1   *Interactive comment on* " Post-glacial reactivation of the
2   Bollnäs fault, central Sweden" *by* A. Malehmir et al.

3   **A. Malehmir et al.**
4   alireza.malehmir@geo.uu.se Received and published: xxx 2015

5
6   Dear reviewers and editor,
7   We are pleased that both reviewers have found our manuscript of interest for the journal and also its
8   readerships. Both reviewers particularly reviewer #1 have provided useful comments for which we are
9   grateful and have considered most of them in the revised manuscript. Following all the comments
10 provided by the reviewer # 1 would have increased the number of figures to more than 20 for which
11 we did not see this helpful. Right now we have 19 figures and this should be sufficient to deliver our
12 data and results from each method. Here we list the comments and our response to each individual
13 comment. A particular question here is the capability of the geophysical methods used to infer any
14 potential step in the bedrock. We considered this for some of the methods and present them in the
15 revised manuscript. A new section on the resolution test has also been introduced. Any step less than 5
16 m or so is likely to be resolved by some of the methods if we assume a simple geology, however this is
17 unlikely as we pointed out in the first submission. We are now discussing this in the light of new
18 results from the resolution tests. We were hoping in the beginning that we can resolve this by just
19 imaging depth to bedrock on both sides of the scarp but the fact that sediments are thicker on the
20 western side of the scarp and that there is unlikely a fresh bedrock made this complicated than what
21 we hoped for. Nevertheless, this finding and the fact that we can be certain about structures in the
22 bedrock allow us to provide some interesting interpretations about the relationships between the scarp
23 and a fault in the bedrock. We do not think that any potential scarp to be sharp and it is likely that its
24 recognition even from drillings to be difficult. This is left however to be proven in the near future
25 studies.

26
27 *Referee #1: GENERAL COMMENTS, The paper shows an example of an integrated geophysical*
28 *ground survey over a fault revealed by LiDAR data. Many different methods have been used and*
29 *compared: mag- netics, gravity, seismic refraction, ERT, RMT, GPR. I think that the paper could be a*
30 *very interesting and original example of the geophysical signatures over a shallow fault and could be*
31 *a good reference for future similar investigations. For these reasons it de- serves publication.*
32 *However, I think that the paper in the present form suffers from some imprecisions in the methodology*
33 *and in the conclusion sections and should be improved. The weakness that in my opinion should be*
34 *addressed are underlined in the following 'specific comments' section.*
35 [Authors' comments:] We thank the referee for the so-many detailed comments. We did not aim at
36 making this a detailed geophysical study but rather providing sufficient information that readers be
37 able to follow without going into these details. We however have addressed most of your comments in
38 the revised version and hope this would be satisfactory now. The so-many methods used here and
39 getting into the details of each method would distract our readers and this is something we aimed at
40 avoiding.

41
42 *Referee #1: SPECIFIC COMMENTS, 1 - Gravimetric method and interpretation 1.1 - Data*
43 *processing and errors estimation. No information are given about gravimetric data processing and*
44 *quality control. The final Bouguer anomaly data show a maximum pick to pick difference of only 6 gu,*
45 *that is 0.6 mGal (see Fig. 5b). Therefore I think the following information could help the reader to*
46 *evaluate the work performed and the resulting anomalies: a) Particular equipment of the L&R G*
47 *gravity meter, such as electronic levels, electronic beam indicator, electronic nulling system or other*
48 *should be indicated, if present.*
49 [Authors' comments:] The equipment brand is provided and some of the other equipment details. We
50 do not think this level of details is so important for our work. Followed and these information is
51 provided to a great detail now.

