We thank Reviewer #2 for reviewing our manuscript and providing valuable suggestions to improve the quality of our manuscript. The reviewer clearly understood our aims and intentions, and we are aligned with the critical comments raised by the reviewer.

- ***Reviewer #2:*** *The manuscript describes and evaluates the performance of a modified electrode design that aims to optimize the process of acquiring resistivity measurements in blocky, rocky terrain. The manuscript, submitted in the form of a brief communication, focuses on i) describing the construction and practical advantages of the modified electrode design, and on ii) confirming the reliability of the proposed electrode design in comparison to more established electrode types (stainless steel spikes).*

**Authors' reply:** The reviewer has clearly grasped the aim of the submitted Brief Communication, which is to propose novel electrodes that facilitate and optimize ERT measurements in high-mountain environments with debris-block surfaces, compared to traditional steel rods and textile bags (Buckel et al., 2023).

- ***Reviewer #2:*** *The principle of the proposed electrode design - sachets made of a conductive material filled with a porous matter that holds moisture and allows the sachet to mould to its surroundings - was, as the authors state, inspired by a cited study (Buckel et al. (2023)). The modifications in the present manuscript propose replacing the conductive textile with more robust and cheaper stainless-steel nets, and the fill of fine sand with lighter carwash sponges. These modifications resulted in three main improvements: the proposed stainless steel mesh electrodes are reported to be cheaper, lighter and more durable than the conductive textile electrodes proposed by Buckel et al. (2023) - all being important considerations when preparing for a resistivity survey.*

**Authors' reply:** Our proposed steel net electrodes provide all the advantages of the textile electrodes introduced by Buckel et al. (2023), whilst addressing the limitations highlighted in the comparative tests presented by Bast et al. (2024), namely the high costs of the conductive fabric, the issue of oxidation affecting the copper-nickel textile, and the considerable weight of the bags (250–300 g each, comparable to traditional steel rods). The new electrodes are made from inexpensive stainless-steel mesh, which reduces production costs and eliminates oxidation concerns. Furthermore, their weight is significantly lower (approximately 50 g each; 50 electrodes = 2.5 kg), making them much easier to transport, for example, in a medium-sized mountain backpack, with substantially less physical effort. In our opinion, this represents a major advantage for researchers conducting ERT measurements in challenging and remote environments such as rock glaciers.

***Reviewer #2:*** *The manuscript delivers on its two main objectives: in terms of description of the proposed electrode design, it is well described and its practical advantages are clearly stated. In terms of evaluating the performance and reliability of the proposed electrodes, the manuscript reports on a number of well-presented and well-established, and thus easily inter-comparable metrics, including 'contact' resistances, reciprocal errors, and comparison of the apparent and inverted resistivities acquired with the proposed electrodes vs. well-established steel spike electrodes. These tests show that the proposed electrodes yield results equivalent to those achieved with spike electrodes in terms of the quality of the measured resistivity datasets. The* *proposed electrodes do not appear to significantly and consistently improve the electrode 'contact' resistances (which was, however, not stated among the goals of the experiment).*

**Authors' Reply:** As correctly noted, the aim of this work is not to propose new electrodes that improve contact resistance, an inherently challenging parameter in such study environments, but rather to provide a cost-effective and durable alternative to the recently introduced textile electrodes by Buckel et al. (2023). Through our tests and comparison of key parameters in ERT acquisition (contact resistance, injected current, measured apparent resistivity, data quality assessed via reciprocal error, and the inverted resistivity models), we have demonstrated the reliability of net electrodes for surveys in debris-block surface environments such as rock glaciers. Net electrodes combine the advantages of both traditional steel rods and textile electrodes: they allow for quick and easy installation and removal of ERT transects in blocky terrains (as textile electrodes do), while also offering high mechanical strength, resistance to oxidation, and relatively low cost. Moreover, net electrodes present a significant additional advantage over both traditional and textile electrodes: their remarkably low weight. As previously highlighted, each net electrode weighs only 50 g, significantly reducing the physical effort required to transport them in challenging high-mountain environments.

