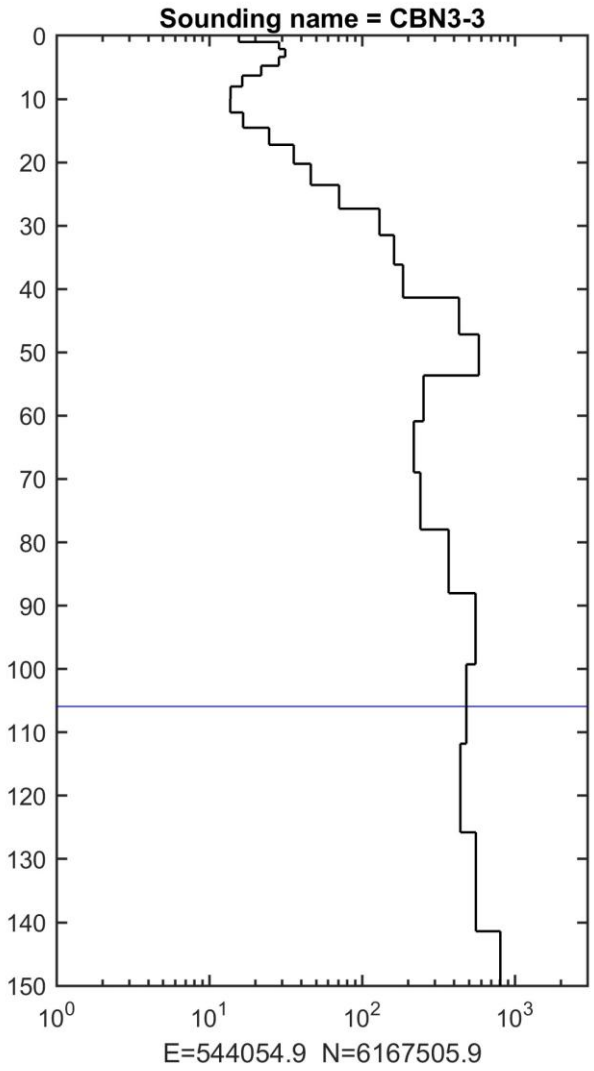
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-2. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