52
53 *Referee #1: b) Mean and standard deviations of the closure errors*

1   [Authors' comments:] See above.
2
3   *Referee #1: c) Error evaluation of a single measurement. If repeated measurements at some locations*
4   *are not available, at least a heuristic estimation should be provided. An alternative could be to*
5   *provide the standard deviation of the difference between the gravity values at the base station and the*
6   *assumed drift curve (obtained as low order approximation of the measurements at the base station).*
7   [Authors' comments:] Thanks for this comment. We now provide some estimate for the equipment
8   error from the repeated measurements from the base station.
9
10   *Referee #1: d) Error evaluation of the final Bouguer anomaly data, taking into account the error of a*
11   *single measurement (see point b) and the elevation errors that affect free air, Bouguer plate and*
12   *topographic corrections.*
13   [Authors' comments:] We are in an open field and unlikely to have any major error in the elevation.
14   Our equipment provided an error at the level of 0.5 cm for the elevation at many locations. We provide
15   some estimate of this contributing to the final Bouguer anomaly since it is requested. We are assuming
16   the error can be presented as sum of the standard deviations or errors of individual steps. The totoal
17   error is estimated to be less than 1 mGal.
18
19   Referee #1: e) References to the formula or methods used for the latitude, free air, Bouguer and
20   topographic corrections. The adopted topographic correction procedure should be explained in some
21   detail.
22   [Authors' comments:] A text book is now referred for this and the software used for the routine work.
23
24   *Referee #1: f) Levelling errors check In the Bouguer anomaly map shown in fig. 5b and 5c, there is a*
25   *clear level error along the second line starting from North. It is not visible in the free air map of fig.*
26   *5A and therefore it could be related to Bouguer and/or topographic corrections. At least a check*
27   *should be performed on data processing to ensure this is not an artefact and a brief comment should*
28   *be addressed in the text.*
29   [Authors' comments:] We now discussed this further. We agree that there maybe some leveling
30   problem but we cannot be sure how this is caused. It is likely the topography effect. The complete
31   Bouguer now has less of this issue. We are providing an updated figure for this.
32
33   *Referee #1: g) Residual maps. The gravimetric data shown in figures 5a, 5b, 5c seem to be residual*
34   *anomaly maps. I agree that the 'absolute' values are not important in this contest. However I couldn't*
35   *find any explanation about the residual procedure in the text.*
36   [Authors' comments:] It is actually not the residual in the sense that we have removed a trend from the
37   data.
38
39
40   *Referee #1: 1.2 – Reference density for Bouguer and topographic corrections. The Authors show two*
41   *different (residual) Bouguer anomaly maps in Fig. 5b and 5c with a reference density of 2200 and*
42   *2670 kg/m3 respectively. Both the maps are used for interpretation. However, the comparison along a*
43   *profile between the (residual) Bouguer anomaly at 1800, 2200, 2670 kg/m3 (Fig. 10B) and the*
44   *topographic profile (Fig. 10A) shows that the correct reference density is around 2200 kg/m3. In fact*
45   *the 2670 kg/m3 (residual) Bouguer anomaly graph is anti-correlated with topography while the 1800*
46   *kg/m3 (residual) Bouguer anomaly graph is slightly positively correlated. The Authors themselves*
47   *note that the correct value is 2200 kg/m3 at pag. 2845, rows 17-21. Therefore, the 2670 kg/m3*
48   *(residual) Bouguer anomaly map should not be shown and interpreted since biased by the topographic*
49   *effect. I suggest a more careful analysis to find the correct reference density for the (residual)*
50   *Bouguer anomaly map. At least two options are available:*
51   *a) Use the Nettleton approach along different profiles and compute the correlations between the*
52   *Bouguer anomaly at different densities (for instance from 1700 to 2700 kg/m3, step 50 kg/m3) and the*
53   *topographic profile. Then graph the absolute value of the correlation factor (y dependent variable)*

