

Supporting Information for “Role of metasomatism in the development of the East African Rift at the Northern Tanzanian Divergence: Insights from 3D magnetotelluric modelling.”

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Introduction

This is the supplementary file to the article “*Role of metasomatism in the development of the East African Rift at the Northern Tanzanian Divergence: Insights from 3D magnetotelluric modelling.*”. This file provides the reader with additional information and data that are important in understanding the concepts laid out in the article but were

August 11, 2023, 7:50am

not necessary to included in the main article. Here we provide information on:

Sensitivity tests on conductor C_1 : Sensitivity tests carried out on conductor C_1 , are made by inserting a block of different resistivities varying from 100 to 10000 Ωm . We looked at the results considering the responses beneath the stations MZ and MS (Figure S??). The results suggest that C_1 is a robust conductor that reflects reality.

Sensitivity tests on conductor C_M : Sensitivity tests carried out on conductor C_M , were made by inserting a block of different resistivities varying from 1 to 10000 Ωm . Since this conductor encompasses several stations and it is hard to understand the complex responses from different stations at longer periods, we calculated the total RMS differences from the inversion model for each case in the vicinity of the inserted block. RMS values are only calculated using the forward responses after 100s. We plotted the figure RMS figure alongside the geometry of the block inserted (Figure S5). Results demonstrate that the best fitting RMS values for the C_M are indeed around 60-100 Ωm , similar to what had been modelled.

Table S1. Lherzolite composition used in this study.

Depth	Ol	Opx	Cpx	Gt
38-98	62.7	30.3	7	0
98-200	60.6	28.4	6	5

Table S2. Kimberlite names where garnet xenocrysts are derived. Mwadui-64k1 and Sultan are clustered together due to their close proximity.

Cluster Name	Longitude	Latitude
Mwadui-64k1-Sultan	33.302	-3.683
80k6	33.269	-4.291
99k2	33.486	-4.804
Makibulei	34.419	-5.201
101k2	34.467	-4.648

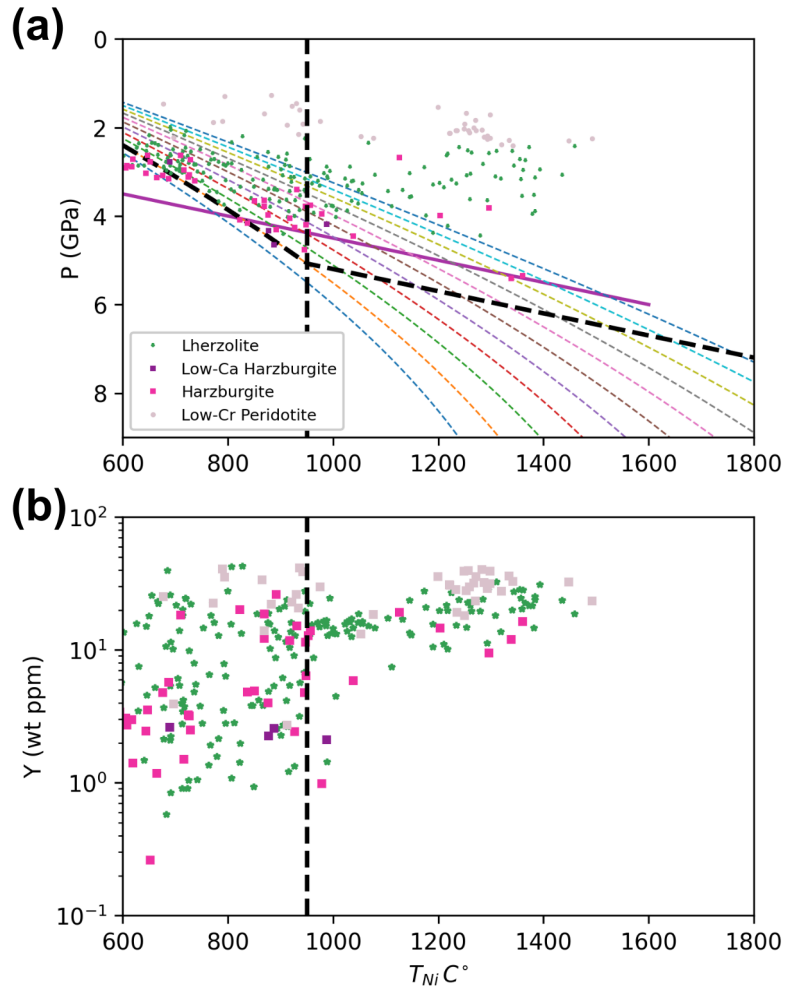


Figure S1. Garnet xenocryst thermobarometry results. (a) The paleogeotherm of $36 \text{ mW}/\text{m}^2$ is determined via the locus of garnet P-T estimates. This paleogeotherm then kinked towards the diamond-graphite transition at the temperature corresponding to the base of the depleted lithosphere, which is determined by the (b) sharp decrease of garnets with yttrium contents lower than 10 ppm.

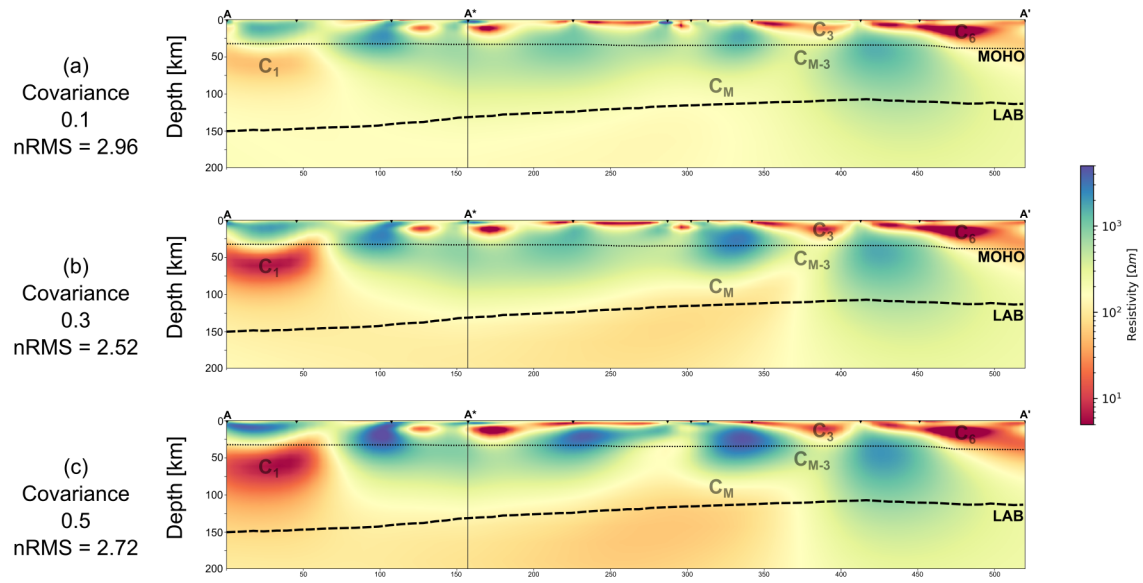


Figure S2. The vertical slices of the Slice A-A' from MT models using different covariance values: (a) 0.1, (b) 0.3, (c) 0.5.

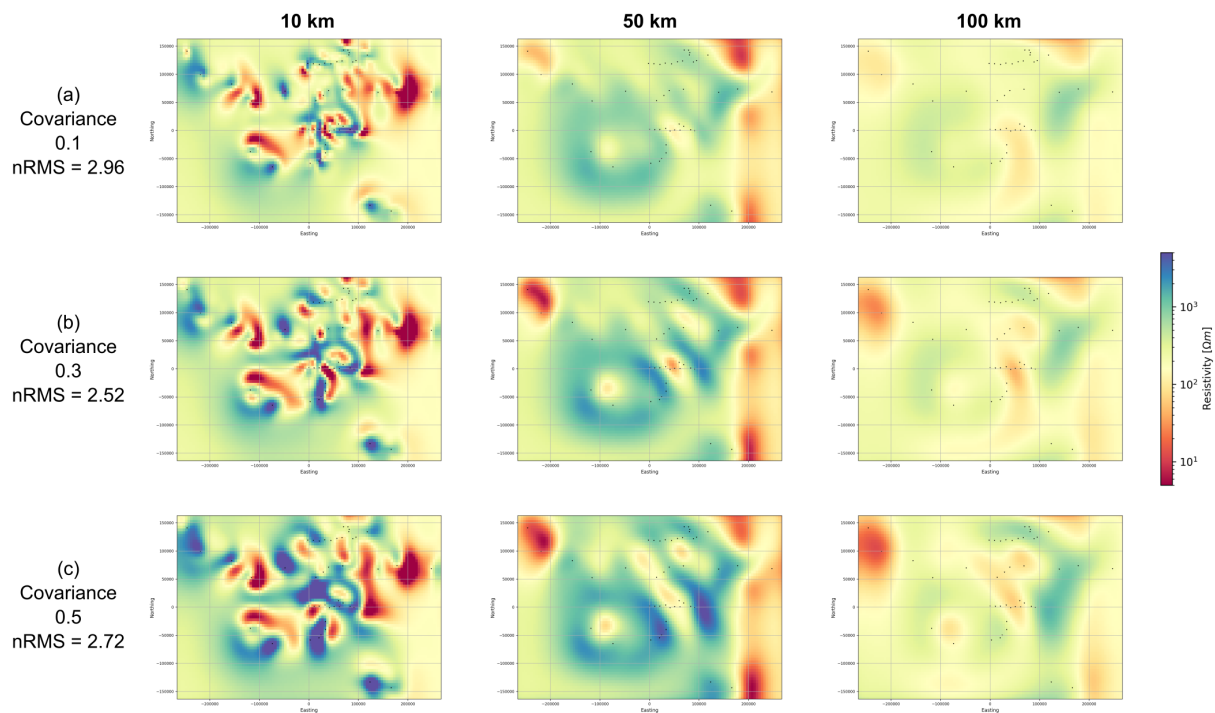


Figure S3. Horizontal slices of 10, 50 and 100 kilometers taken from the MT models with different covariance values: (a) 0.1, (b) 0.3, (c) 0.5.

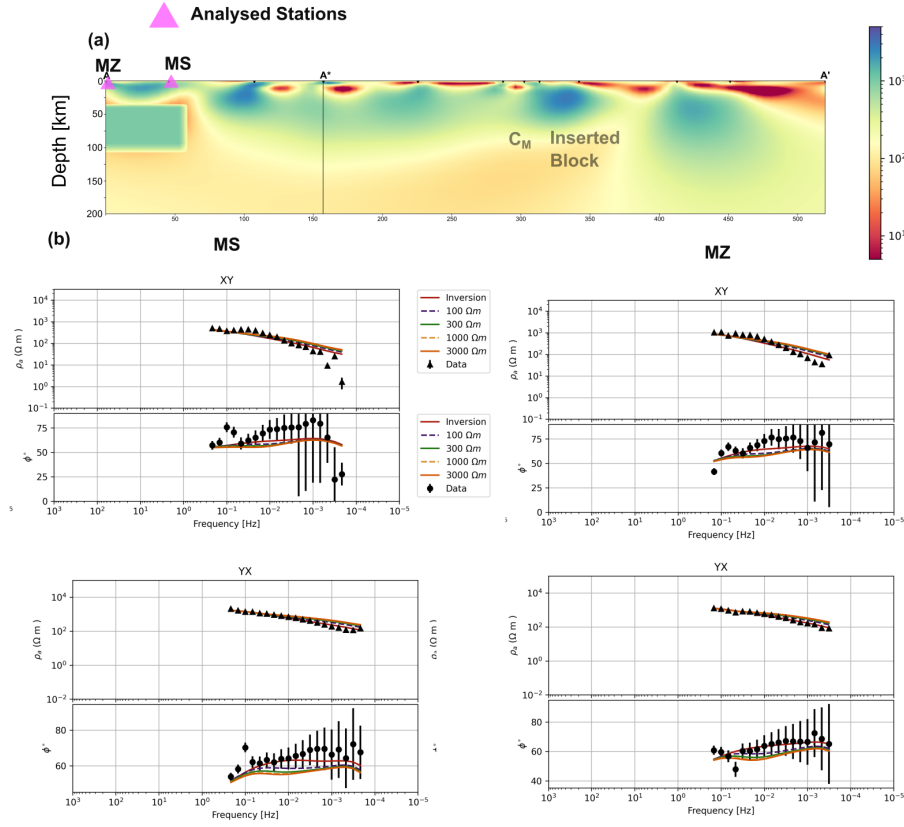


Figure S4. Sensitivity tests that are carried out for C_1 . (a) Vertical section figure indicating the location of the inserted anomaly with different resistivities. (b) Forward responses of the inserted block of different resistivities at stations MS and MZ.

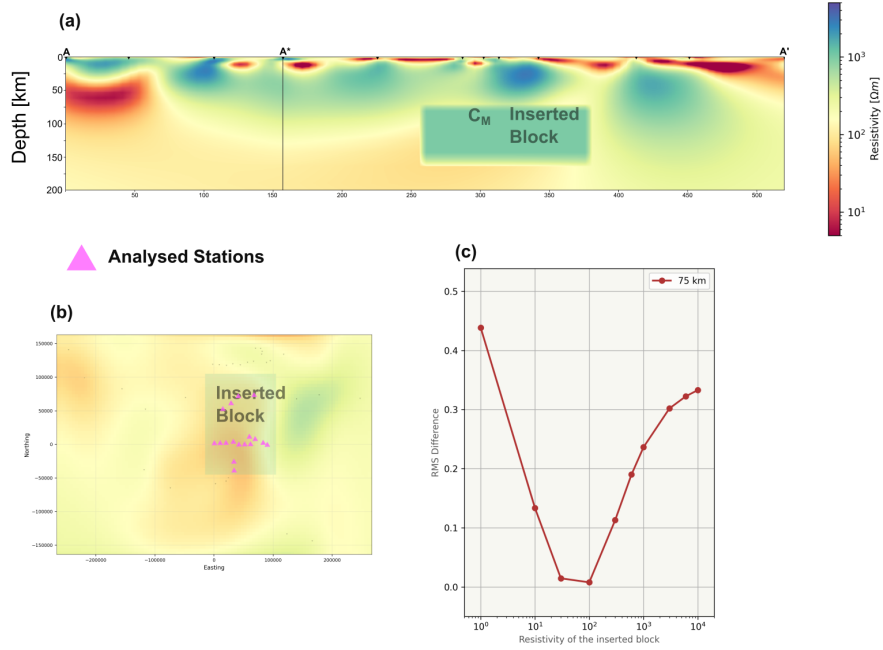


Figure S5. Sensitivity tests that are carried out for C_M . (a) Vertical section figure indicating the location of the inserted anomaly with different resistivities. (b) Plan view of the inserted anomaly over horizontal slices. Pink triangles indicate the stations used for the RMS calculation. (c) RMS differences observed from the inversion model with the given resistivity of the inserted anomaly, indicating that the 60-100 Ωm is likely the most probable solution to the anomaly here.