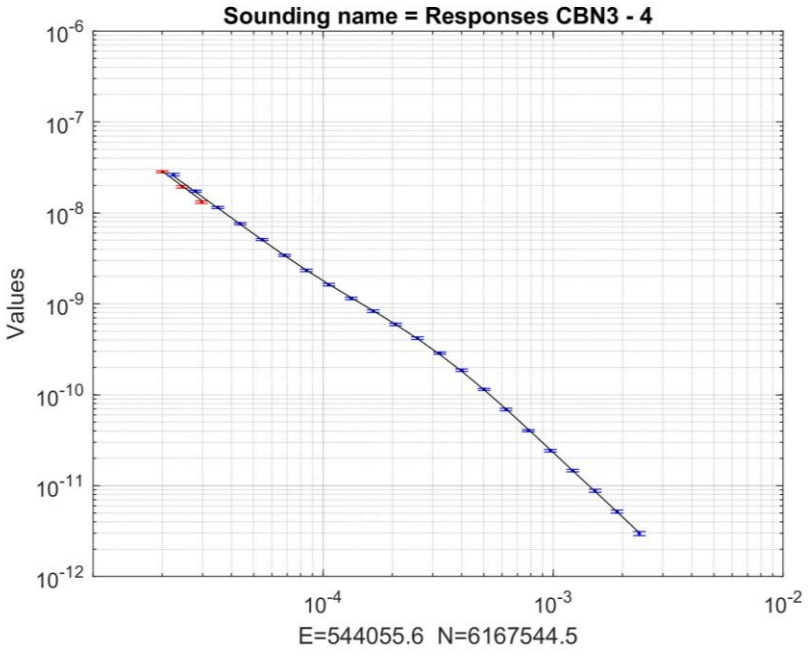


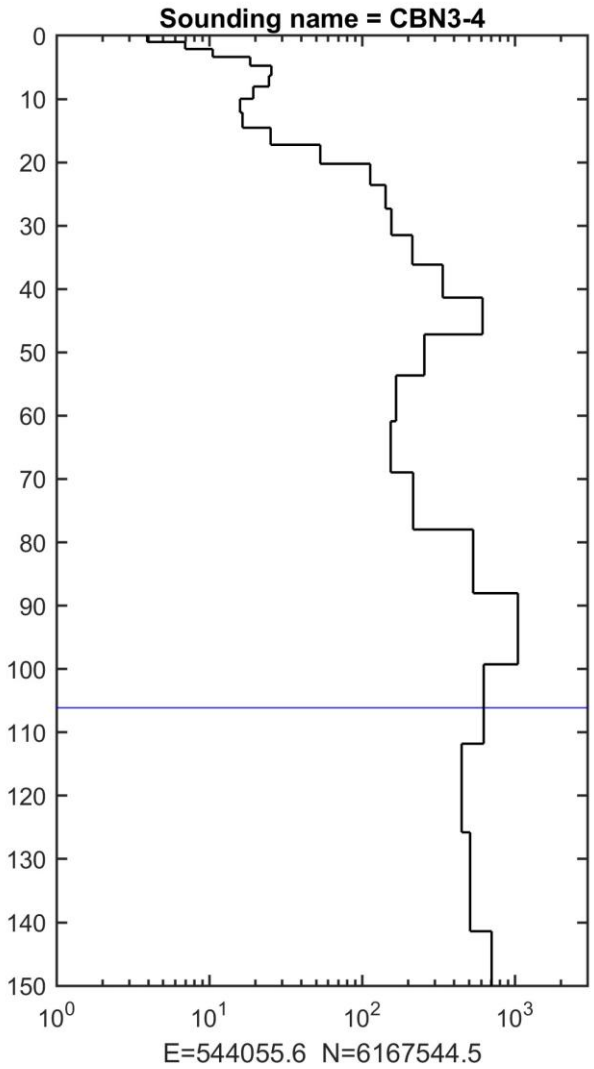
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