1   *against the density (x independent vari- able): the correct density value is found at the minimum of the*
2   *function.*
3   *b) Compute the gravimetric 3D forward effect of the topography at different densities. Then compute*
4   *the RMS misfit between the calculated field and the measured free air anomaly and choose the density*
5   *that gives the lower RMS misfit.*
6   [Authors' comments:] Followed. We now present a careful inspection of density required for the
7   Bouguer correction using the approach mentioned in (a). We find a density of 2000 kg/m3 to show the
8   least correlation with the topography and used this for the correction. A new figure is introduced to
9   explain this procedure.
10
11   *Referee #1: 1.3 - Gravimetric interpretation. a) All the interpretations based on the 2670 kg/m3*
12   *(residual) Bouguer anomaly map must be avoided since this reference density correction is wrong. In*
13   *particular: pag. 2839, rows 4-7; pag. 2845, rows 12-14 and 25-27. The gravimetric interpretation*
14   *must be reassessed on the base of the correct reference density (residual) Bouguer anomaly map. Note*
15   *also that using both the 2200 and 2670 kg/m3 density for the interpretation, the results appear*
16   *somehow confused or contradictory. For instance, at pag. 2845, row 20-21: <... there is no detectable*
17   *bedrock level difference from one side of the scarp to another>; then, immediately after: <... the fault*
18   *location and depth to the body would be similar to that of the magnetic data (i.e., 25 m)>*
19   [Authors' comments:] Agree with the reviewer. We have now excluded the standard 2670 kg/m3
20   Bouguer anomaly map. We thought in the initial submission this was useful as most would have just
21   used this for this type of correction. We have followed the comment and have modified the text to
22   avoid confusing the readers. We kept the free-air map for the quality check.
23
24   *Referee #1: b) In the case the final reference density will be close to 2200 kg/m3, the Bouguer*
25   *anomaly will be similar to the map shown in Fig. 5b, where the Eastern side of the survey area shows*
26   *values larger than the Western part of about 0.3-0.5 mGal. In the (very simple) case where the*
27   *sedimentary cover and the bedrock are considered uniform, two different explanations of the observed*
28   *(residual) Bouguer anomaly are possible. i) The bedrock is approximatively flat and the (residual)*
29   *Bouguer anomaly is only due to the clearance between the measurement points and the bedrock (the*
30   *distance from the supposed flat bedrock and the measurement points grows up moving from East to*
31   *West due to the topography) or ii) there is also the effect of a step in the bedrock. I think that a simple*
32   *2D modelling could help to give an answer, even if many simplifying assumptions must be taken about*
33   *the densities and the mean depth of the bedrock.*
34   [Authors' comments:] The newly calculated complete Bouguer data along profile 1 do not show any
35   evidence of any step in the data. It is rather flat and may indicate either a small step or what we
36   proposed a rather flat surface!
37
38   *Referee #1: 2 - Magnetic method and interpretation. 2.1 – Definition of the magnetic lineament. The*
39   *magnetic lineament cited firstly at pag. 2844, row 19, is not defined. That is, it is not clear which*
40   *method and assumptions have been used to trace it.*
41   [Authors' comments:] We now provide information how this was produced and what we mean with a
42   magnetic lineament. Magnetic lineament shown in a figure 2 is generated from upward continued
43   total-field airborne magnetic data that was then subtracted from the original data and after which a tilt
44   derivative was calculated from. This way we enhanced the magnetic lineament associated with the
45   Bollnäs scarp.
46
47   *Referee #1: 2.2 – Short wave length signal. Data shown in Fig. 5d are affected by short wave length*
48   *signal (apparently noise coming from the walk-gradient configuration) that disturbs the signature of*
49   *the fault. Perhaps an upward continued or low pass filtered map could help the reader to concentrate*
50   *on the signal coming from the bedrock and could be used to test the effectiveness of some digital*
51   *enhancement techniques.*
52   [Authors' comments:] We agree with the reviewer. We tried various upward continuation and low-
53   pass filtering and even combinations. We however think the original data were much better showing
54   the possible fault signature as it was observed and affected by the measurements than the smooth-

