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Comment on gi-2021-36

Anonymous Referee #2

Referee comment on "Design and operation of a long-term monitoring system for spectral electrical impedance tomography (sEIT)" by Maximilian Weigand et al., Geosci. Instrum. Method. Data Syst. Discuss., <https://doi.org/10.5194/gi-2021-36-RC2>, 2022

This is a very interesting paper describing the test experiment for the small-scale sEIT monitoring system, in which several data quality parameters such as contact resistances, cable capacitances, and resulting leakage currents were monitored along with the actual sEIT measurements. The authors demonstrated how detailed analysing of these quality parameters was used to improve significantly the measurement system setup in real monitoring experiment. They developed the ways to improve the system's reliability and also imaging quality. One of the advantages of the paper is investigating inductive coupling effects between cables and development of a novel technical solution and procedure for correction of these effects that is combined with the calibration procedure. The authors managed to demonstrate the performance of the system under real field conditions in a small-scale biogeophysical experiment. Their findings and recommendations concerning materials for electrodes and other technical details of their equipment are very valuable.

However, I think that the paper still requires some improvement. Here are some of my comments:

1) In Chapter 2, lines 90-97 you wrote that L1-norm inversion is a well-known mean to perform robust inversion of the data with large amount of noise or/and outliers. It seems that your data represent exactly this case. It is not true that such a scheme is not providing the way to evaluate uncertainty of the results, as one can always use general Bayesian formulation of inverse problem and obtain the uncertainty estimate in the form of a-posteriori probability density function (see Tarantola, 1987). For me it is not clear why you still decided to follow the general inversion scheme described in equation (1), because it seems that it is not suitable for your type of data, as the regularization implemented in (1) was clearly not sufficient to stabilize your solution. So what was the reason that you still followed the procedure that is well suited for Gaussian distribution of error in the data only?

2) As a result, you had to use a large amount of empirically defined parameters for additional filtering the data, as it is described in Chapter 4.6. I think that justification for using them is quite weak and should be described more detailly. For example, what happens if a threshold in (8) is 3.05, but not 3, or can the threshold in (9) be 9.56, for example?

3) Looking at Figure 6, one see a clear temporal variations in the amount of data points left after filtering. In particular, application of SMOOTHENESS filters removed half of the data after 24.06. Do you have any explanations for this?