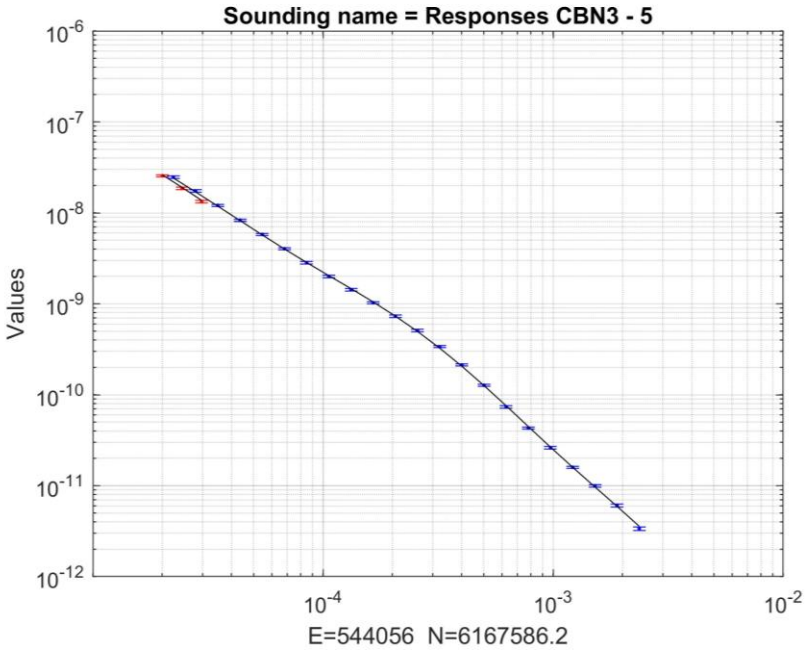


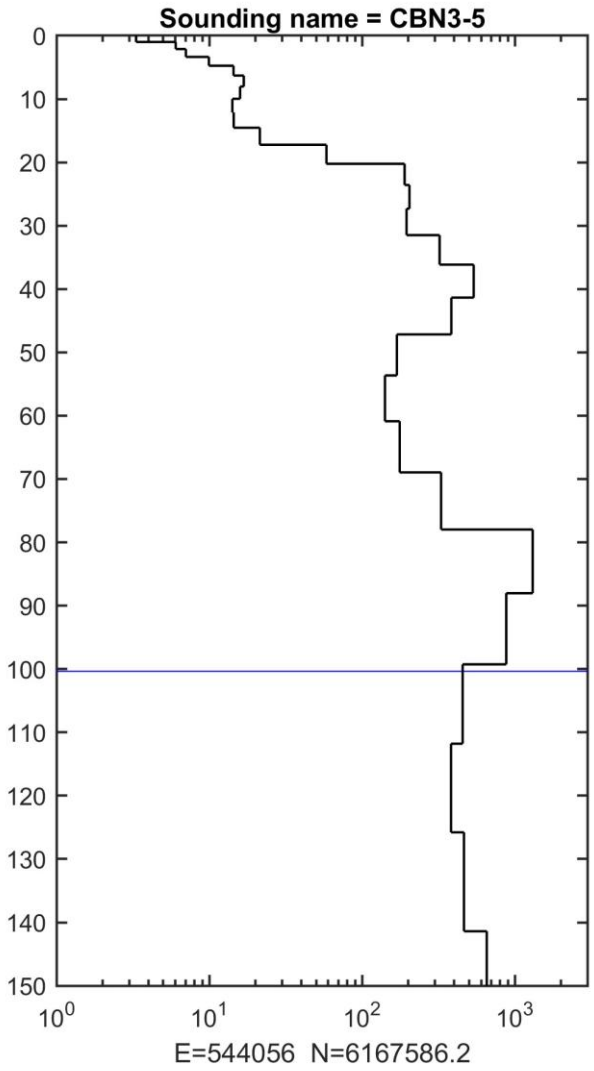
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-3. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