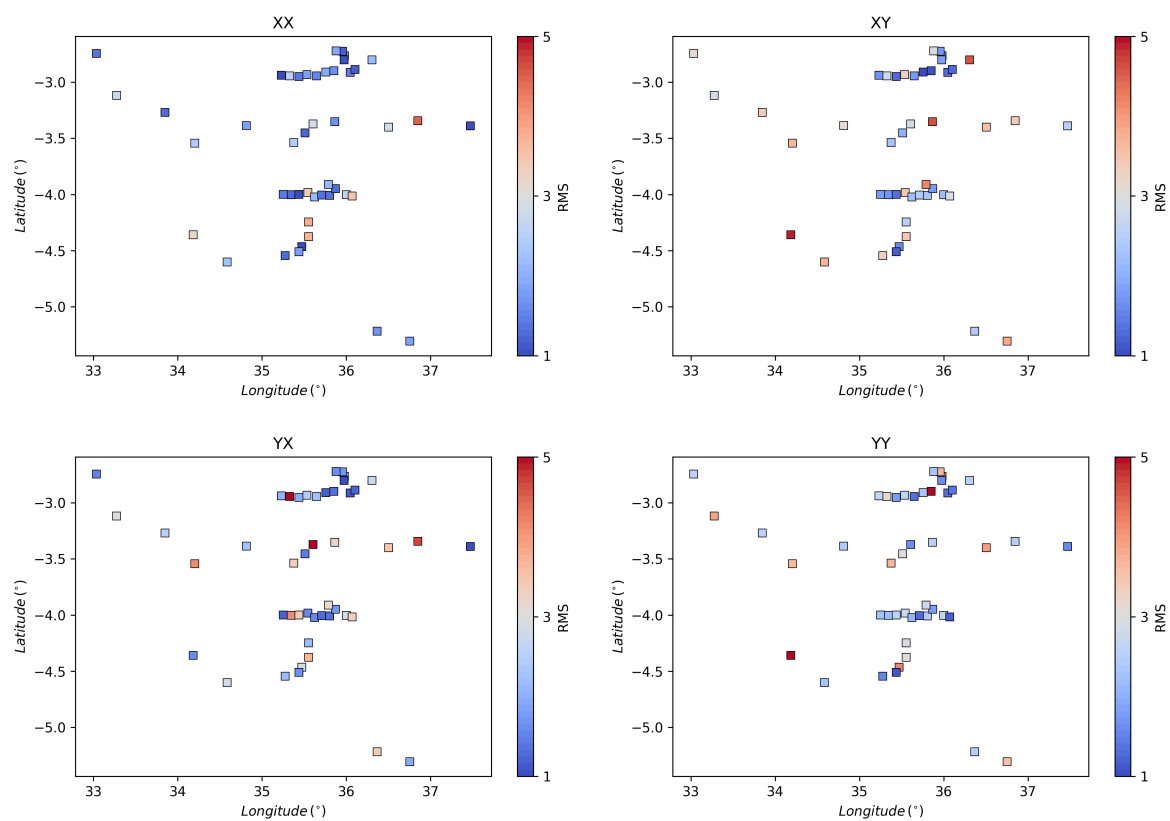


Figure S6. RMS map of the final model for all stations.

August 11, 2023, 7:50am

Station AR

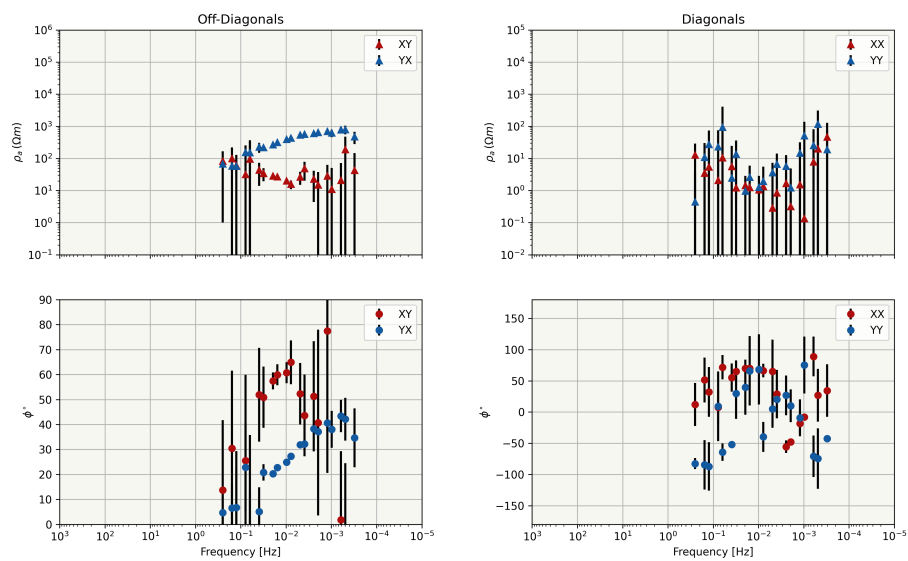


Figure S7. MT responses for the station AR.

Station BA

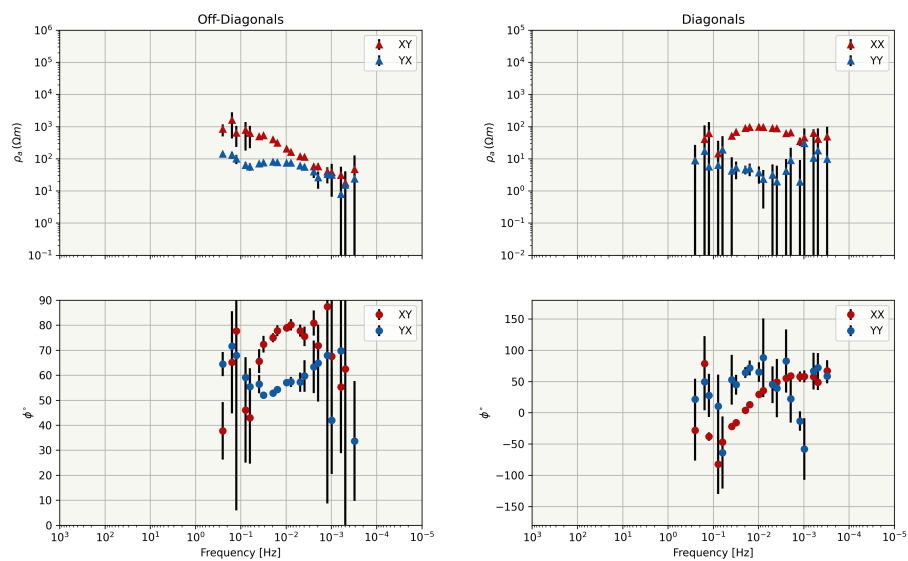


Figure S8. MT responses for the station BA.

August 11, 2023, 7:50am

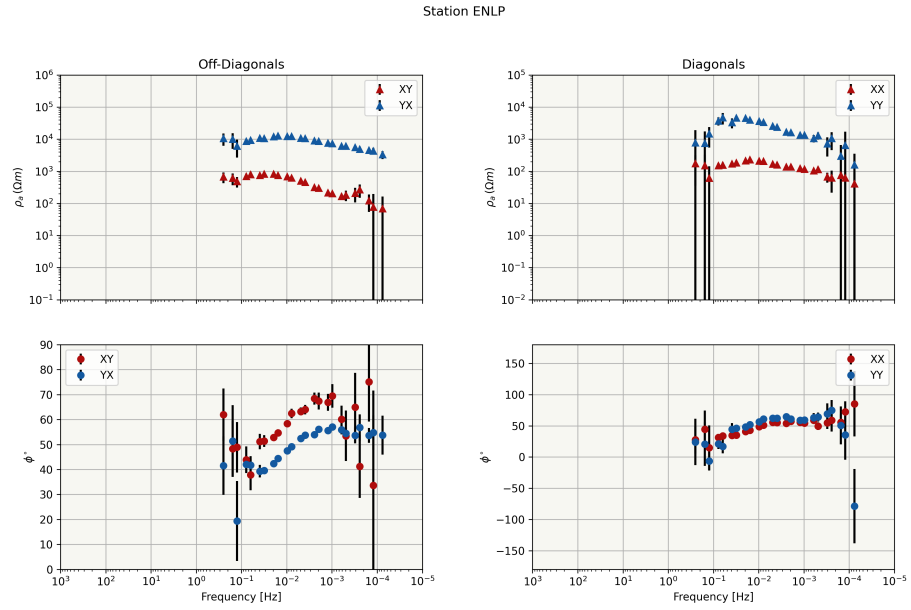


Figure S9. MT responses for the station ENLP.

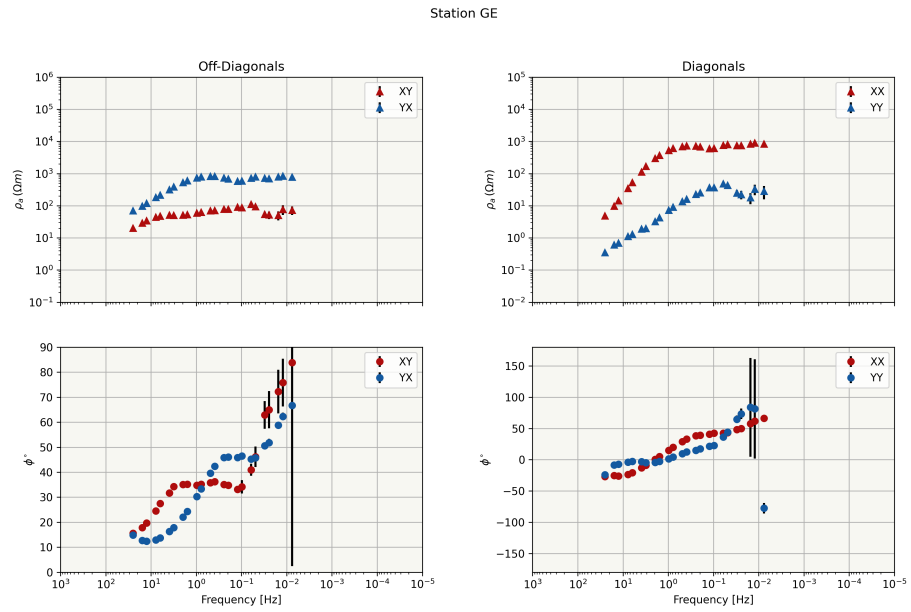


Figure S10. MT responses for the station GE.

August 11, 2023, 7:50am

Station IS

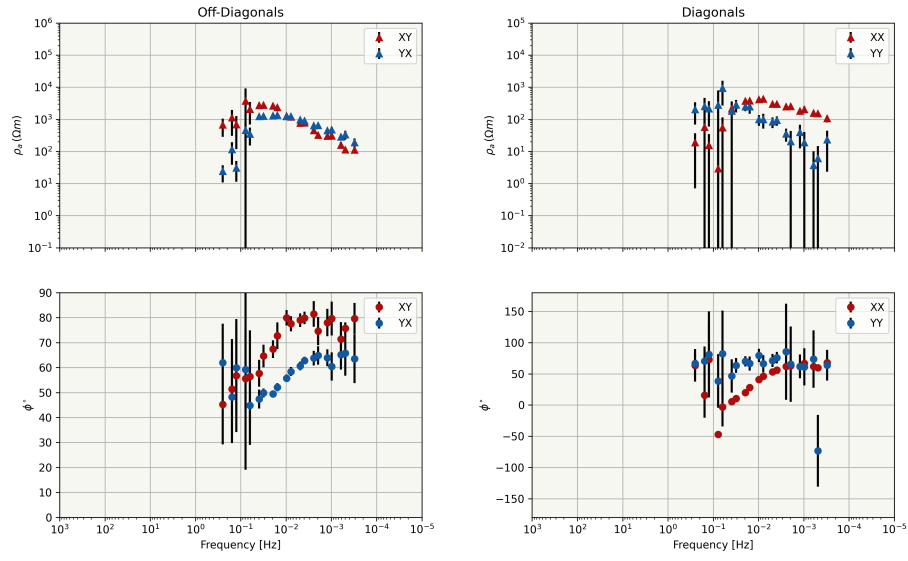


Figure S11. MT responses for the station IS.

Station KI

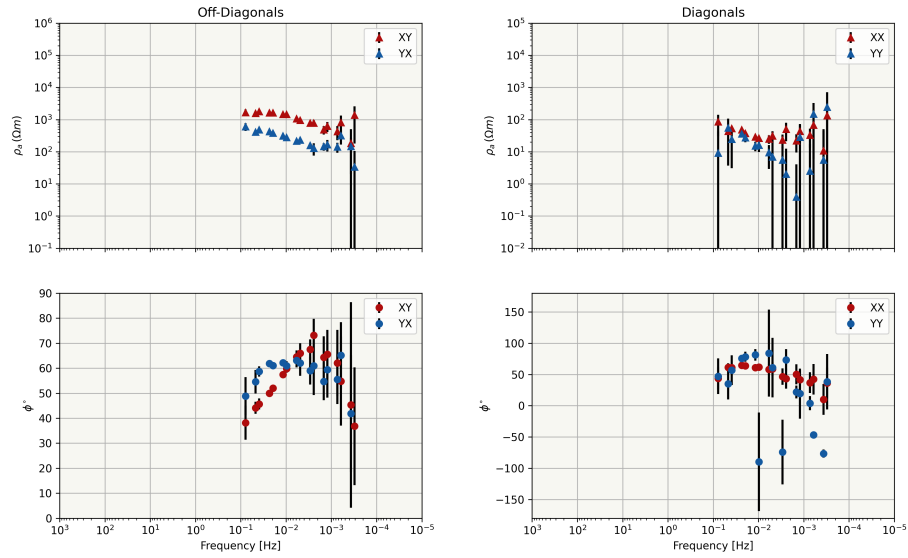


Figure S12. MT responses for the station KI.

August 11, 2023, 7:50am

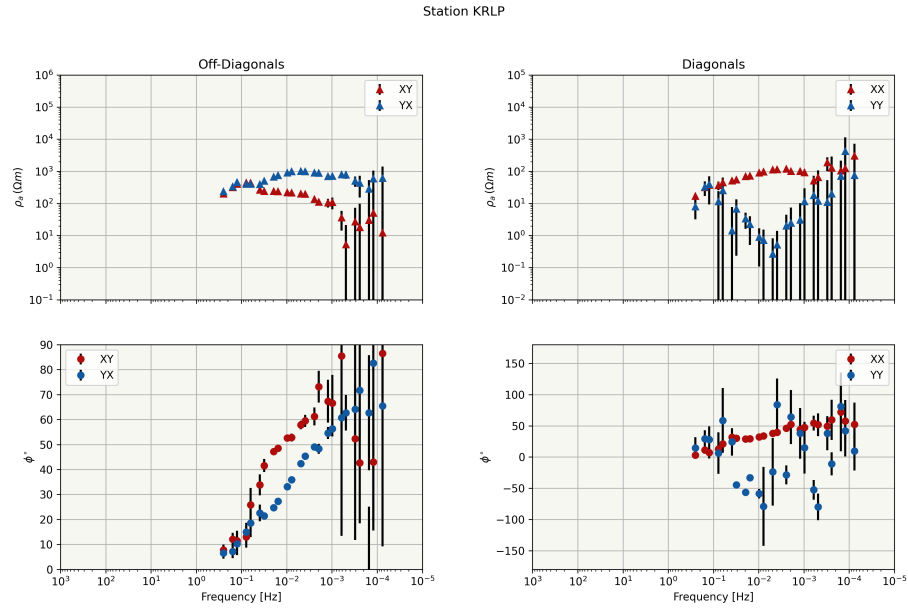


Figure S13. MT responses for the station KRLP.