1 upward continued or filtered ones. We realized the footprint of the data but still think the magnetic
2 map as shown is much superior to when it is filtered. Here we show a couple of versions like 10 m and
3 20 m upward continued in addition to one when the upward continued at 100 m was subtracted from
4 the original data (the right end figure). The latter is now replacing an older version of Figure 9
5 (projection on the LiDAR data). So both original and slightly enhanced magnetic maps are presented.
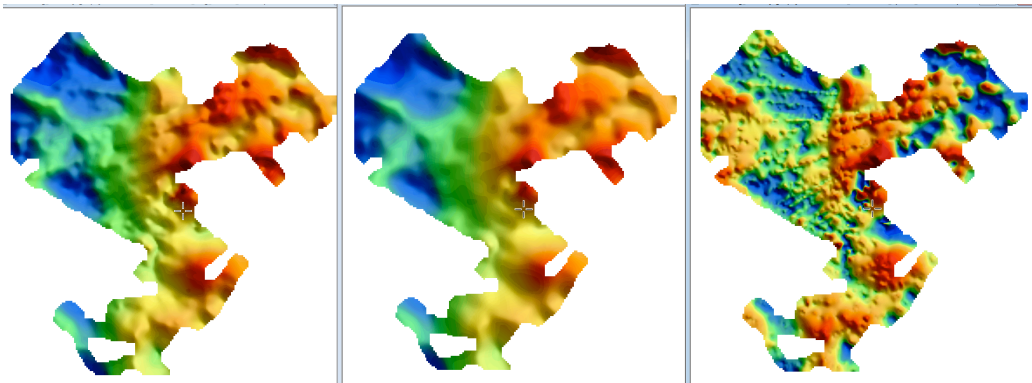
6
7
8 *Referee #1: 2.3 - Digital enhancement. To improve data processing some digital enhancement*
9 *techniques could be tested and, if successful, included in the paper to better constrain the location and*
10 *depth of the source originating the 'lineament'. For instance tilt derivative usually can map faults and*
11 *discontinuities location, Euler deconvolution can map simple step/faulting in the bedrock and give an*
12 *evaluation of the depth, the analytic signal and pseudogravity analysis can depict the magnetic*
13 *sources.*
14 [Authors' comments:] See above.
15
16 *Referee #1: 2.4 – Magnetic interpretation. The situation is similar to the one discussed for gravity. To*
17 *the East the magnetic values are about 200 nT higher than to the West. If we assume a magnetised*
18 *bedrock against low magnetised sediments, again two different models must be tested by 2D*
19 *modelling: i) the bedrock is approximatively flat and the anomaly derive from the variations of the*
20 *source – measurement point distance that increases from East to West or ii) there is also the effect of a*
21 *step in the bedrock.*
22 [Authors' comments:] We have tested these scenarios and presenting them in the revised manuscript.
23 We notice that the topography and difference in the sediment cover would be enough to produce the
24 gravity and magnetic data. In case of magnetic this is a bit different and a step may have a response
25 but we do not see this in the observed data as synthetic modeling suggests.
26
27 *Referee #1: 3 - Seismic method and interpretation. 3.1 – Refraction data analysis. First P arrival*
28 *classical dromocrones are not presented, but they are usually very useful to give an idea of the whole*
29 *data set to the reader. The cumulative first break picks shown in Fig. 7a are not enough to give a clear*
30 *picture of the data set. Classical refraction modelling have been tested but results have been*
31 *considered <... not convincing and hence ... not presented> (pag. 2841, row 10). However there is*
32 *some contradiction with what is stated at pag 2840, rows 24-28, where a refractor is described and*
33 *identified with the bedrock that appears deeper on the western side of the scarp. Moreover in Fig. 6*
34 *different refractors are described and velocity assigned, without taking into consideration possible*
35 *inclination of the refractors biasing the velocity estimations. Therefore I think that:*
36 *a) First arrival dromocrones should be shown to illustrate the data set with some detail*
37 *b) The failure of classical refraction data analysis should be investigated and discussed with more*
38 *detail. Otherwise the reader will look with suspicious to the next refraction tomography analysis.*
39 [Authors' comments:] The first arrival dromocrones are now shown. The reason we did not show it
40 before was because they are huge and we were afraid that nothing can be seen. To overcome this
41 problem we used a color-coding approach and at every 20 m or so, we show the first breaks for the
42 shots fired at these locations. The first breaks as suggested by the reviewer clearly depict the different
43 sediment cover on the eastern and western sides of the scarp particularly when direct arrivals are