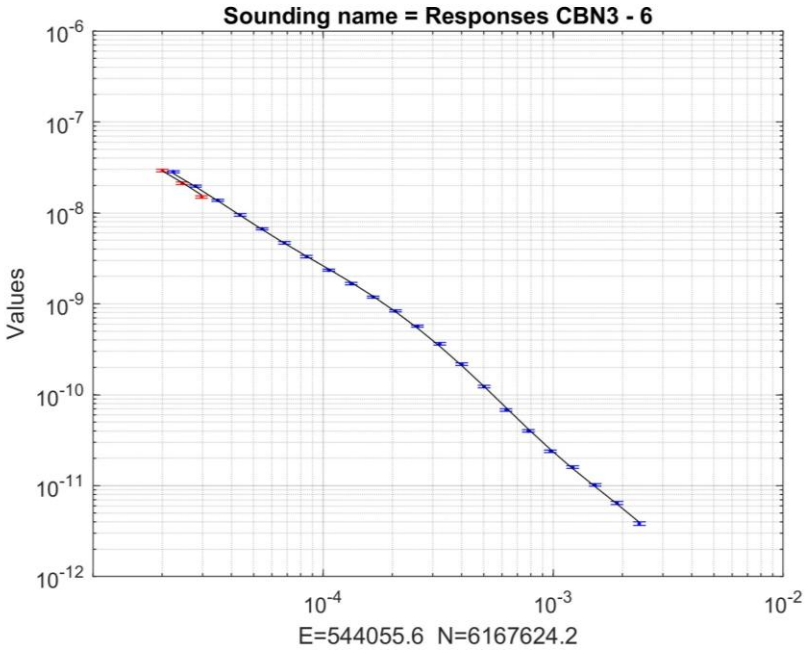


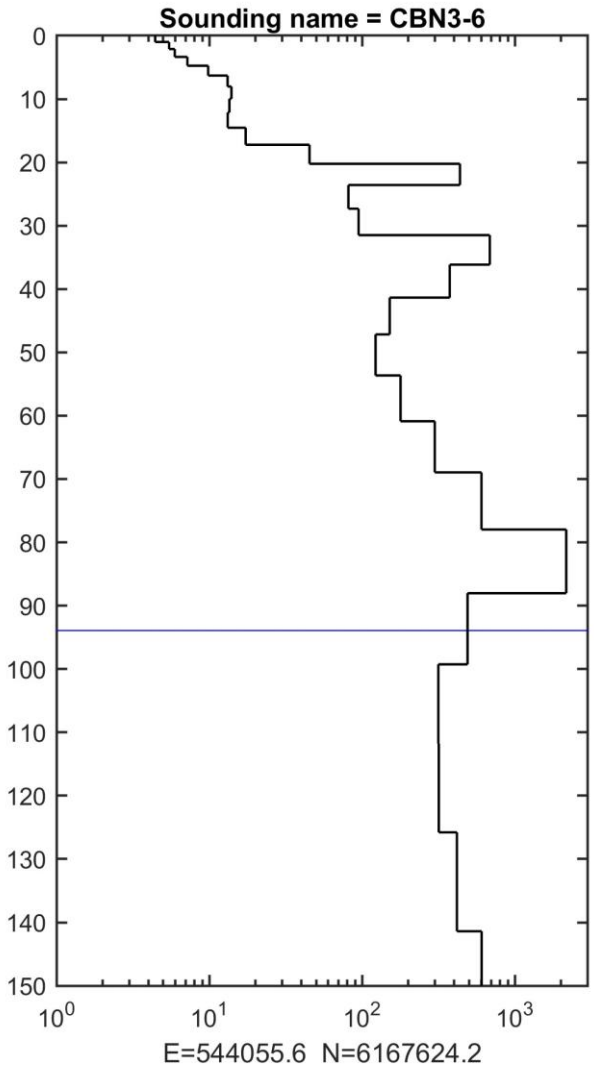
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-4. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



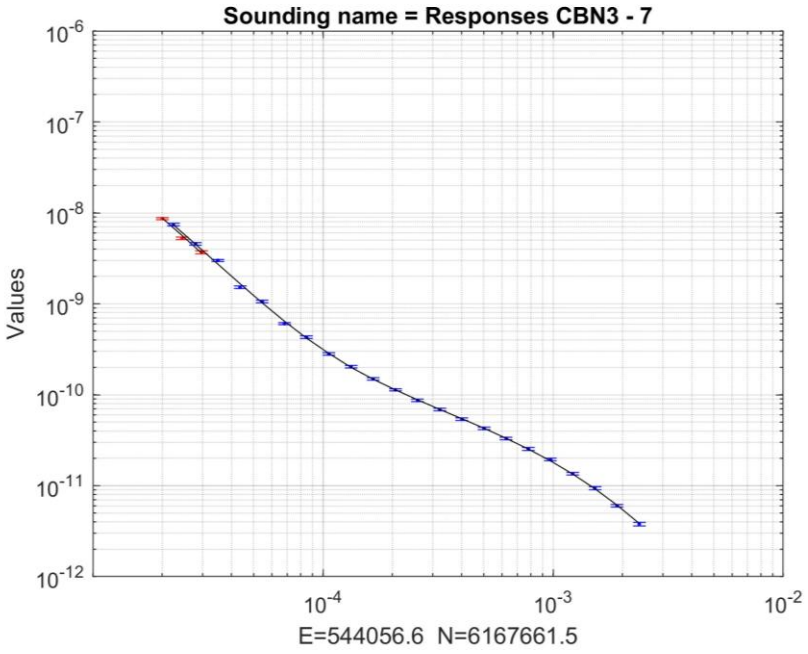


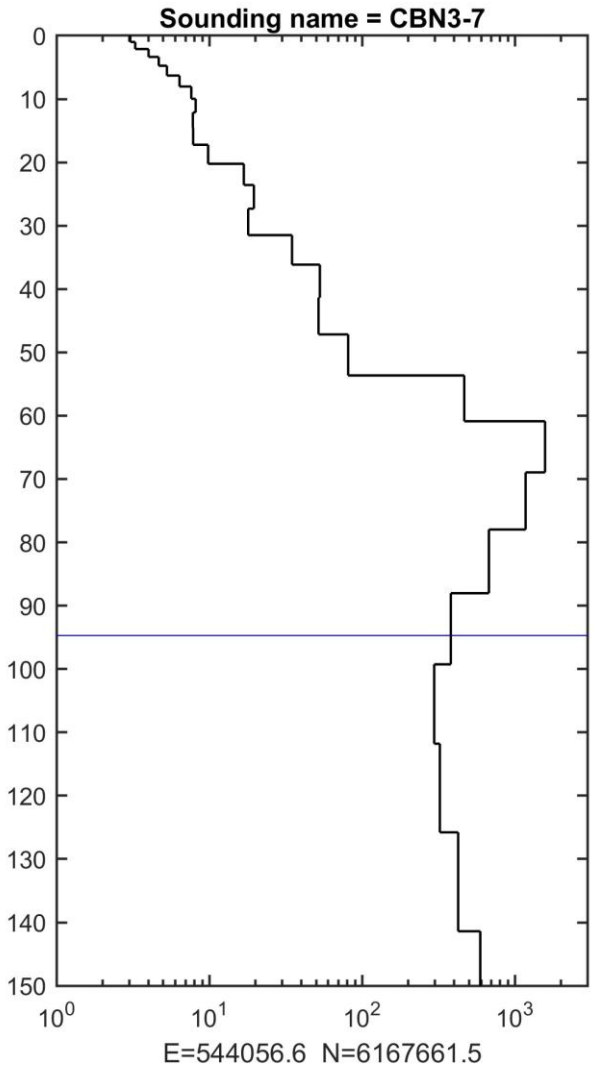
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-5. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