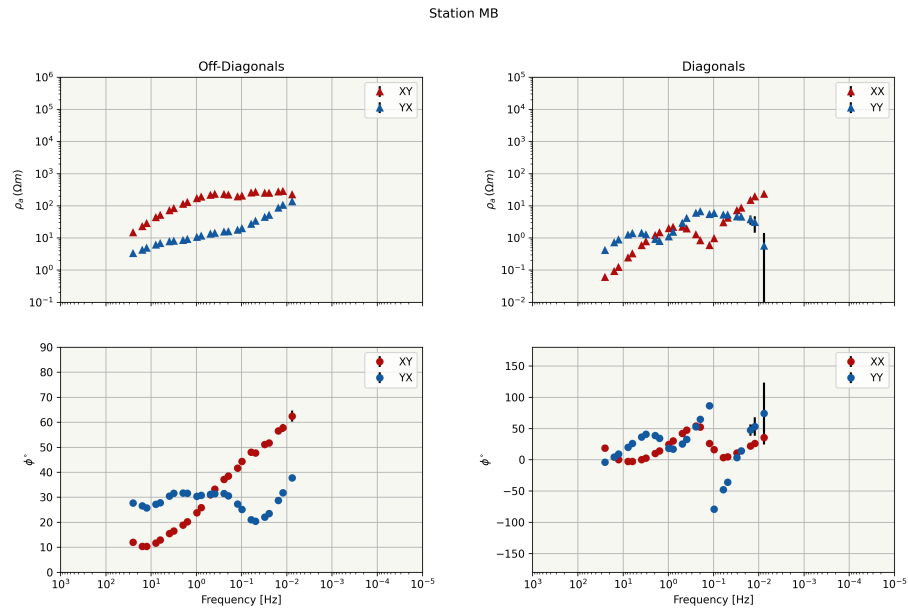


Figure S14. MT responses for the station MB.

August 11, 2023, 7:50am

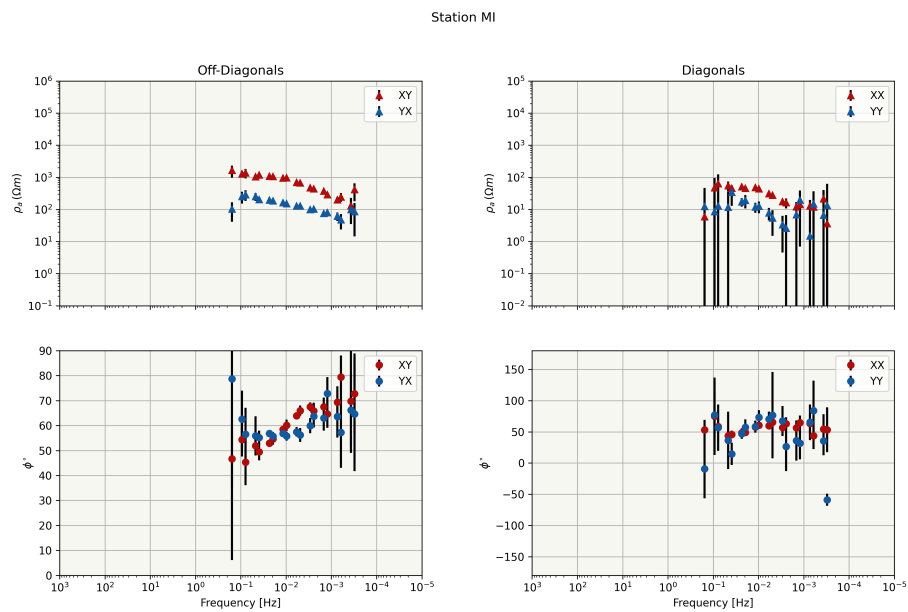


Figure S15. MT responses for the station MI.

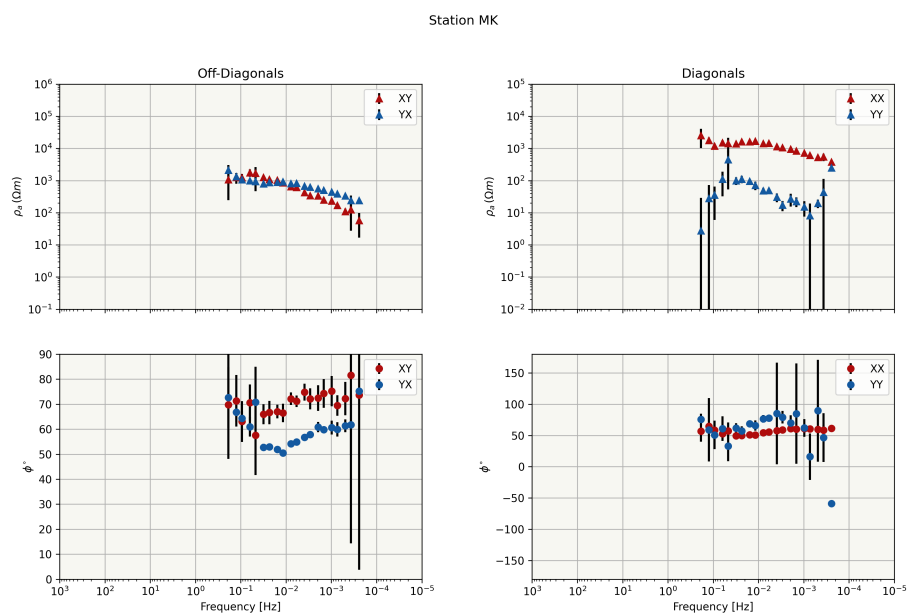


Figure S16. MT responses for the station MK.

August 11, 2023, 7:50am

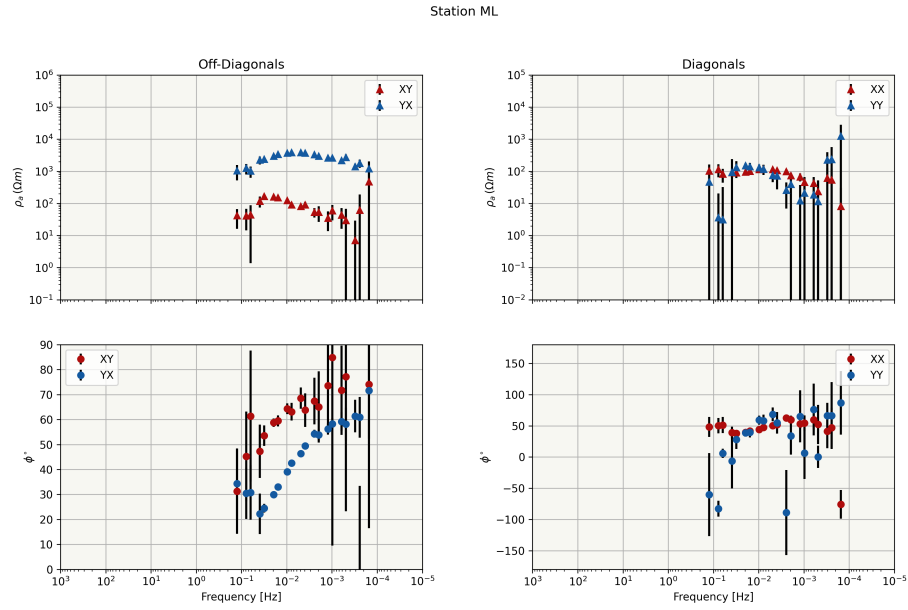


Figure S17. MT responses for the station ML.

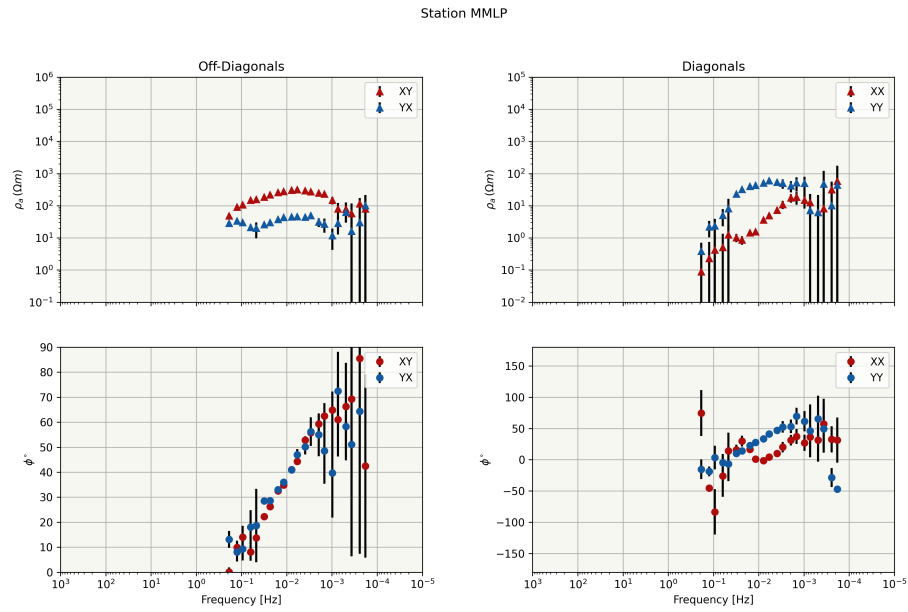


Figure S18. MT responses for the station MMLP.

August 11, 2023, 7:50am

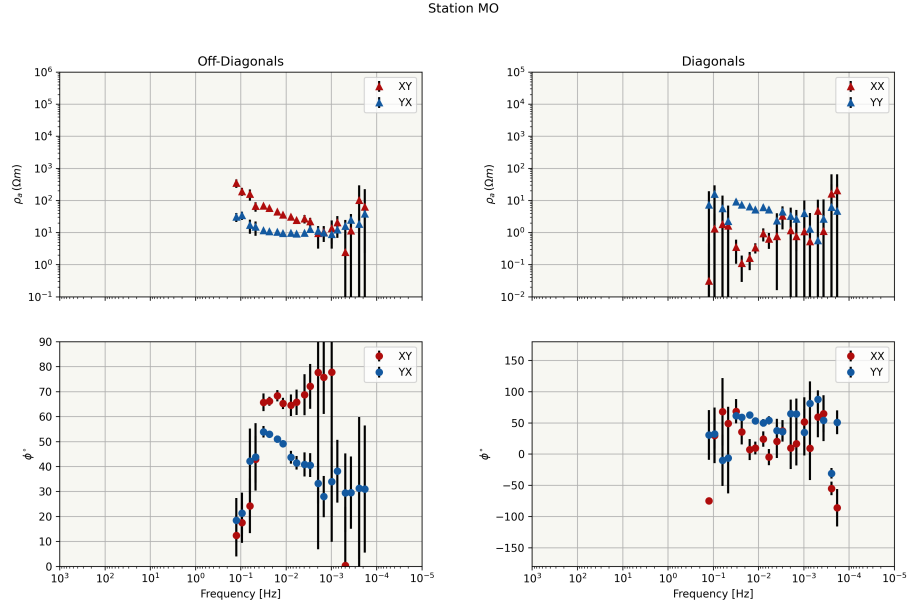


Figure S19. MT responses for the station MO.

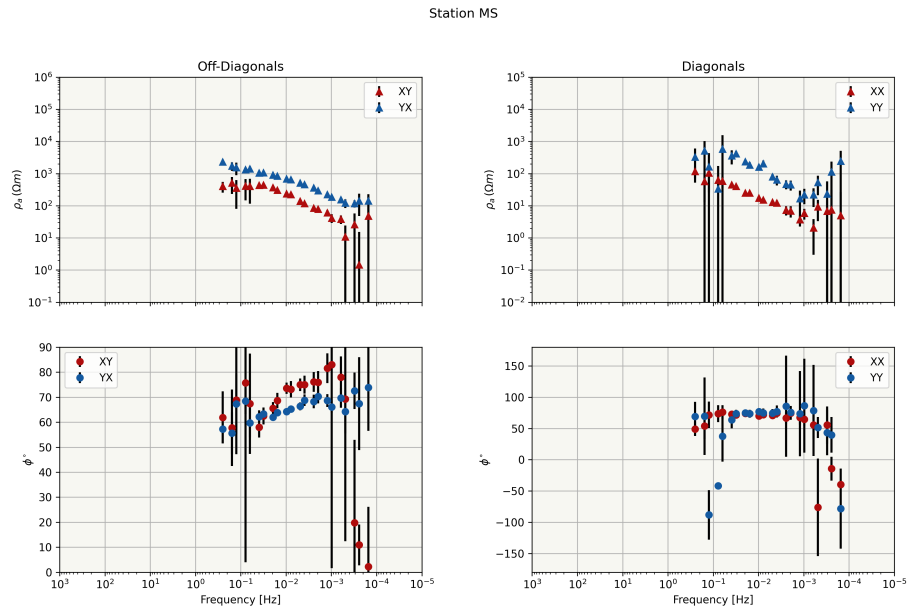


Figure S20. MT responses for the station MS.

August 11, 2023, 7:50am

Station MTI01

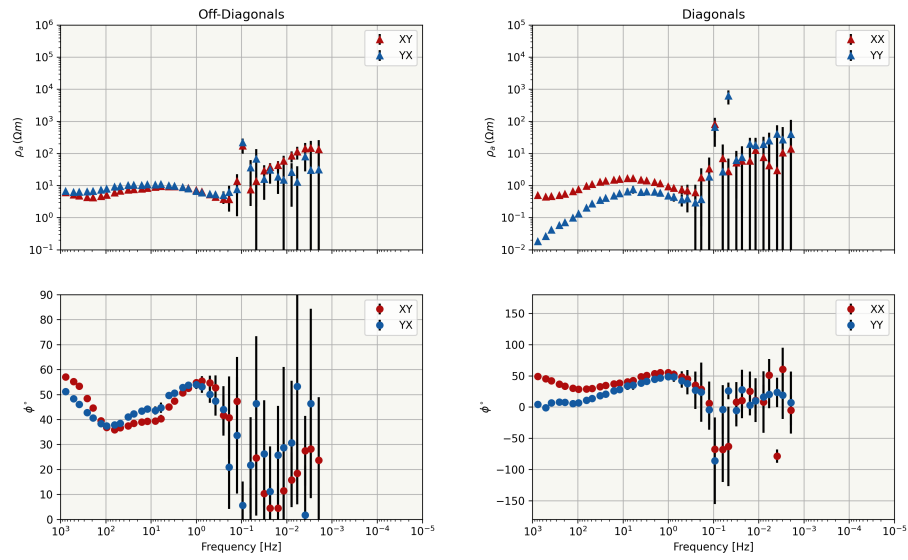


Figure S21. MT responses for the station MTI01.