carefully compared. A new figure is introduced now. The conventional refraction analysis was done using various approaches. An example is shown below. The RMS was on the order of 2-3 ms, however for some reason the GRM 2D-based modeling cannot find the low velocity part as obtained using 3D tomography approach. We have rewritten the text to make this clearer.

Referee #1: c) Refractors' identification and velocity assignments (pag. 2865, Fig. 6) should be discussed considering the possible geometry of the refractors. Ideally at least a simplified model obtained with the GRM method or similar should be presented. If not possible, they should be avoided.
[Authors' comments:] Here is an example of the GRM method. Structures of the bedrock are similar but the tomographic model better fits the interpreted fault location (low velocity zone). We now avoid discussing this in the article to not make the reader confused.
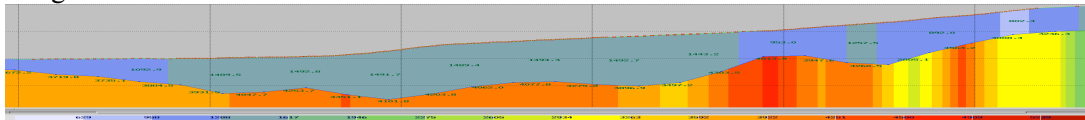
Referee #1: 3.2 – Refraction tomography. a) 3D modelling along a line. The adopted discretization model (pag. 2841, rows 19-23) with 15 m long cells along the transversal direction is necessary to force the software acting as a 2D software. Maybe the transversal length of the cells should be much longer than 15 m (7.5 m from one side and 7.5 m to the other) to ensure a 2D solution?
[Authors' comments:] This is now rewritten. The 3D model contained 3 layers each 30 m wide in the lateral direction. An earlier test using 15 m cells did not work as the rays channeled to the other cells during the every first iterations. Thanks for noticing this.

Referee #1: b) Travel time residuals. Travel time residuals as a function of offset for all the receiver locations are shown in Fig. 7b (pag. 2866). If possible, in order to have a deeper (and interesting) insight on the velocity model data fitting, also i) the measured vs the calculated dromocrones should be shown together with ii) the rays' path superimposed on the velocity model.
[Authors' comments:] The forward calculated first breaks were not so easy to export and we decided to not do this and avoid producing many figures. The first breaks are however shown as mentioned before. The ray paths (density) are now also shown. See the revised figure.

Referee #1: c) Far-offset data. It is not clear for me the explanation about the higher misfit of the far-offset data given at pag. 2841, rows 26-28, based on the <less ray coverage [at depth?] as opposed to the high-density ray coverage at the near surface>. If the ray coverage is reduced at depth, then it should be easier to find a velocity model that predicts the data, because there are fewer constraints to be accounted for. Therefore I think the explanation is another one. The shorter offset data number is much higher than the far-offset data, and they influence the shallow velocity distribution alone. On the contrary, the far-offset data depends on both the shallow and the deep velocity distribution. Therefore, in order to get a final low RMS misfit, it is preferable to fix the shallow velocity distribution in order to have a good fit for the many shorter offset data even if the far offset data would require some modification of the shallow velocity distribution to get a good fit.
[Authors' comments:] We thank the reviewer for this comment. The point is well noted and addressed in the revised manuscript.