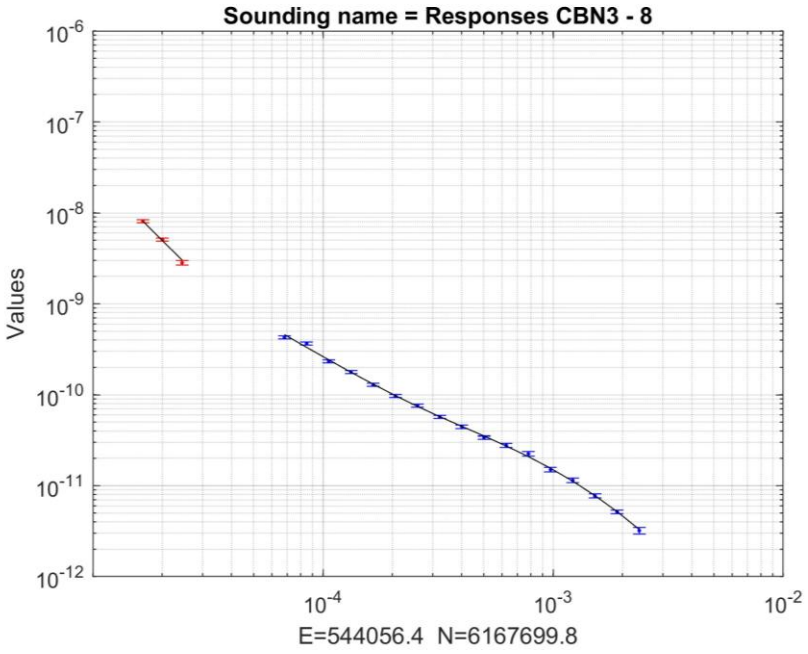


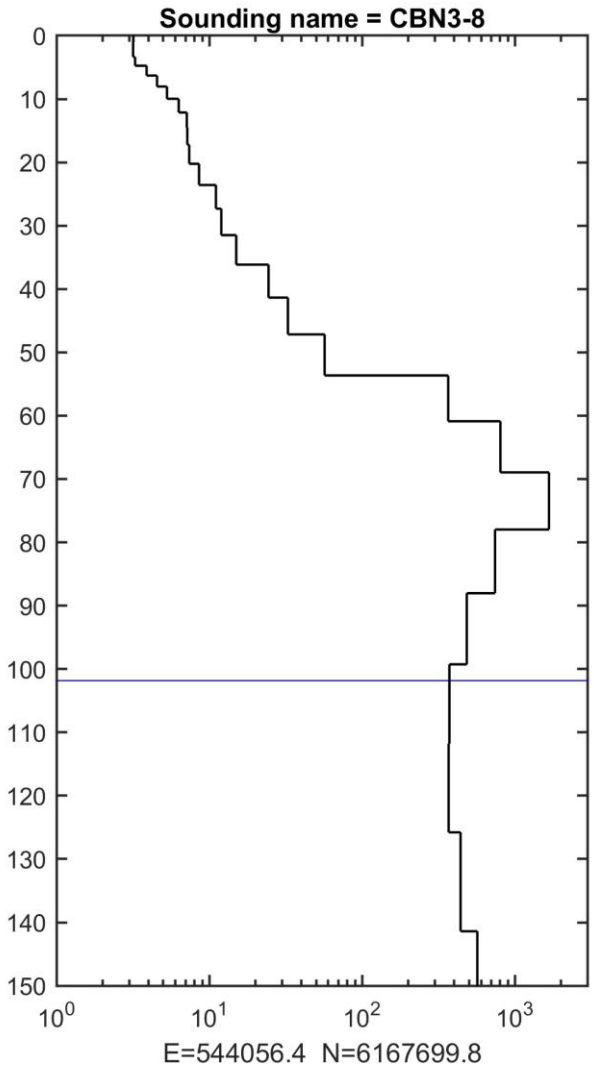
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-6. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