Station MTI03

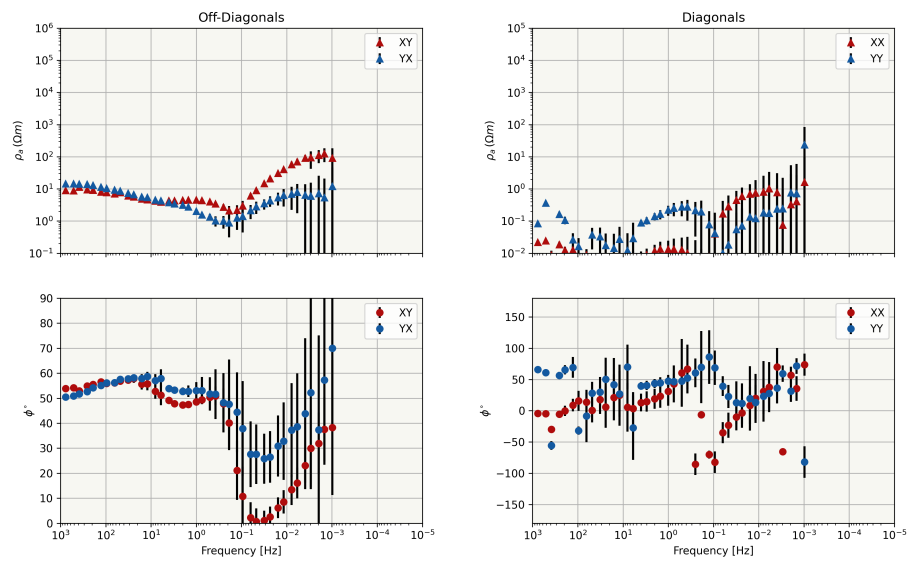


Figure S22. MT responses for the station MTI03.

August 11, 2023, 7:50am

Station MT105

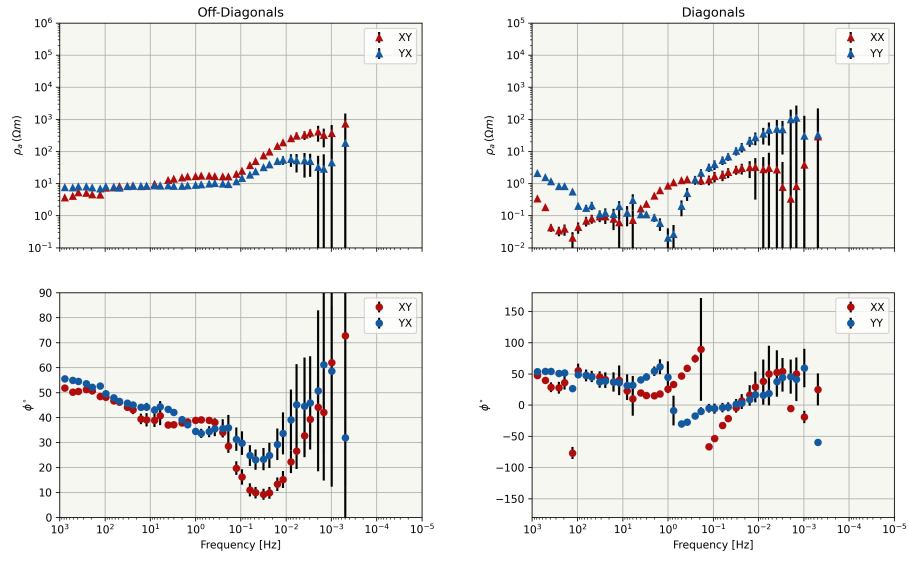


Figure S23. MT responses for the station MT105.

Station MT107

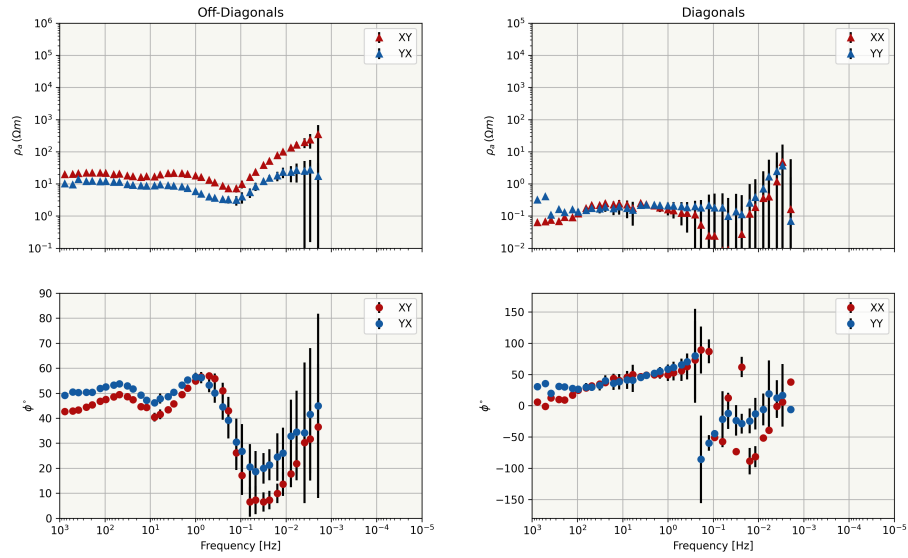


Figure S24. MT responses for the station MT107.

August 11, 2023, 7:50am

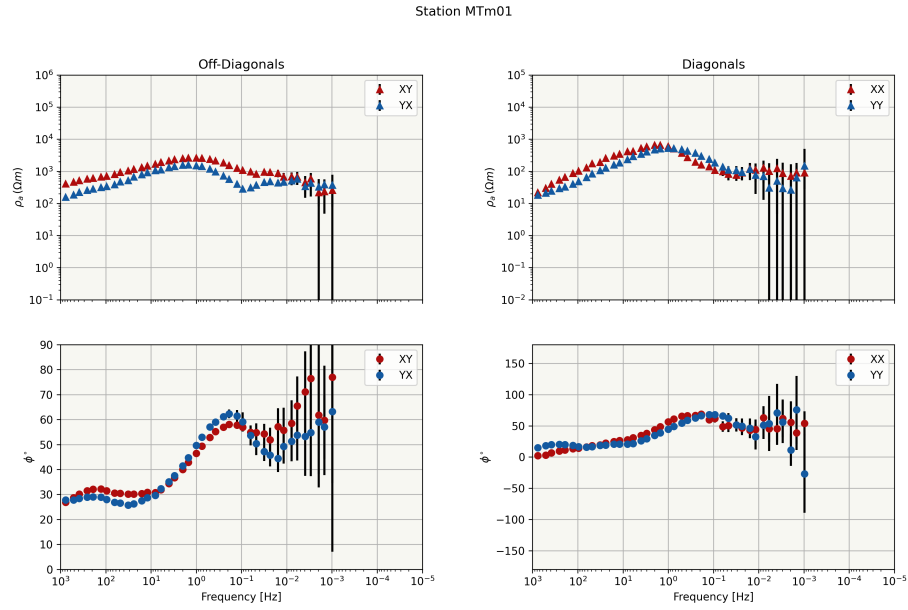


Figure S25. MT responses for the station MTm01.

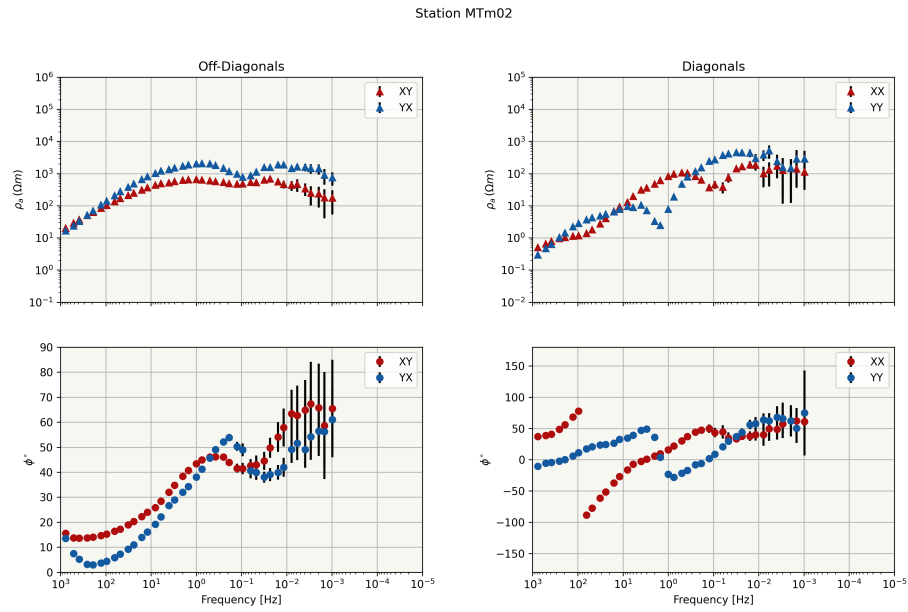


Figure S26. MT responses for the station MTm02.

August 11, 2023, 7:50am

Station MTm03

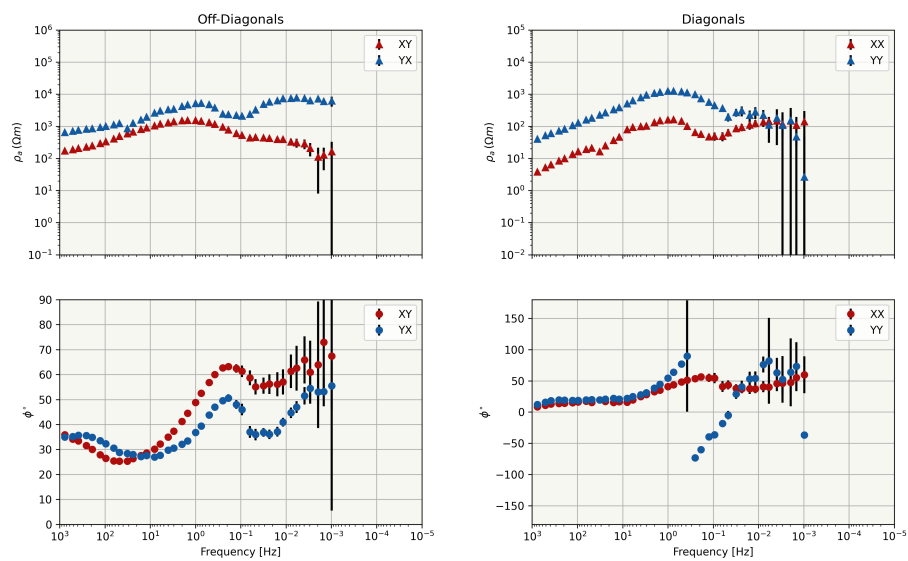


Figure S27. MT responses for the station MTm03.

Station MTm04

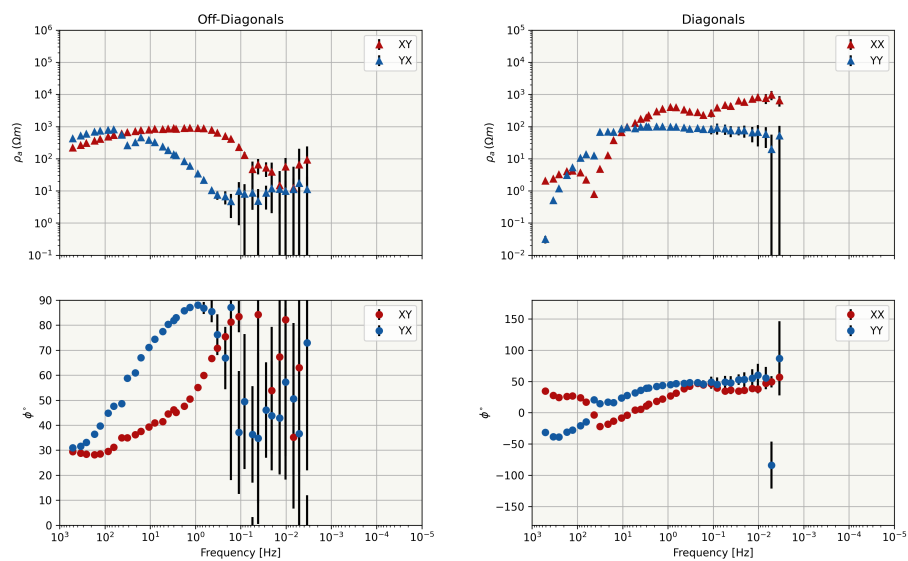


Figure S28. MT responses for the station MTm04.

August 11, 2023, 7:50am

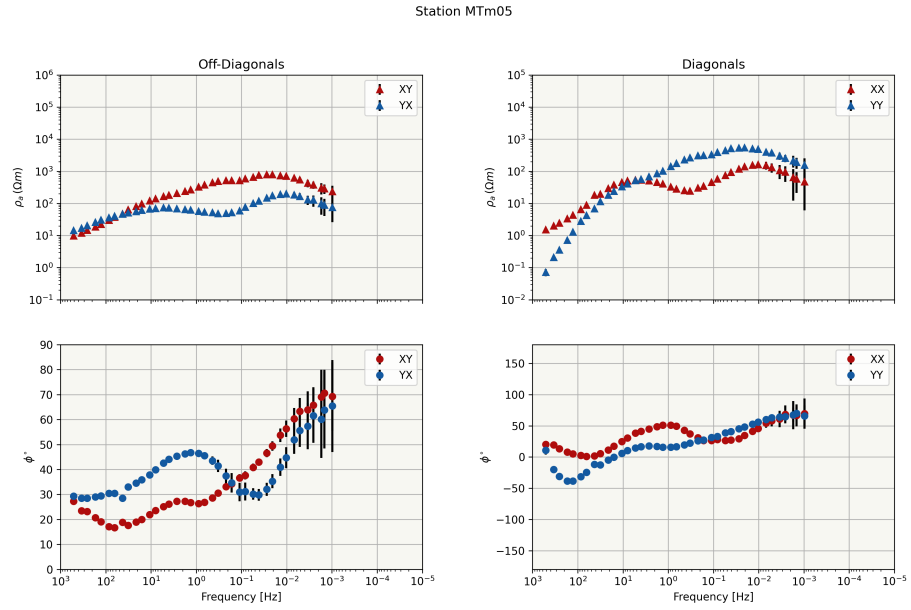


Figure S29. MT responses for the station MTm05.

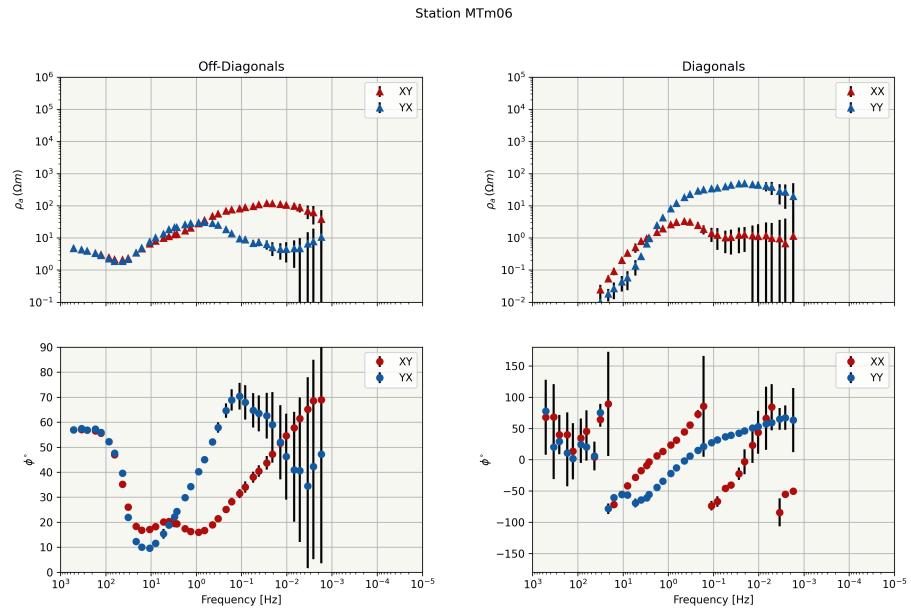


Figure S30. MT responses for the station MTm06.