Referee #1: 4 - RMT method and interpretation 4.1 – Raw phase and resistivity data. Raw phase and resistivity RMT data are shown in Fig. 8 (pag. 2867) at three stations located in Fig. 11 (pag. 2870). a) The computed phase and resistivity data should be superimposed on the measured ones, in order to give to the reader an idea of the model data fitting.
[Authors' comments:] We now introduce a new figure showing the raw data and their misfit. This should address this comment.

Referee #1: b) It is not clear to me what the red arrow in Fig. 8C would indicate: i) the one value drop of the apparent resistivity at about 25 KHz or ii) the whole frequency range 10-70 KHz that shows lower apparent resistivity values with respect to the other two stations. If it is the first case like the

1 *figure suggests, it is difficult for me imagine how the fault signature could influence just one frequency*
2 *alone.*
3 [Authors' comments:] Agree. We have removed this figure and replaced with a better one showing
4 apparent resistivity, estimated and misfit along the whole profile as a function of frequency.
5
6 *Referee #1: c) The phase values of Fig. 8f do not start close to 45° and appear very low. Are they*
7 *reproduced by the model shown in Fig. 11a? 4.2 - Error floor. An error floor of 4% on apparent*
8 *resistivity and phase has been used for the inversion (pag. 2842, row 27). However, since the phase*
9 *values are not intensity values, an absolute floor value (e.g. 2°) should be preferable for it. I cannot*
10 *see any reason to explain why a phase value of 10° should have an error floor of 0.4° while a 80°*
11 *phase value should have an error floor of 3.2°.*
12 [Authors' comments:] We have now introduced a new figure 8 that shows the estimated phase for all
13 the stations. A low phase can be observed in both observed and estimated phase.
14 We agree about the error floor value of phase and we missed to mention it. It was an error floor of 1.2°
15 on phase that had been used for inversion.
16
17 *Referee #1: 5 - ERT method and interpretation. Also in this case, I think that the acquired data set*
18 *should be shown in some way to allow the reader to have a clear image of it. Is it possible to show the*
19 *measured and calculated (from the final models shown) pseudo-sections for both the profile?*
20 [Authors' comments:] we show these figures as an example along profile 1.
21
22 *Referee #1: 6 - GPR method and interpretation. 6.1 – Time to depth transformation. In Fig. 13A (pag.*
23 *2872) an example of GPR profile is shown. The vertical scale is in metres. No reference in the text can*
24 *be found about how the time has been transformed in depth. How was the electromagnetic velocity*
25 *estimated? Moreover, two not coincident antennas were used (at what distance?) but nothing is said*
26 *about the data processing, if any.*
27 [Authors' comments:] This section is really a pseudosection. Due to an absence of more precise
28 knowledge, a homogeneous velocity of 0.1333 c (0.4 ^10^8 m/s) has been used to transform travel
29 times to depth. The actual velocity could vary as much as -50% and +100%, and thus the observed
30 depths from the surface could be off by a similar percentage. The reflector could reach to, e.g., 2.5 m
31 or 10 m where the section shows 5m depth. The antennae were separated by 1 m. There has not been
32 any processing other than multiplying each trace with a gain function to increase visibility of features
33 at depth and to avoid short-time ringing artifacts, which probably arose because of non-shielded
34 antennae and non-zero distance between antenna and ground. The drift of the traces, which was
35 amplified by this procedure as well, has been removed by a high-pass filter.
36
37 *Referee #1: 6.2 – GPR interpretation. The only interpretable signal in GPR data is a shallow (2 – 5 m)*
38 *reflector dipping towards East, found in most of the profiles immediately east of the scarp and shown*
39 *in Fig. 13a (pag. 2847, rows 1-2). At pag. 2847, rows 8-18, three different contrasting explanations of*
40 *the reflectors are reported. The reflection in the GPR data is likely generated by the interface between*
41 *till and underlying silt and varved clays, revealed by a trench (indicated as 'Seminstation' in Fig. 3b*
42 *and shown in Fig. 13b) along the same profile 1 (pag. 2847, rows 8-9). However, note that in the*
43 *trench stratigraphy of Fig. 13b the reflector (red arrows?) is indicated at the interface between layers*
44 *'Till 1' and 'Till 2'; on the contrary, in the trench of Fig. 13c, the reflector is indicated at the interface*
45 *between layers 'Till 2' and (varved) clay.*
46 *b) Moreover, <it is possible that the lack of continuity in the western-end of side of the GPR reflection*
47 *at roughly where the scarp starts is an indication for faulted sediments> (pag. 2847, rows 13-14).*
48 *However, from the text and the stratigraphy shown in figure 13b and 13c, it seems that no fault*
49 *evidence has been revealed by the trenches that are coincident or close to the GPR profile (Fig. 13a).*
50 *c) Moreover, <the reflection may also be from groundwater table and its interruption in the western*
51 *side (Fig. 13c) due to water flowing suddenly into the faulted bedrock>. However, i) in Fig. 13 b the*
52 *water table (dashed line) appears continuous along all the trench and extends over a much larger*

