

## Response to the Editor

29<sup>th</sup> May 2024

Dear Baptiste Vandecrux,

Topical Editor at ESSD,

Thank you for the opportunity to revise our manuscript entitled “**A new repository of electrical resistivity tomography and ground penetrating radar data from summer 2022 near Ny-Ålesund, Svalbard**” for consideration by the journal Earth System Science Data. We greatly appreciate the suggestions to improve the paper. We have addressed all the comments, as explained below.

The comments are numbered in bold and written in italics. Our responses follow sequentially, including how and where the text has been modified. The text added to the original manuscript has been underlined, while the text deleted has been crossed.

The revision has been developed in agreement with all coauthors, and each author has given approval to the final form of this revision.

We hope that this revision will meet your requests.

Thank you.

Yours sincerely,

Francesca Pace.

## Response to the Editor's comments

Dear Dr. Pace and co-authors,

Thank you for the revised manuscript. I believe the preliminary interpretation of the data provided in l.609-656 will help the data users to interpret your observations and encourage its reuse. However, many vague sentences (see my specific comments below) have been added to the manuscript providing partial or no response to some of my previous requests (e.g. what are the geological data available in the region, is there any measurement of phase transition resistivity for these relevant geology). It is important to connect your dataset to the useful meta-information for potential reuse. Those low-information statements are even more frustrating for the reader as it does not require extra measurements, but just better description.

Please address those comments thoroughly and please go through the manuscript to avoid any other use of vague forms such as "some data/information is available", "high/low values"... or alike and replace them by specific, quantitative informations, such as: "geological description of  $N \times m$  boreholes,  $Y$  km west of our site is available at this URL" or "Noise level was under a  $X \Omega m$  level" or "high resistivity ( $> Y \Omega m$ ) indicates...". Please replace all use of "some" and "few" by specific, quantitative statements.

Once the writing and level of information has been improved, your manuscript should be ready for publication.

Sincerely,

Baptiste Vandecrux

Specific comment:

1. Please split the discussion section into two subsections: 1) Preliminary interpretation, and 2) Future work and other data in the area

Thank you for your advice. The two sections were added.

2. l.666: "As regards the quality of ERT data, different levels of noise and error were recognized, ranging from high to very low." Please be quantitative, what do you mean by high and low?

Thank you for your comment. We have improved the sentence: "As regards the quality of the ERT data, different levels of noise and error were recognized, ~~ranging from high to very low~~. For example, Fig. 8b represents for ERT9 the pseudosection of the percentage reciprocal errors that are in the range  $\pm 2.5\%$  for most of the data points and reach  $\pm 10\%$  for some of them at 60-90 m of pseudodepth. The pseudosections from the Bayelva catchment

presented reciprocal errors up to  $\pm 40\%$  (see in the repository the figures “ReciprocalError.png” in folders 2 *Filtered data inversion input/DD*). In contrast, the pseudosections of the percentage reciprocal errors in the piezometers area showed the lowest values, with a maximum of  $\pm 4\%$  (for example, see in the repository ERT10, DD acquisition).”.

3. l. 667 *"The data set provided in the repository includes complete information to allow the user to assess the quality of the data in terms of measurement errors (stacking errors) as well as reciprocal errors." I think it should be part of the paper to quantify the uncertainty. There is currently no way for the reader to get an understanding of the data quality. If you are referring to an uncertainty estimation already presented in the paper*

Thank you for your observation. The raw data were added to the repository with the aim of enabling any users to inspect the data quality, the stacking errors and the reciprocal errors from the published figures but also by re-processing the data with the typical geophysical software for ERT. We observed a clear heterogeneity in the ERT data quality, and, given the amount of the published data, a line-by-line analysis of the errors would have been too long for the manuscript setup. We have improved the sentence: “Given that the quality of ERT data was heterogeneous among the different profiles, the ~~The~~ data set provided in the repository includes the raw data as well as processed/filtered ERT data ready to use. The raw data can be inspected for each line ~~complete information~~ to allow the user ~~to assess~~ing the ~~quality of the data in terms of original~~ measurement errors (stacking errors) as well as ~~or the~~ reciprocal errors and then potentially reprocessing them according to different criteria.”

4. l. 668 *"The measurements in the Bayelva catchment present the highest measurements errors, whereas the measurements in the piezometers area present very high quality." as quantified by what? Please give an estimation of the error for each site to support this statement.*

Thank you for the comment. We deleted this sentence because the quantification of the ERT errors has been added to the revised manuscript as explained in the reply to comment n.2.