August 11, 2023, 7:50am

Station MTm07

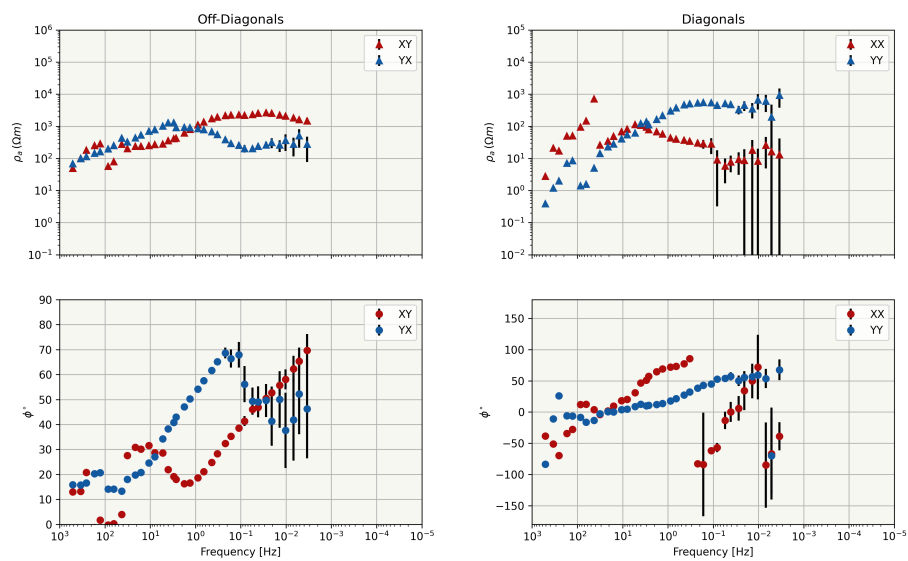


Figure S31. MT responses for the station MTm07.

Station MTm08

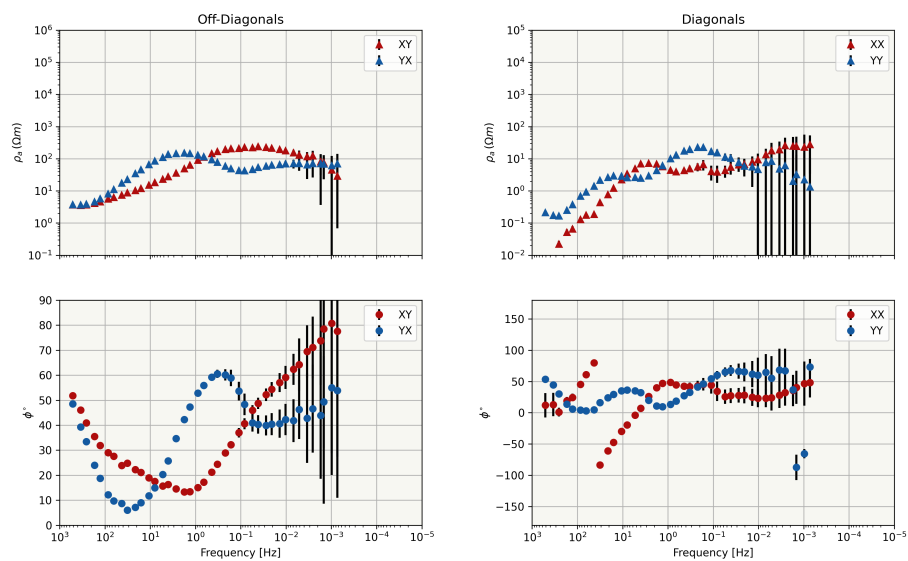


Figure S32. MT responses for the station MTm08.

August 11, 2023, 7:50am

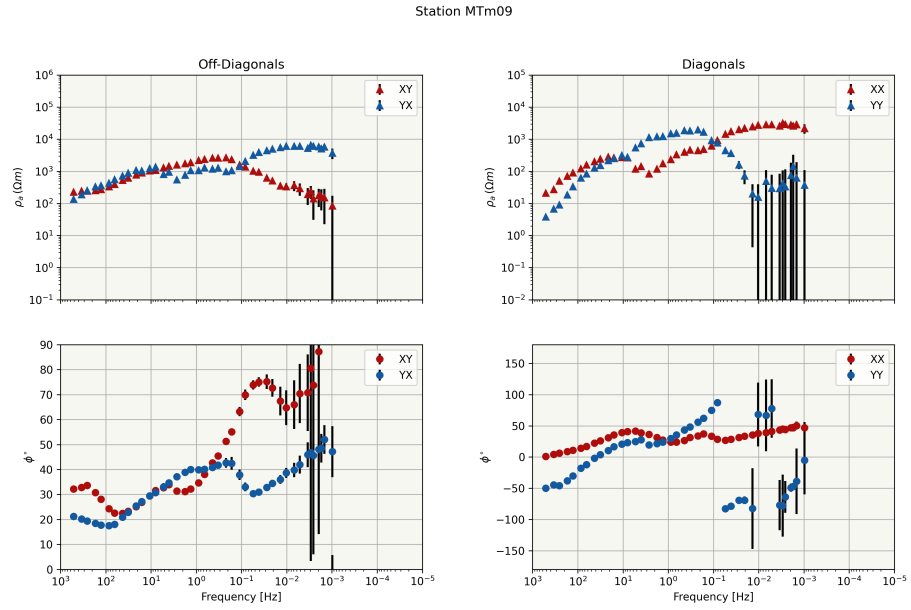


Figure S33. MT responses for the station MTm09.

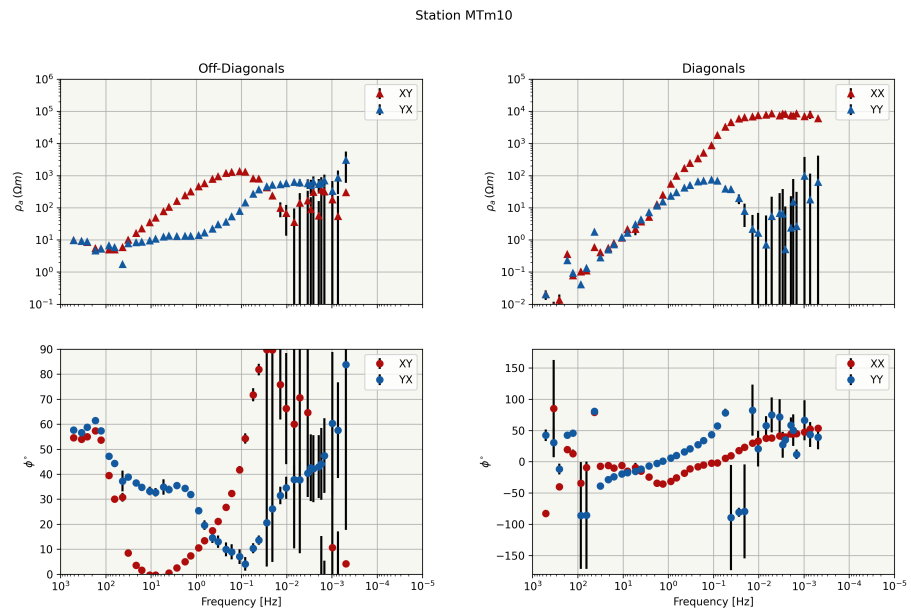


Figure S34. MT responses for the station MTm10.

August 11, 2023, 7:50am

Station MTP01

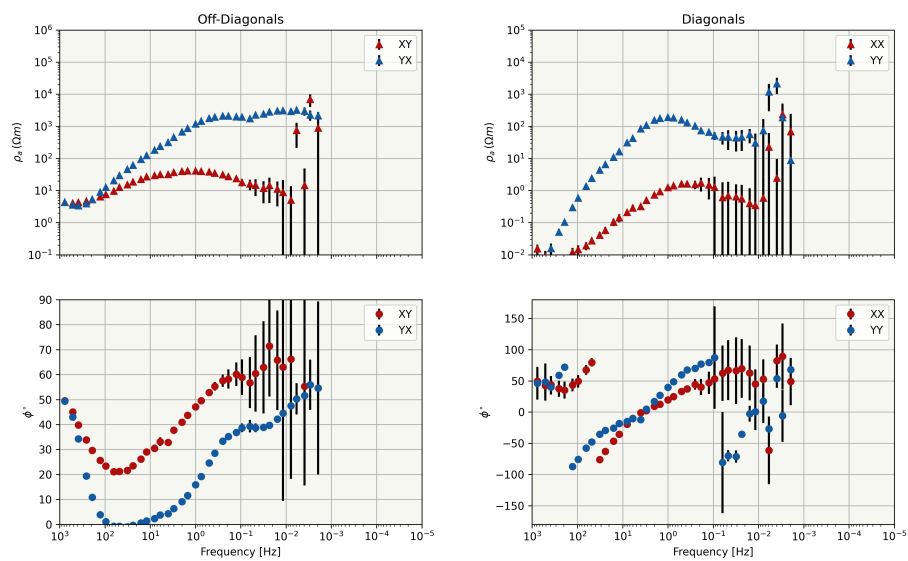


Figure S35. MT responses for the station MTP01.

Station MTP02

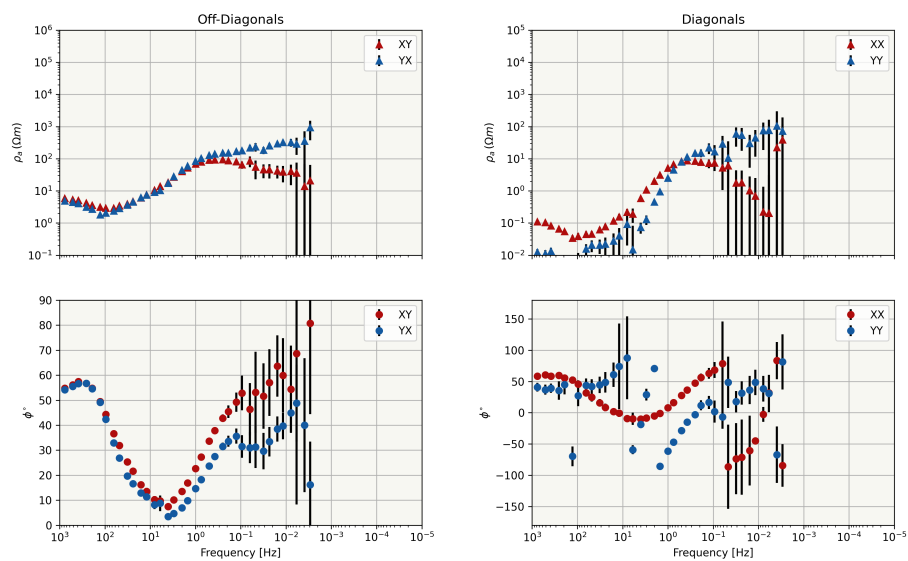


Figure S36. MT responses for the station MTP02.

August 11, 2023, 7:50am

Station MTP03

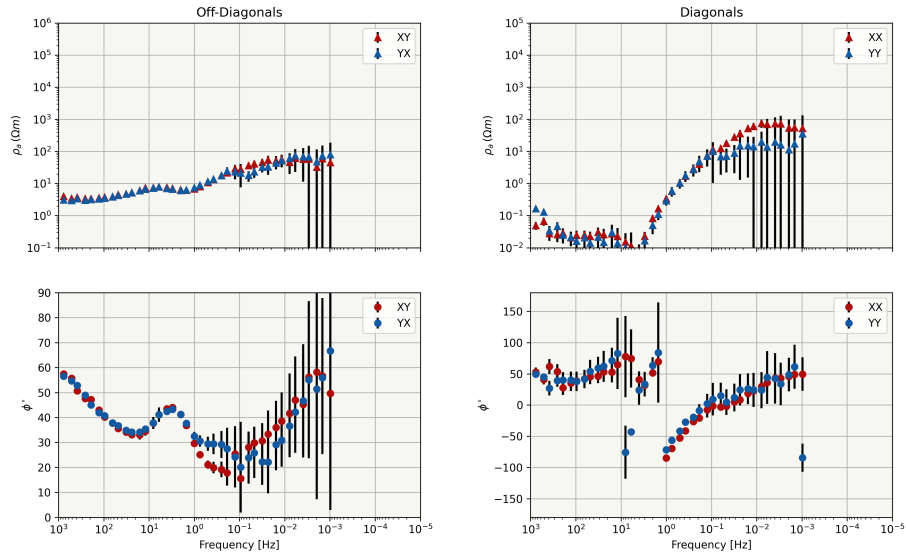


Figure S37. MT responses for the station MTP03.

Station MTP04

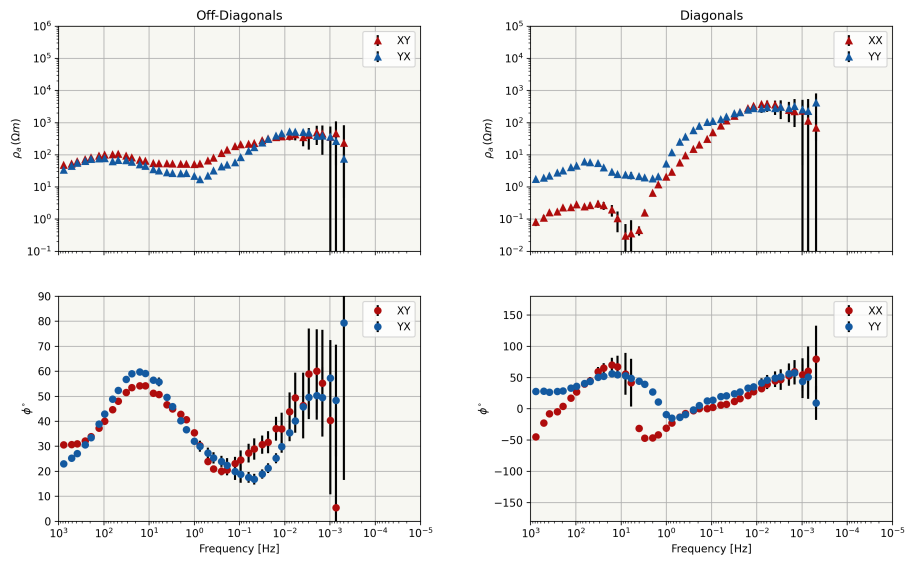


Figure S38. MT responses for the station MTP04.