area than the reflector shown in the GPR section while ii) in Fig. 13c the water table (dashed line) has
not been detected where the reflector is.
I think that the most realistic interpretation is the first (a) and the other two, on the base of the
indications shown in the paper, should be omitted.
[Authors' comments:] We have now minimized these contradictory explanations. We also think the
most plausible scenario is the till contact. The text is modified accordingly but also the figure. The
arrows are now all point towards the till contacts.

Referee #1: 7 – Discussion and Conclusions. 7.1 – Bedrock: flat or step? The key question is: the
bedrock shows a step below the scarp or is approximatively flat? But, before, the Authors should
answer to the following one: is the resolution of the methods and the collected data enough to see a
step in the bedrock of the expected amount of 5 m? Therefore I think that the Authors should:
a) Perform some forward/inversion synthetic modelling (with noise) in order to gain an insight on the
different methods resolution in the contest they are working.
b) Test 2D modelling on gravity and magnetic data (as suggest at paragraph 1.3 and 2.4), to
understand if the data require a step on the bedrock or not.
c) Review the ERT, RMT and seismic interpretations, that at the moment indicate a flat bedrock (), and
evaluate if the resolution is enough to exclude a step in the bedrock.
[Authors' comments:] Please see the modified manuscript. We have performed some modeling to
illustrate that our data have some sensitivity to 5-m steps in the bedrock but when geology is assumed
simple. As mentioned however before, we do not think that the bedrock step is sharp and fresh. It is
likely highly crushed and altered almost like the sediments above it. This is most likely complicate
finding a step in the bedrock. See the revised manuscript and new figures introduced for the resolution
tests of seismics and potential field data.

Referee #1: d) Give a final clear answer to the questions:
i) Has any of the methods detected a step in the bedrock?
ii) In the case of the methods that have not detected a step in the bedrock, is the resolution enough to
exclude the step?
[Authors' comments:] None of the methods are capable of seeing any step. Magnetic data are
suggesting a lineament but not sensitive to provide accurate information about the step size. Cover
sediments are likely complicating the whole thing in addition to highly fractured bedrock.

Referee #1: 7.2 Discussion and conclusions. Discussion and conclusions should be readdressed with
the new results of modelling suggested at the previous point and definitive final more clear indications
of the geophysical results.
[Authors' comments:] Followed and rewritten.

Referee #1: TECHNICAL CORRECTIONS. Page. 2836, row 1: typo mistake (o → to)
[Authors' comments:] Fixed.

Referee #1: Pag. 2836, row 3-4: Authors state that the scarp <apparently cross cuts multiple units of
glacial and post-glacial sediments (Fig. 2)>. However in Fig. 2 glacial and post- glacial sediments
units are not shown. Maybe they would like to refer to Fig. 3?
[Authors' comments:] Followed.