5. l.672 *"We provided piezometer data about depth of the frozen ground, water table depth in the active layer, and water conductivity, measured at the time of the geophysical survey." This sounds like the piezometer data is described in this publication. Please rephrase to "Piezometer data is available at ... and gives information about ...". Please note that according to ESSD standards, data accessible under request is not an accepted way for*

*distributing the data. If the piezometer data is necessary for the use and the interpretation of your geophysical surveys, then it should be made freely available.*

Thank you for your comment. We did not add the complete data set of the piezometers to the geophysical database because the repository (and this manuscript) focuses on the geophysical surveys of the I2F project. In the previous revision step, we added to the discussion those piezometer data that could help the interpretation of the geophysical models: depth of the frozen ground, water table depth in the active layer, and water conductivity. Fundamental information about the piezometers and the collected data was written and now revised in lines 172-180.

We have rephrased the sentence: “~~In Section 7.1, the We provided~~ piezometer data ~~about, including~~ depth of the frozen ground, water table depth in the active layer, and water conductivity, measured at the time of the geophysical survey, ~~were provided and commented to support preliminary interpretation of the geophysical models in the piezometers area.~~ The whole time series from a two-years continuous monitoring of various parameters directly measured in the four piezometers ~~was not relevant for the interpretation of the geophysical models and is being used for hydrogeological modeling. The whole time series (including geochemical data) will soon be delivered as outcomes of the I2F project (https://www.icetoflux.eu/data/).~~”.

6. *The link to the piezometer data does not work: "Arctic data Center webpage (https://metadata.iadc.cnr.it/geonetwork/srv/eng/catalog.search;jsessionid=D5D17204B9DE391F0E3A72C26CE9AC6F#/metadata/5e0ba64e-71a7-4949-8752-9fb57b38b4fa) " Please provide a stable URL. On the Ice2Flux website, I cannot find url to any data, not even to this one which is already published on Zenodo.*

Thank you for your comment. We noticed that the direct mouse click on the link did not work but the copy-and-paste of the same link did work. In Section 2, at line 180-185, we corrected the link and rephrased to avoid misunderstandings: “The piezometer metadata ~~and data sets~~ are available ~~under request~~ from the Italian Arctic ~~eData~~ Center (IADC) webpage (~~https://metadata.iadc.cnr.it/geonetwork/srv/eng/catalog.search;jsessionid=D5D17204B9DE391F0E3A72C26CE9AC6F#/metadata/5e0ba64e-71a7-4949-8752-9fb57b38b4fa)~~ (~~https://metadata.iadc.cnr.it/geonetwork/srv/eng/catalog.search;jsessionid=D5D17204B9DE391F0E3A72C26CE9AC6F#/metadata/5e0ba64e-71a7-4949-8752-9fb57b38b4f).~~ Moreover, the I2F webpage shows the location and coordinates of piezometers, the network of sampling stations (snow pits, glacial and proglacial drainages, bulk snow) and geophysical surveys (https://www.icetoflux.eu/data/). This page will provide the piezometer data from continuous monitoring (including chemical and isotopic water analyses) as soon as the hydrological modeling is completed by the project partners. Some of the piezometer data measured during the geophysical surveys, such as

depth of frozen ground, water level and water electrical conductivity and temperature, were used for preliminary interpretation of the geophysical results of this work.”.

We added the link to the Zenodo repository in the I2F website: <https://www.icetoflux.eu/products/>. In the “Data availability” section we added the links to the project website: “Data described in this manuscript can be accessed at the repository under data doi: <https://zenodo.org/doi/10.5281/zenodo.10260056> (Pace et al., 2023). The same geophysical data set can also be accessed from the I2F project website: <https://www.icetoflux.eu/products/>. The piezometer metadata can be accessed here: <https://www.icetoflux.eu/data/>.”.

7. *l.676 "The geological data of the study area are available from the literature" what literature? Please be specific and give some examples. If the geological data has been mentioned elsewhere (which I think you did), then no need for such a vague sentence.*

Thank you for your comment. The literature about the geology of the area has been already mentioned and reported in Sections 1 and 2 of the manuscript. We revised the sentence: “The geological data of the study area are available from the above-mentioned literature ([Hoel, 1925](#); [Orvin, 1934](#); [Horota et al., 2023](#)) and could be useful to interpret the data set and geophysical models. Unfortunately, the different sectors of the study area have different coverage of geological data.”.