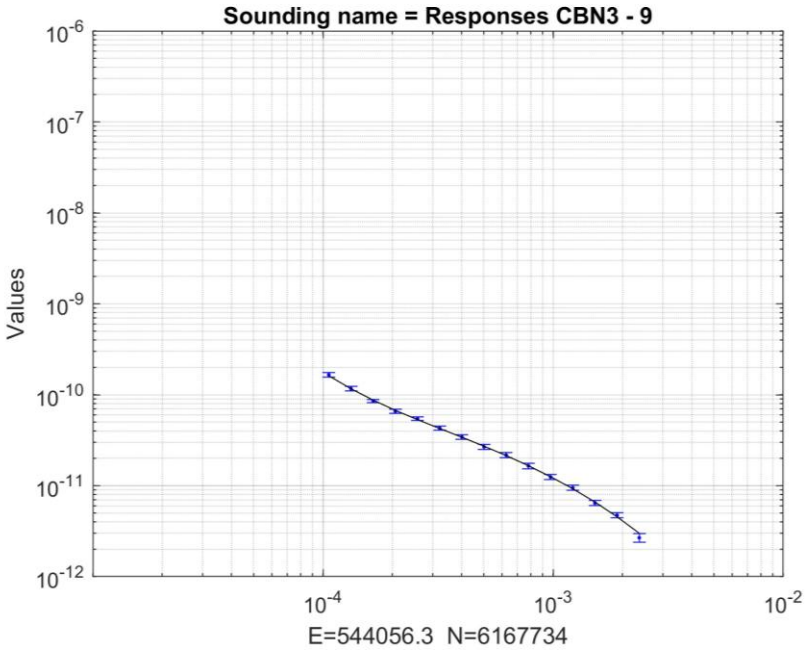


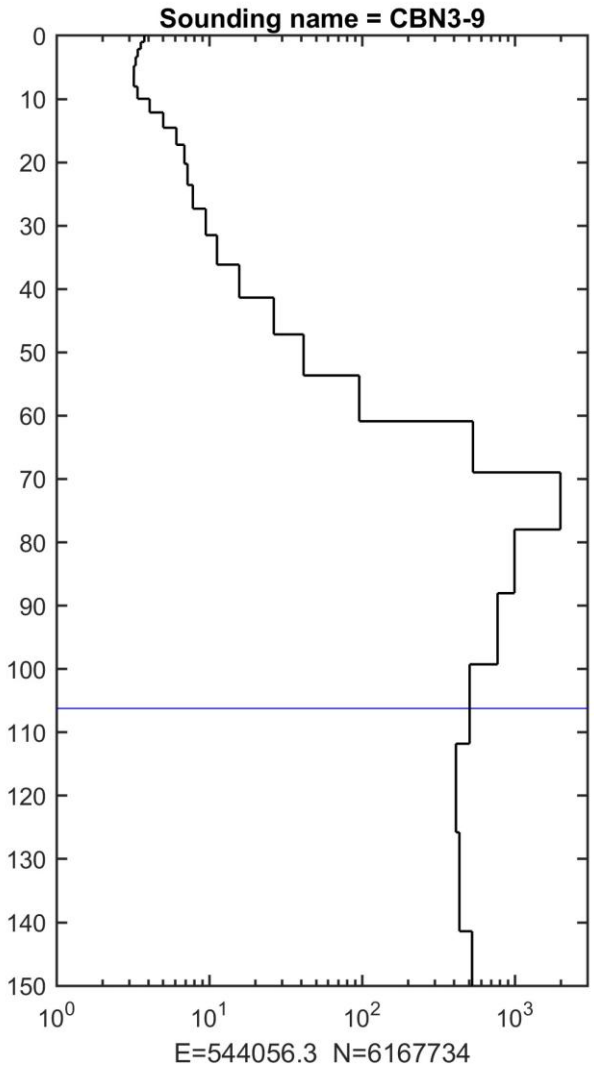
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-7. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