Referee #1: Pag. 2837, rows 12-13: <we found additional segments, also in the LiDAR data, in the
southern parts (Fig. 2a).>. It is not clear in Fig. 2A what are the found additional segments
[Authors' comments:] We show this now on the revised Figure 2.

Referee #1: Pag. 2838, row 25: were the tidal variations corrected by computations (based on the time
of acquisition) or by the periodic measurements at the base station? Usually the first procedure is
adopted.
[Authors' comments:] No, based on computation and the routine implemented in Oasis Montaj.

1

2 *Referee #1: Pag. 2845, row 13: <mgal> should be substituted by <mGal>*

3 [Authors' comments:] Followed.

4

5 *Referee #1: Pag. 2859, Tab. 1: in the acquisition system row, the model of the system should be*

6 *indicated.*

7 [Authors' comments:] Followed.

8

9 *Referee #1: Pag 2860, Fig.1: The phrase in the caption: <Bollnäs prospective fault being much*

10 *smaller in size and length was recently discovered from LiDAR-imagery (shaded regions) as a 4–5m*

11 *high scarp is the focus of this study.> is not clear (at least for my English level).*

12 [Authors' comments:] Rewritten.

13

14 *Pag. 2861, Fig. 2 i) The trace of the scarp superimposed on the tilt derivative map (b) does not look to*

15 *precisely resemble the scarp trace in the LIDAR image (a). ii) The phrase: <(blue magnetic low, red*

16 *magnetic high)> is not clear; are the shown values the tilt derivative or the total field magnetic*

17 *values?*

18 [Authors' comments:] They are tilt-derivative angles (radian). The magnetic lineament and the scarp at

19 the surface do not follow each other likely because the actual fault in the bedrock is, 40-50 m west of

20 the scarp not where the scarp is seen. Note also this is typical response for bedrock faults.

21

22 *Referee #1: Pag. 2862, Fig. 3 i) In the caption the different location symbols used (blue crosses,*

23 *triangles,...) should be described to help the reader to understand what method they refer to. ii) The*

24 *number close to well symbols is not described in the caption: does it refer to the depth of the well,*

25 *bedrock, water level? If available, depth of the bedrock should be reported as the most important*

26 *information in this contest. iii) A contour of the elevation in one of the map could help the reader to*

27 *have an idea of the topographic variations in the survey area*

28 [Authors' comments:] The caption is modified now. We did not want to make the figure full of

29 information and think the LiDAR data and 3D views are enough to show the topographic variations.

30

31 *Referee #1: Pag. 2862, Fig. 5 i) In figures 5b and 5c titles <Bougue> must be corrected in*

32 *<Bouguer>. ii) In figure 5d title <magentic> must be corrected in <magnetic>. iii) The blue points*

33 *indicating the gravimetric stations are not well visible over the blue of the gravity lows. For instance*

34 *they could be made in white. iv) The maps seem to be residual maps*

35 [Authors' comments:] Followed.

36

37 *Referee #1: Pag. 2867, Fig. 8 What does it mean <noisy data> in Fig. 8B? The frequencies below 15*

38 *KHz have been excluded from all the stations or just for station 10?*

39 [Authors' comments:] Yes, we have modified this figure, in fact completely changed it. It showed that

40 the estimated error floor on the data was very high and there are several factors that can be responsible

41 for such behavior. Also, the RMT frequencies range from 15 KHz to 250 KHz. So there are no data

42 below 15 KHz.

43

44 *Referee #1: Pag. 2872, Fig. 13 In the trench stratigraphy of Fig. 13b the reflector (red arrows?) is*

45 *indicated at the interface between layers 'Till 1' and 'Till 2'. On the contrary, in the trench of Fig.*

46 *13c, the reflector is indicated at the interface between layers 'Till 2' and (varved) clay.*

47 [Authors' comments:] We have now moved the arrow down in this figure to be consistent.

48

49

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51