August 11, 2023, 7:50am

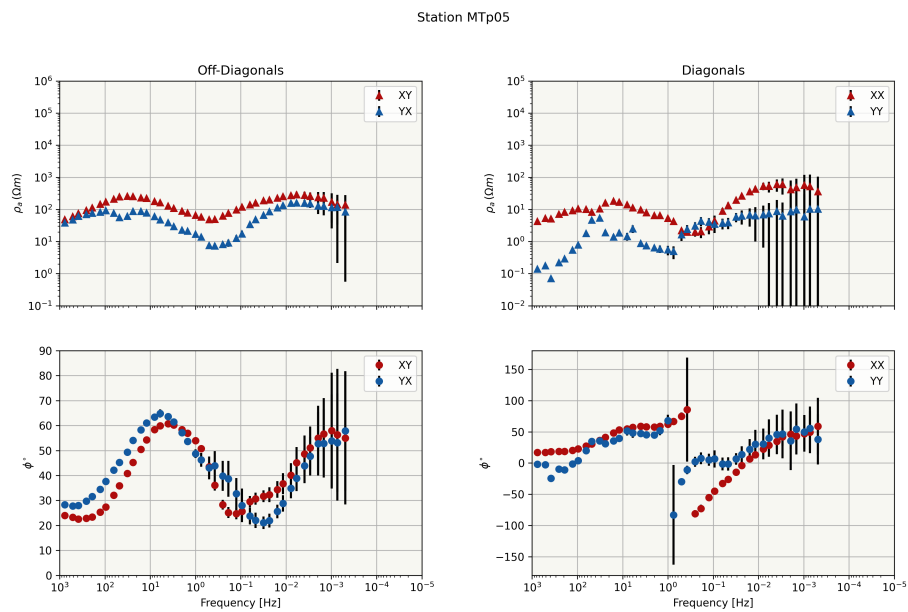


Figure S39. MT responses for the station MTP05.

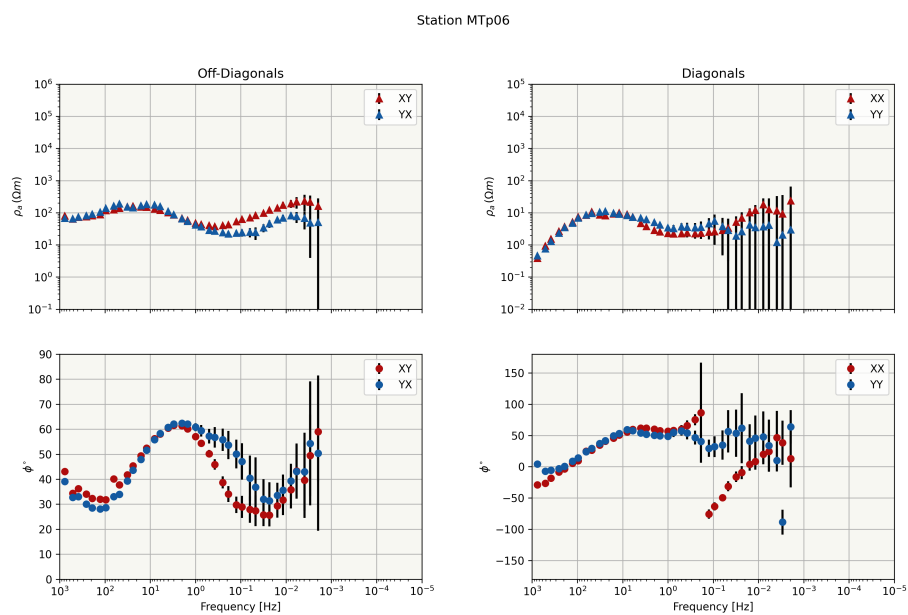


Figure S40. MT responses for the station MTP06.

August 11, 2023, 7:50am

Station MTP07

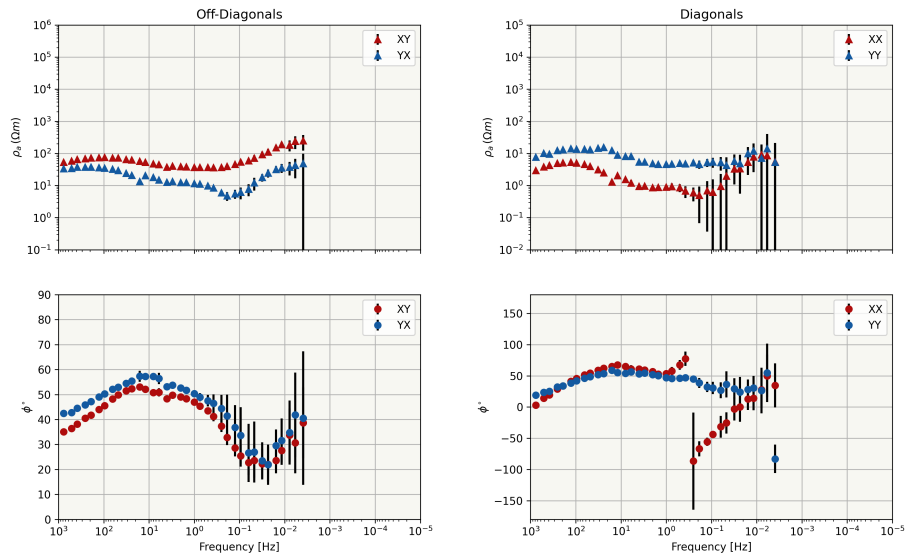


Figure S41. MT responses for the station MTP07.

Station MTP09

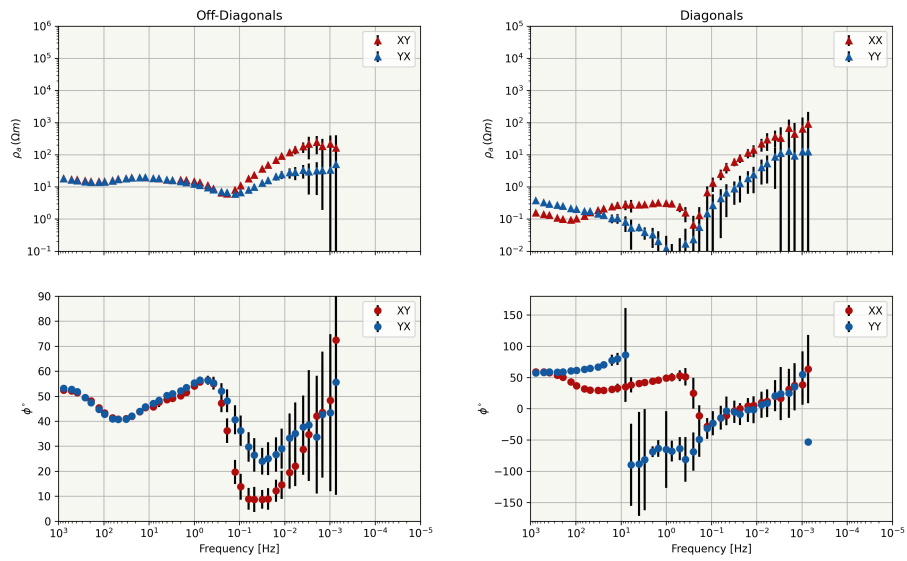


Figure S42. MT responses for the station MTP09.

August 11, 2023, 7:50am

Station MTp10

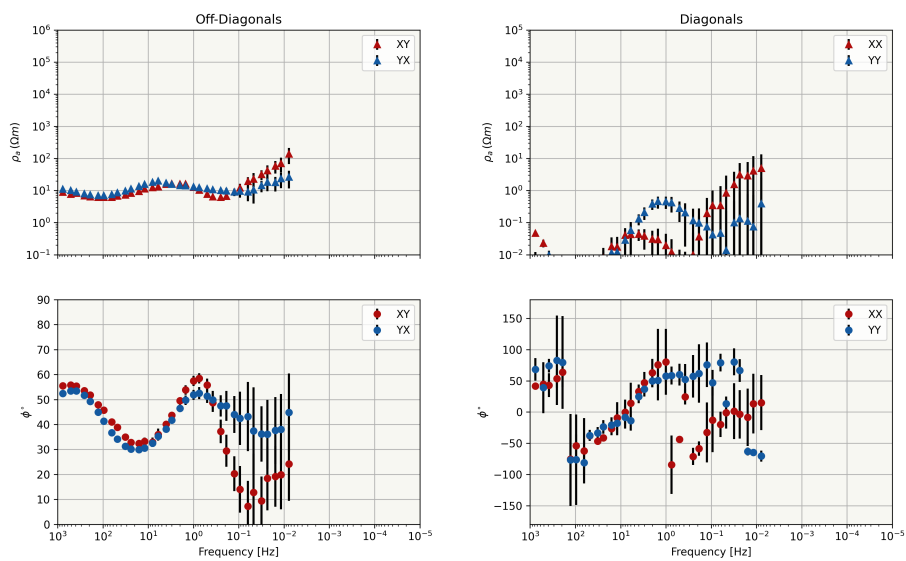


Figure S43. MT responses for the station MTp10.

Station MTp11

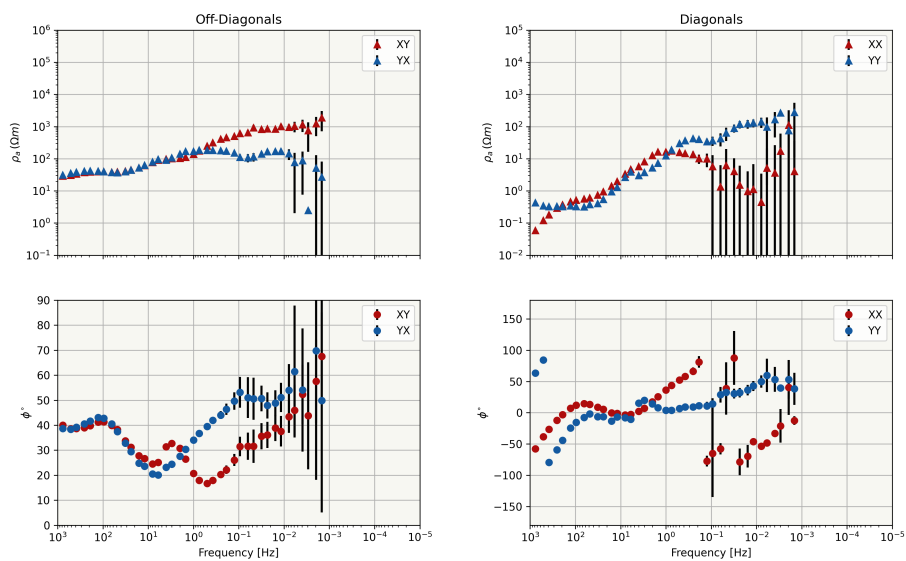


Figure S44. MT responses for the station MTp11.

August 11, 2023, 7:50am

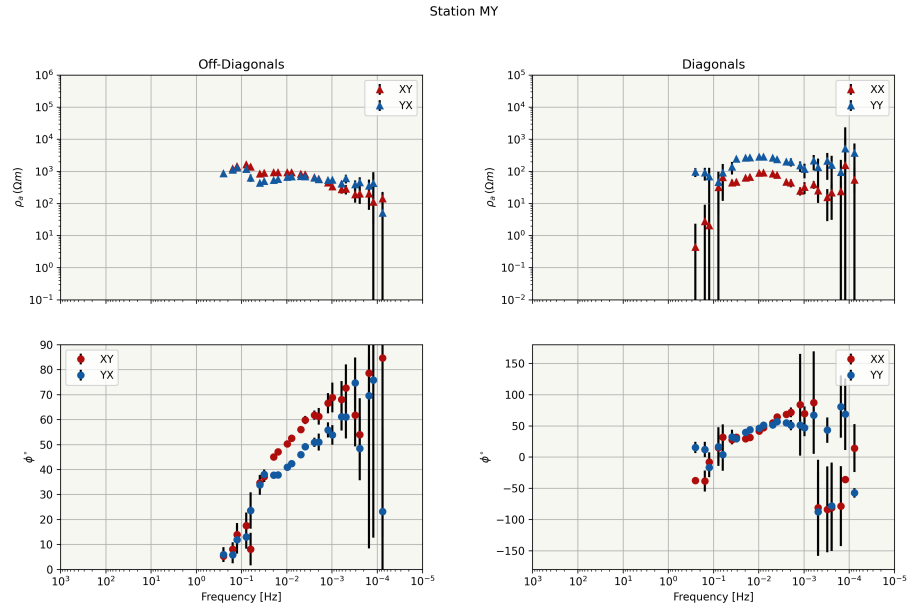


Figure S45. MT responses for the station MY.

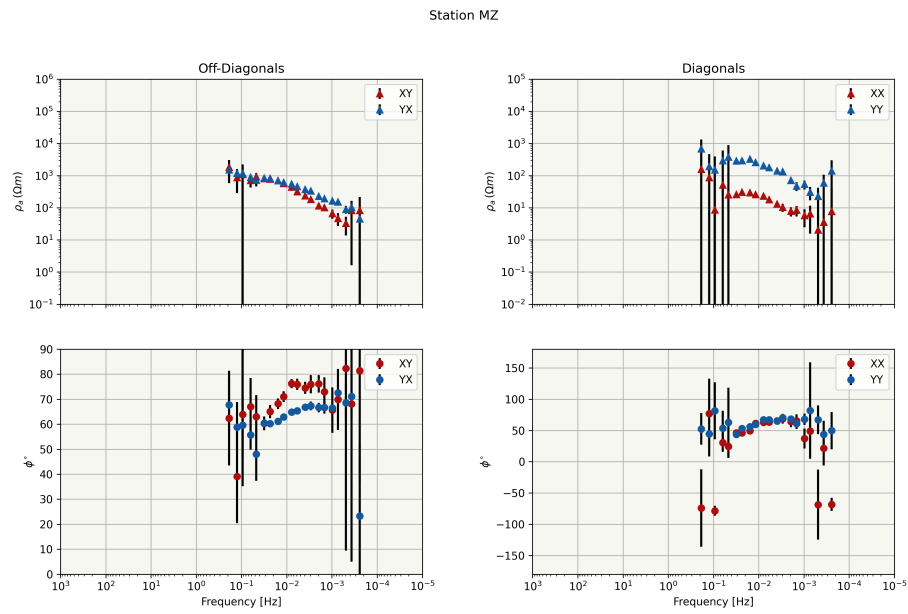


Figure S46. MT responses for the station MZ.

August 11, 2023, 7:50am

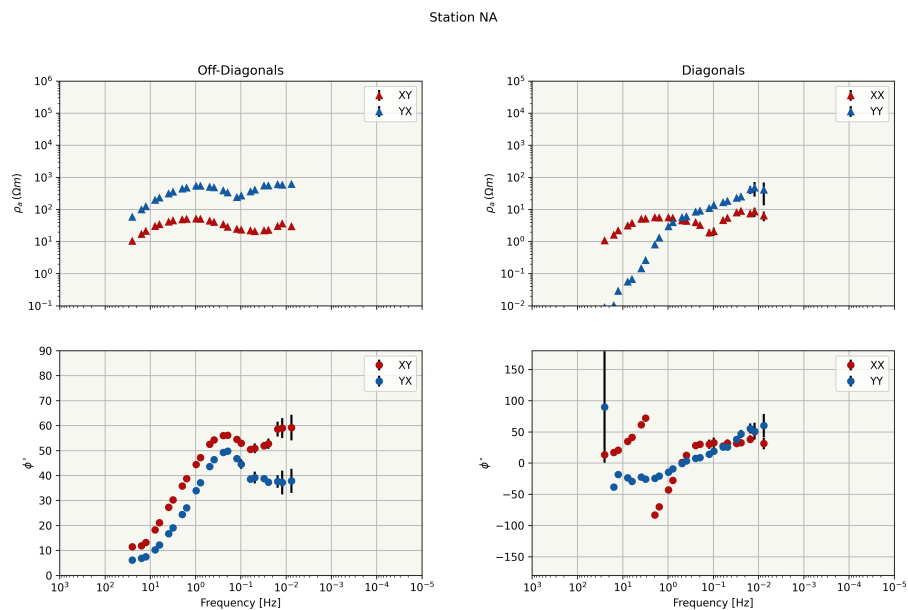


Figure S47. MT responses for the station NA.