- ***Reviewer #2:*** *I commend the authors for pursuing practical improvements to electrode design, especially for ever-challenging mountain environments, as well as for carefully evaluating the performance of the new electrode design prior to basing any interpretations on it. As the focus of the manuscript is practical innovation, I would suggest exploring opportunities to compensate for the somewhat limited novelty (the key design principles are largely inspired by a previously published study) and increase the impact (the electrodes' grounding qualities match though do not significantly outperform the more established electrode types) of the experiment by expanding the types of applications for which the proposed electrodes are validated. In this context, and especially as the brief communication was submitted for a special issue on 'Emerging geophysical methods for permafrost investigations: recent advances in permafrost detecting, characterizing, and* monitoring' *it would be relevant to quantify the performance of the proposed electrodes in repeated measurements. This could be as simple as measuring the same profile with the proposed electrodes at the same location right after installation (wetted with saline solution, ideal conditions), after drying out (poor measurement conditions), and after re-wetting naturally e.g. by a rain event (good though less-than-ideal conditions as salts may be progressively washed out of the sponges). I reckon a summary of such an experiment would be relevant for the target audience of the special issue, and could be reported in one paragraph*.

**Authors' reply:** We have already published a study in which we explored the effect of performing ERT measurements in debris-block surface environments, both with and without wetting the electrodes with saltwater (Pavoni et al., 2022). In that work, we clearly showed that conducting measurements without adding saltwater results in extremely high contact resistance values (several hundred kOhm), which clearly prevent the acquisition of reliable ERT datasets (Pavoni et al., 2022; data quality was assessed through reciprocal error). Furthermore, in Bast et al. (2024), we investigated the effect of using freshwater instead of saltwater for wetting the electrodes. In that study, the site where both traditional and textile electrodes were wetted with freshwater showed significantly higher contact resistance values compared to the two test sites where saltwater was used.

In accordance with Reviewer #2's suggestion, we believe it would be valuable to include in the submitted Brief Communication some results demonstrating the high mechanical resistance and oxidation resistance of the net electrodes, and thus the long-term reliability of their performance. In June 2024, a permanent ERT monitoring line was installed on the Sadole rock glacier (North Italy) using 48 net electrodes (the first 24 electrodes correspond to those used in the test presented in this study). Over the past year, several datasets have been acquired to investigate the seasonal variations of permafrost in this study area. Figure 2 of the manuscript can be updated to include a comparison of contact resistances, injected electrical currents, and reciprocal error from the datasets acquired in June 2024 and June 2025. As shown in panels (j), (k), and (l), after one year, the performance remained essentially unchanged, despite the electrodes having remained in situ. Achieving the same result would not have been possible with textile electrodes (Buckel et al., 2023), as oxidation issues would have inevitably compromised data acquisition. Therefore, we demonstrated that, similar to traditional stainless-steel spikes, net electrodes can also be employed in permanent ERT monitoring lines on rock glaciers.