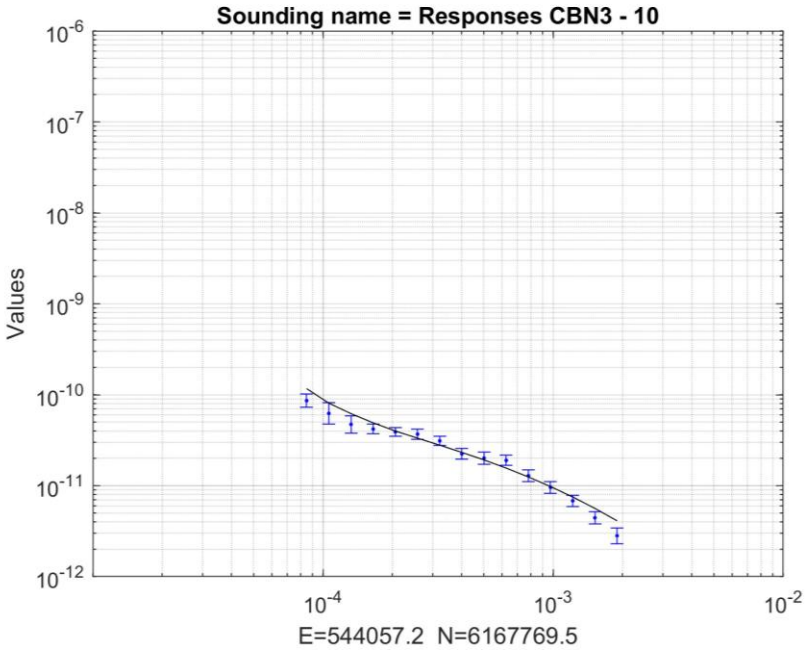


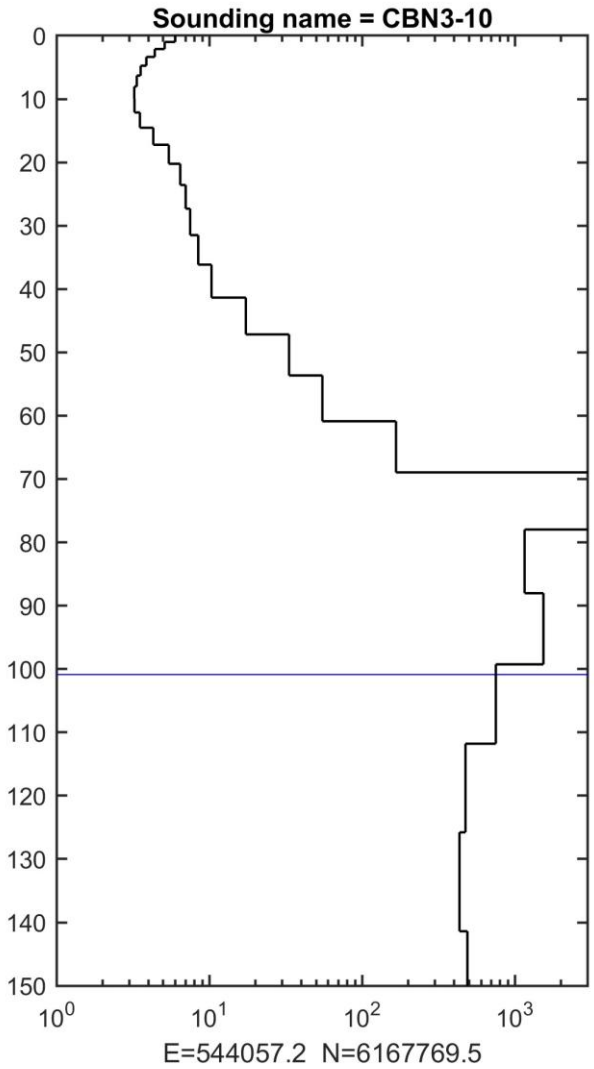
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-8. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.