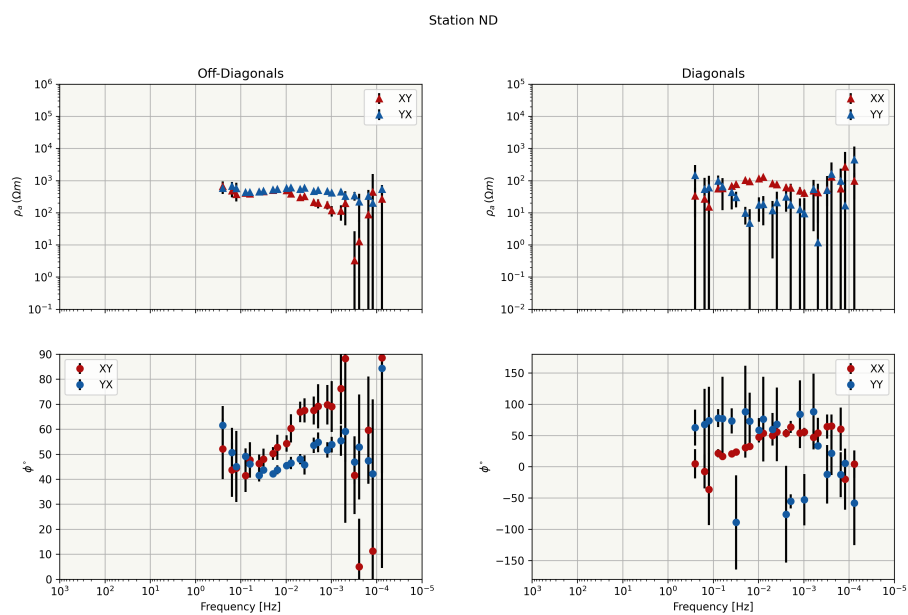


Figure S48. MT responses for the station ND.

August 11, 2023, 7:50am

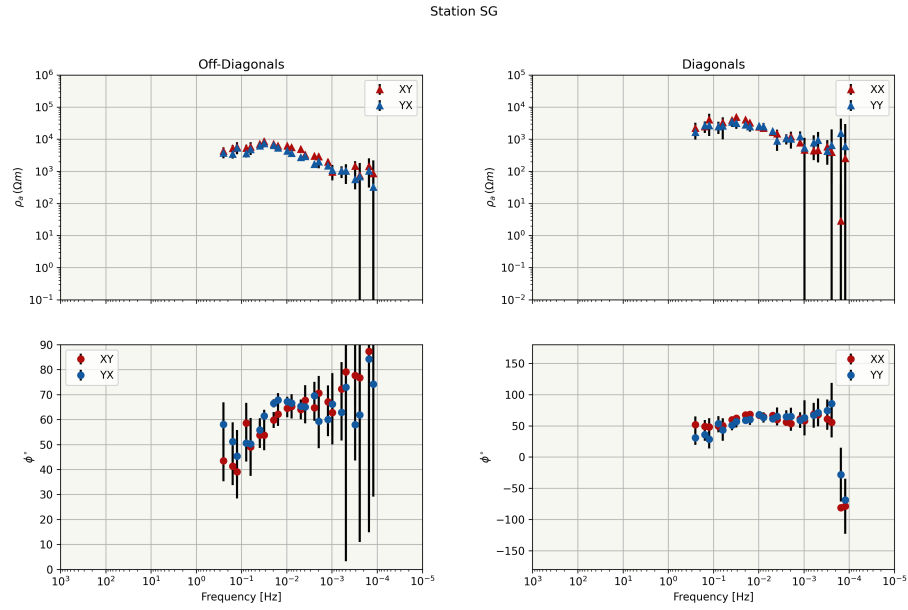


Figure S49. MT responses for the station SG.

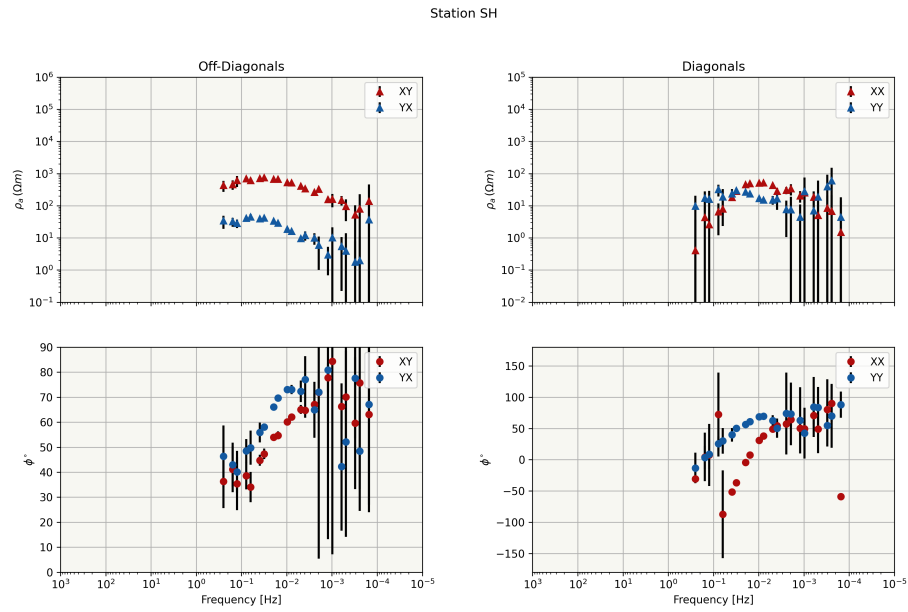


Figure S50. MT responses for the station SH.

August 11, 2023, 7:50am

Station SI

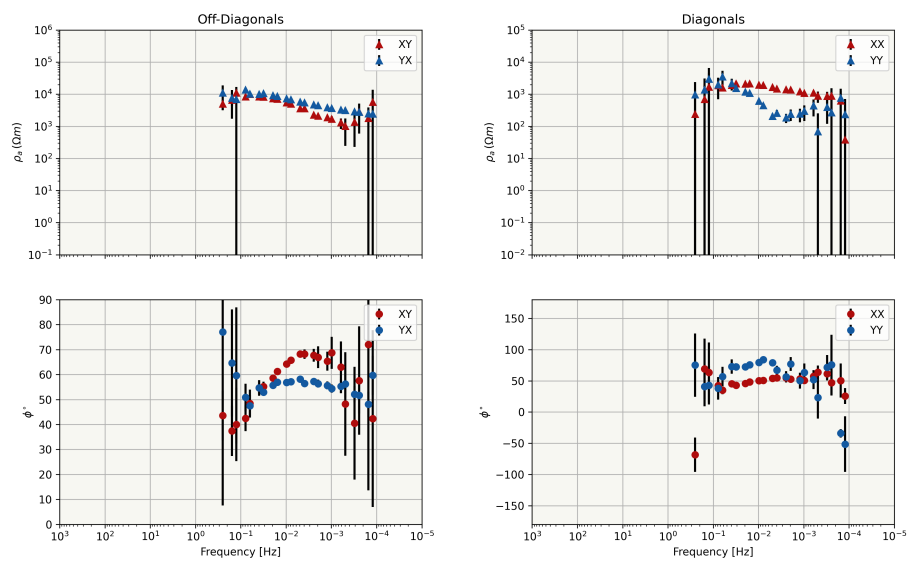


Figure S51. MT responses for the station SI.

Station UR

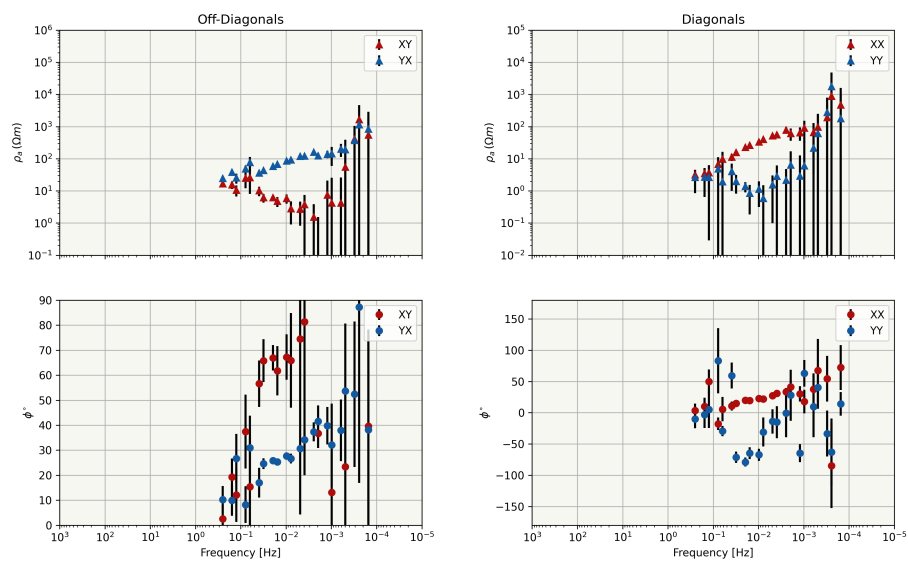


Figure S52. MT responses for the station UR.

August 11, 2023, 7:50am

AR_rev

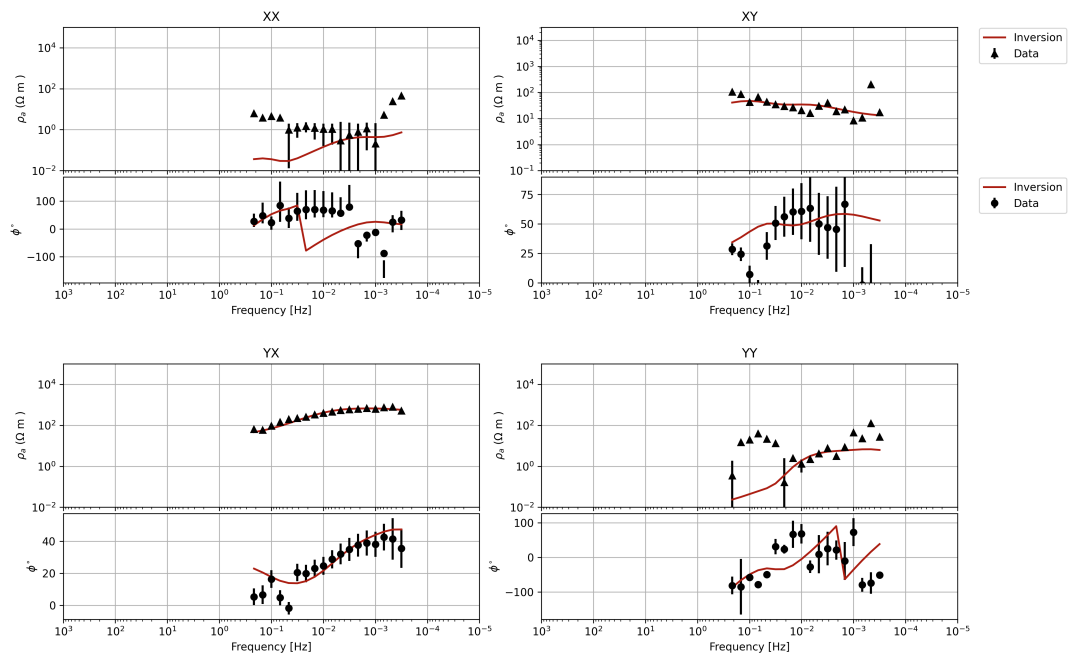


Figure S53. Apparent resistivity and phase fitting plot for the final model: Station AR

August 11, 2023, 7:50am

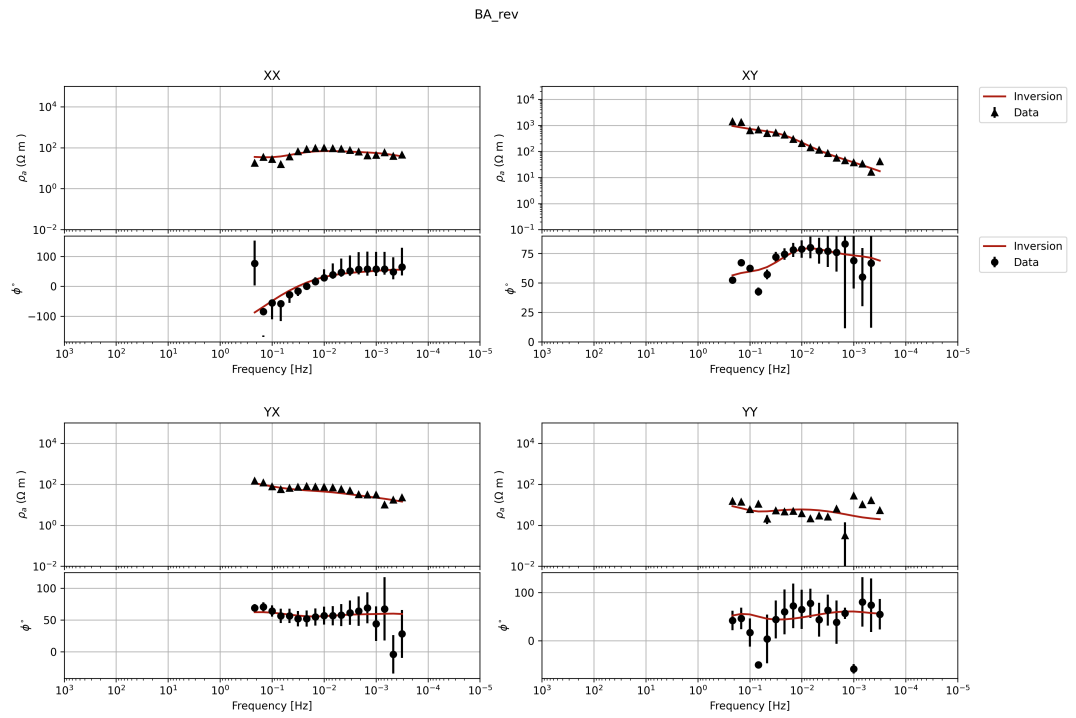


Figure S54. Apparent resistivity and phase fitting plot for the final model: Station BA