8. *l.677 "Poor coverage of direct borehole data is available in the Bayelva catchment" What do you mean by poor coverage? Please be specific, how many, how deep, how far from your transect, what are they called, where have they been described and where to get the data?*

Thank you for your comment. We revised the sentence and expanded the content with further information about the boreholes drilled in the past: “Poor coverage of direct borehole data is available in the Bayelva catchment so that it was challenging to reliably interpret the data measured in this sector (ERT1 and ERT2). An old borehole, reported in Orvin (1934) and called “Borehole n. 4”, was drilled in 1928 up to 149 m of depth. Further details are reported in Orvin (1934), whose appendix plates n. V, VI and VII show the geological sections. There are no references about the boreholes in Orvin (1934) after the mineral exploration period. The location “Borehole n. 4” is provided in Orvin (1934), appendix plate n. III, with a local reference system over a hand-drawn map. We reported this map in QGIS to recover the geographical coordinates in an international up-to-date reference system. In WGS84 (EPSG 4326) the coordinates of “Borehole n. 4” are 78°55'12" N latitude and 11°49'46" E longitude.

“Borehole n. 4” is placed 100 m east from the end of our ERT1. Another borehole, called “Bayelva”, was installed by Alfred Wegner Institute (AWI) in 2009 to monitor permafrost and active layer temperature up to 9.3 m of depth (Boike et al., 2018; Orr et al., 2019). Its latitude is 78°55'15" N and its longitude is 11°50'03" E (WGS84, EPSG 4326) and is placed 150 m south from the intersection of ERT1 and ERT2. Unfortunately, stratigraphic information and drill core were not recovered.”

9. l.679 "A few geological data about the piezometer area are available in the literature" Again, be specific, give concrete information about where to look for geological information.

Thank you for your comment. We revised the sentence: “~~A few geological data about~~ Around the piezometer area are available in the literature ~~escant geological information exists in the aforementioned literature.~~”.

10. l.680 "some borehole data are available from Orvin (1934)" be specific, how many how deep, where to find them?

Thank you for your comment. We revised the sentence: “In addition to the aforementioned I2F piezometers, some borehole data are available from Orvin (1934) and few geological data can be accessed for borehole “DBNyÅlesund” (Orr et al., 2019; ~~https://sios-svalbard.org/node/648; -).~~ The borehole from Orvin (1934) is called “Borehole n.2” and was drilled in 1928 up to 59 m of depth to study a coal seam. Its latitude is 78°55'3" N and its longitude is 11°51'8" E (WGS84, EPSG 4326), after the conversion from an old reference system over a hand-drawn map. It is placed 67 m east from the end of our ERT10 and around 100 m south from our piezometer P4. The geological section is described in Orvin (1934). Other three boreholes are reported in Orvin (1934), but they are around 500 m apart from our ERT lines. The borehole “DBNyÅlesund” was drilled in 2015 by Insubria University up to 48.5 m of depth for permafrost observations. While the temperature time series can be downloaded, the only information available about the borehole stratigraphy is that there are around 14 m of a possible glacial till and bedrock below it (data accessible from: ~~https://sios-svalbard.org/node/648; http://gtnpdatabase.org/boreholes/view/1837/).~~ “DBNyÅlesund” is 78°55'14" N latitude and 11°52'00" E longitude (WGS84, EPSG 4326) and is placed 72 m north from the middle of our ERT3 and 208 m east of our piezometer P1.”.

11. l. 680 "few geological data can be 680 accessed for borehole "DBNyÅlesund"" what are those "few geological data" ? Please be specific. When clicking on the link that follows I can only download ground temperature. How far is that from your closest observation point? Where is the "geological data" available?

Thank you. We have improved the text as reported in the reply to the previous comment.

12. Conclusion:- "The data set has been carefully uploaded to the repository using a common and standard geophysical format for an easy-to-use processing with commercial and not commercial software." Please remove. This is a requirement from ESSD and does not contain new information for the reader.

Thank you, deleted.

13. "though Ny-Ålesund represents the most popular scientific center in the High Arctic." Please remove, it's not a popularity contest. Or change for another metric more scientific than popularity.

Thank you, we improved the text: "even though Ny-Ålesund represents the ~~most popular~~northernmost scientific ~~center~~hub in the High Arctic."

14. Please group single-sentence paragraphs. Maybe into one paragraph for the dataset you provide, and one paragraph about perspectives and future work.

Thank you, corrected.