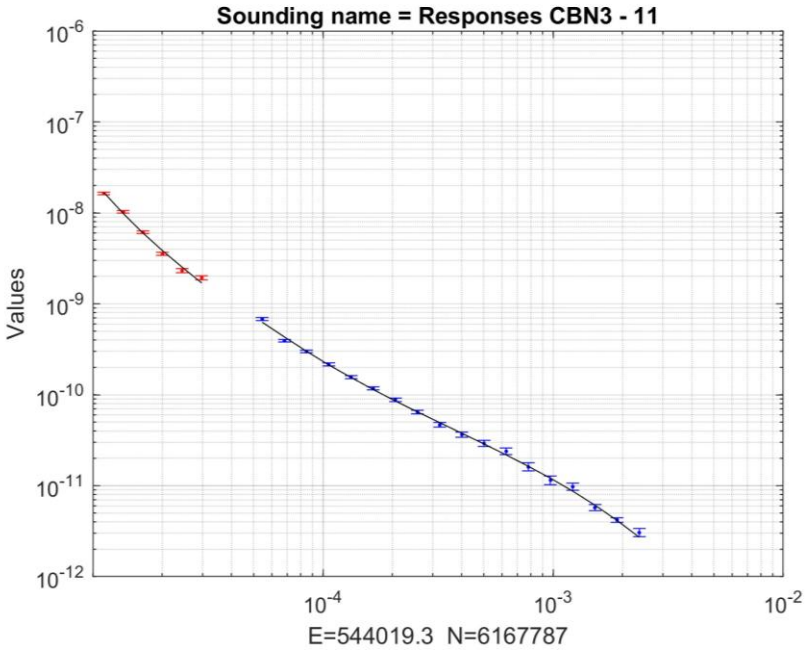


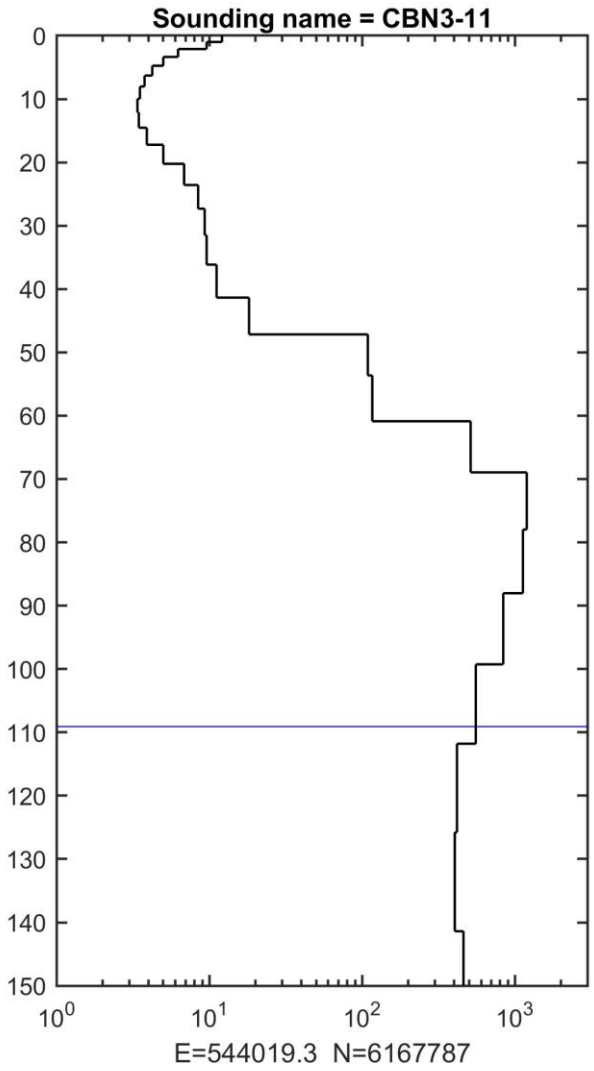
Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-9. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.





Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-10. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.





Transect N3: Observed responses – low and high moments (top panel) for Sounding CBN3-11. Model results from a smooth model Layered Earth Inversion (30 layer) are presented in the lower panel. Depth of investigation shown as blue line in model.

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