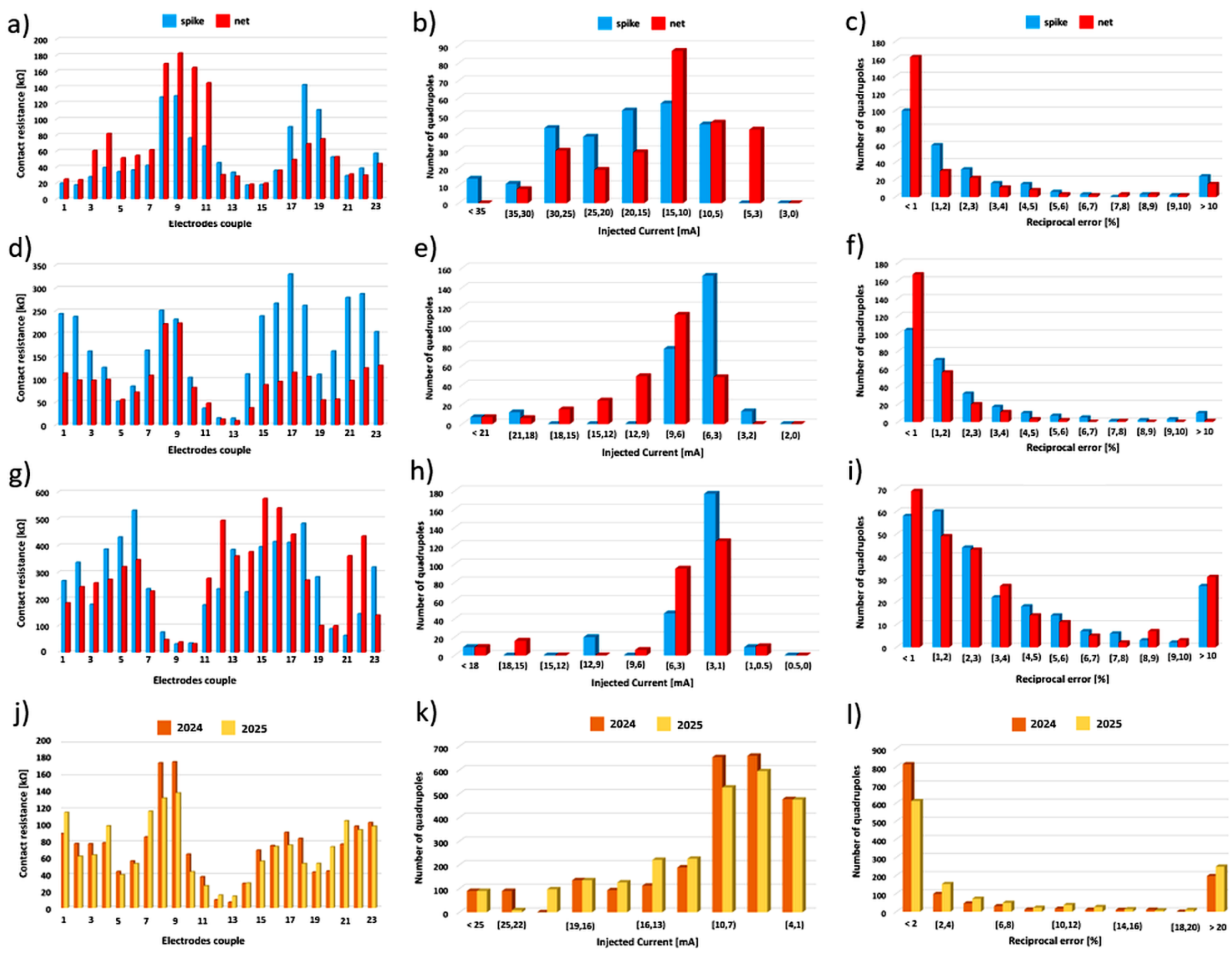

Figure 2. Histograms (a), (d), and (g) illustrate the comparison of contact resistances [kΩ] recorded at the Marocche di Drò, Sadole, and Flüela test sites, respectively, using traditional stainless-steel spike electrodes combined with sponges (blue bins) and the newly proposed stainless-steel net electrodes incorporating a sponge (red bins). Histograms (b), (e), and (h) show the comparison of injected electric currents [mA], measured at the Marocche di Drò, Sadole, and Flüela test sites, respectively, with the two electrode types. Histograms (c), (f), and (i) present the comparison of reciprocal error [%] of the quadrupoles measured at the Marocche di Drò, Sadole, and Flüela sites, respectively, using the two electrode configurations. Both electrode types were moistened with the same amount of saltwater and positioned approximately at the same locations between the boulders (see Fig. 1b and 1c). Figures (j), (k), and (l) present a comparison of contact resistances (measured on the first 24 electrodes of the array, corresponding to those shown in Fig. 2a) [kΩ], injected electric currents [mA], and reciprocal error [%] for datasets acquired at the Sadole site in June 2024 and June 2025, along the permanent ERT monitoring line equipped with the newly proposed stainless-steel net electrodes, moistened with saltwater.

- ***Reviewer #2:*** *Line 81: What is the protocol for measuring the 'contact' resistances by Syscal-Pro? (type of the electrode test).*

**Authors' reply:** We agree, and we will provide a more detailed description of the procedure used by the Syscal Pro instrument to measure contact resistance in the modified manuscript.

- ***Reviewer #2:*** *I would suggest the authors to consider the advantages of using the term 'grounding resistance' instead of 'contact resistance'. Use of 'grounding' resistance communicates that what's measured during the electrode test is not only the resistance at the contact between the electrode and the embedding medium, but also the effect of geometry of the electrode and properties of the embedding medium, including any alteration zone in the immediate vicinity of the electrode (the saltwater soaked sponges).*

**Authors reply:** We agree, and we will replace the term contact resistance with grounding resistance in the revised manuscript.