August 11, 2023, 7:50am

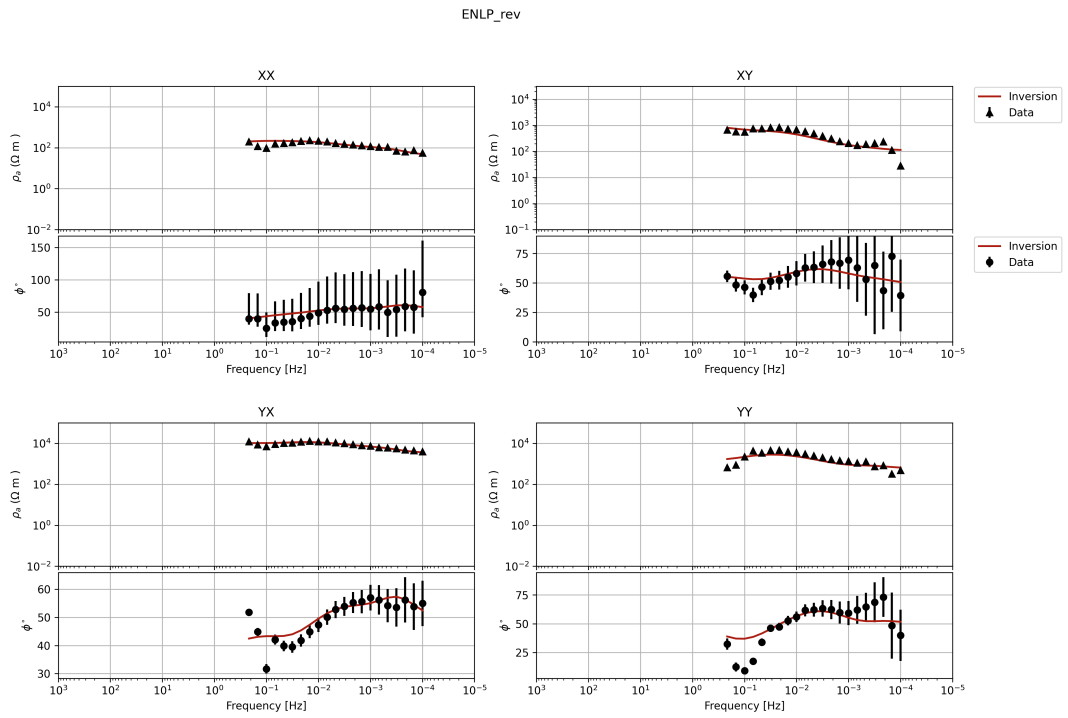


Figure S55. Apparent resistivity and phase fitting plot for the final model: Station ENLP

August 11, 2023, 7:50am

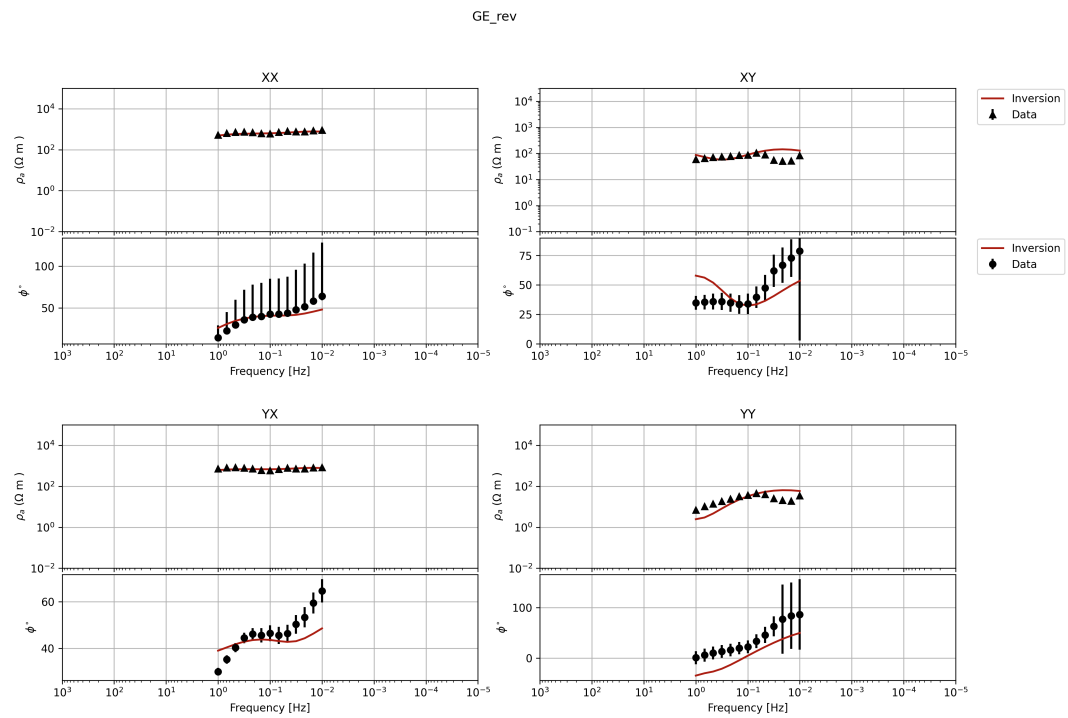


Figure S56. Apparent resistivity and phase fitting plot for the final model: Station GE

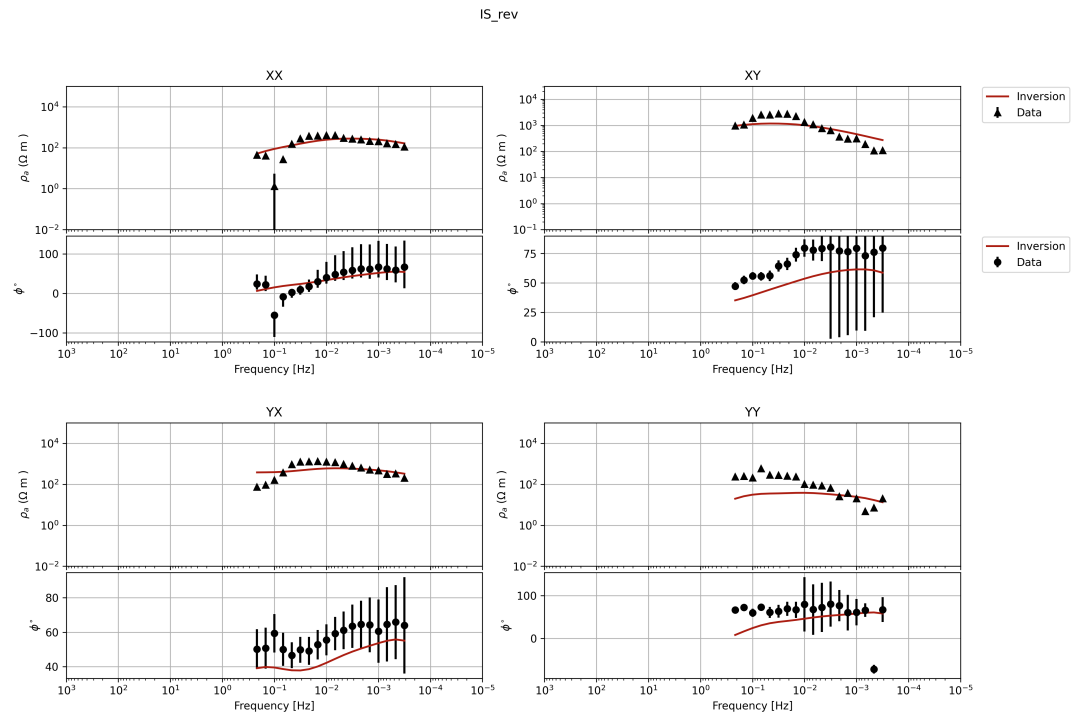


Figure S57. Apparent resistivity and phase fitting plot for the final model: Station IS

August 11, 2023, 7:50am

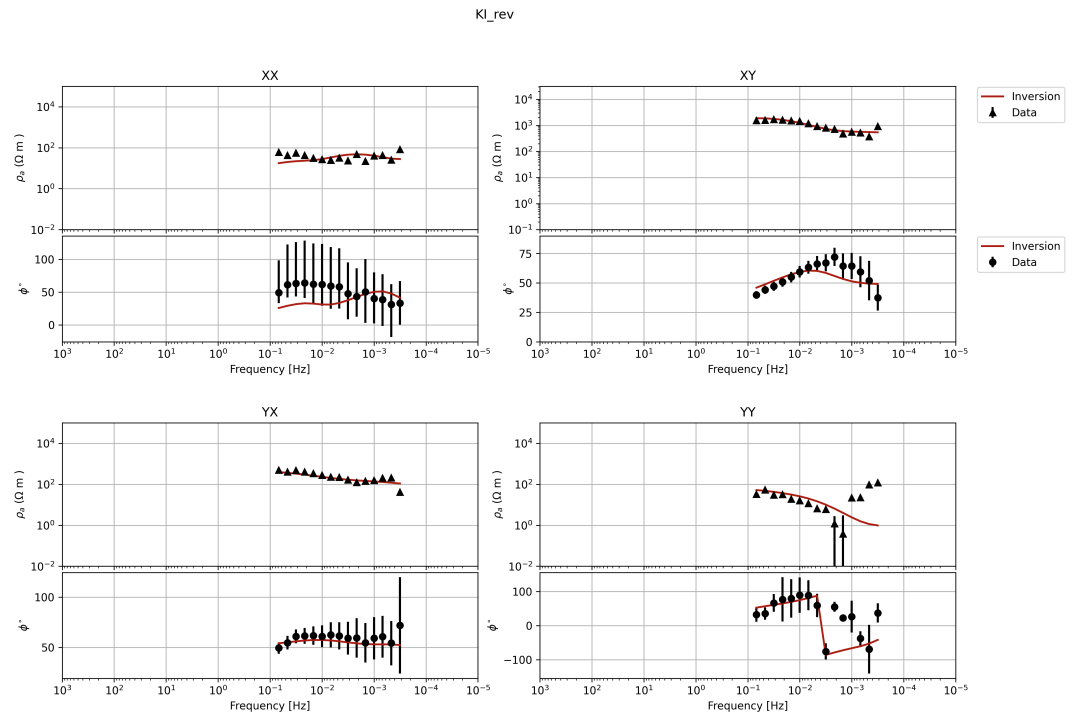


Figure S58. Apparent resistivity and phase fitting plot for the final model: Station KI

August 11, 2023, 7:50am

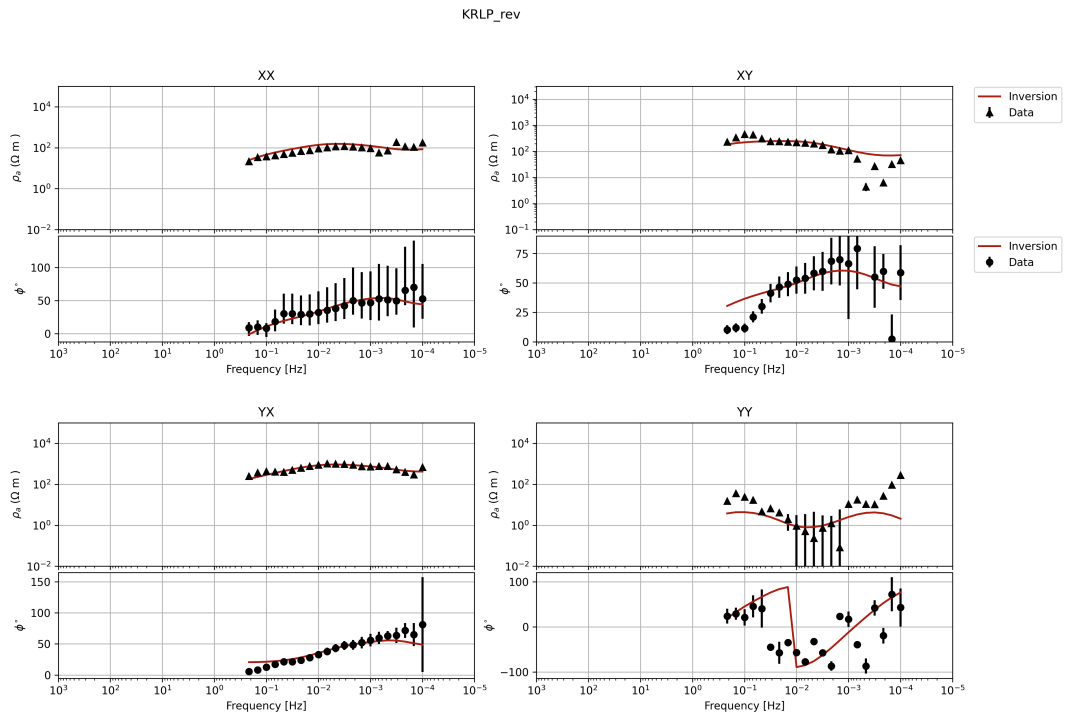


Figure S59. Apparent resistivity and phase fitting plot for the final model: Station KRLP

August 11, 2023, 7:50am

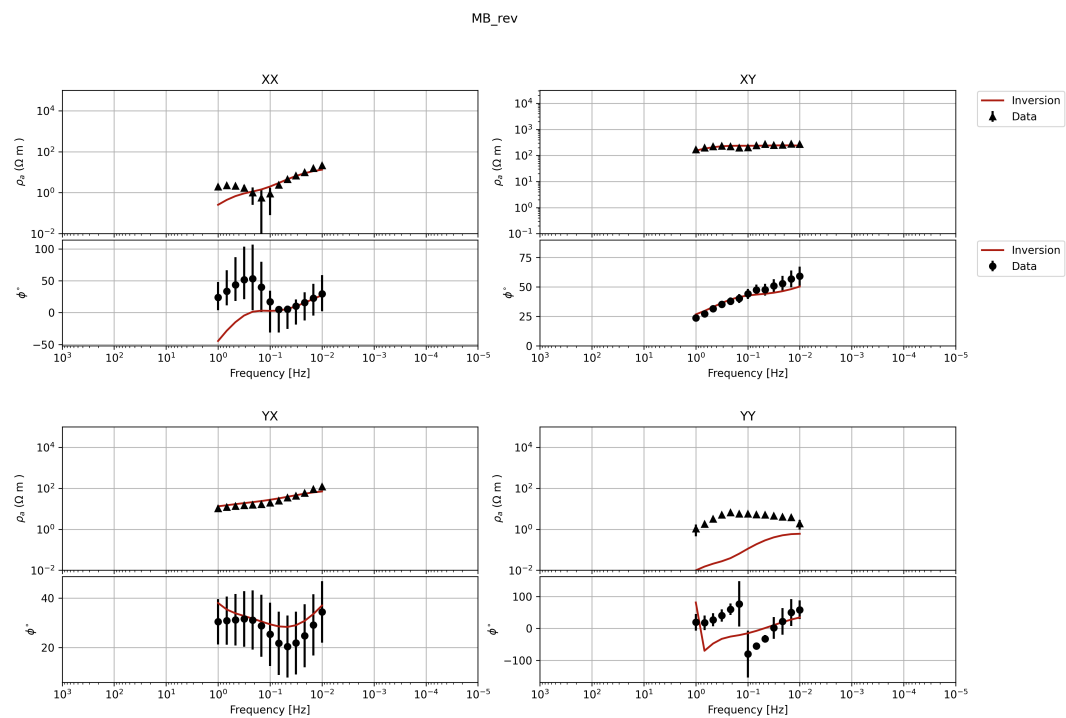


Figure S60. Apparent resistivity and phase fitting plot for the final model: Station MB

August 11, 2023, 7:50am

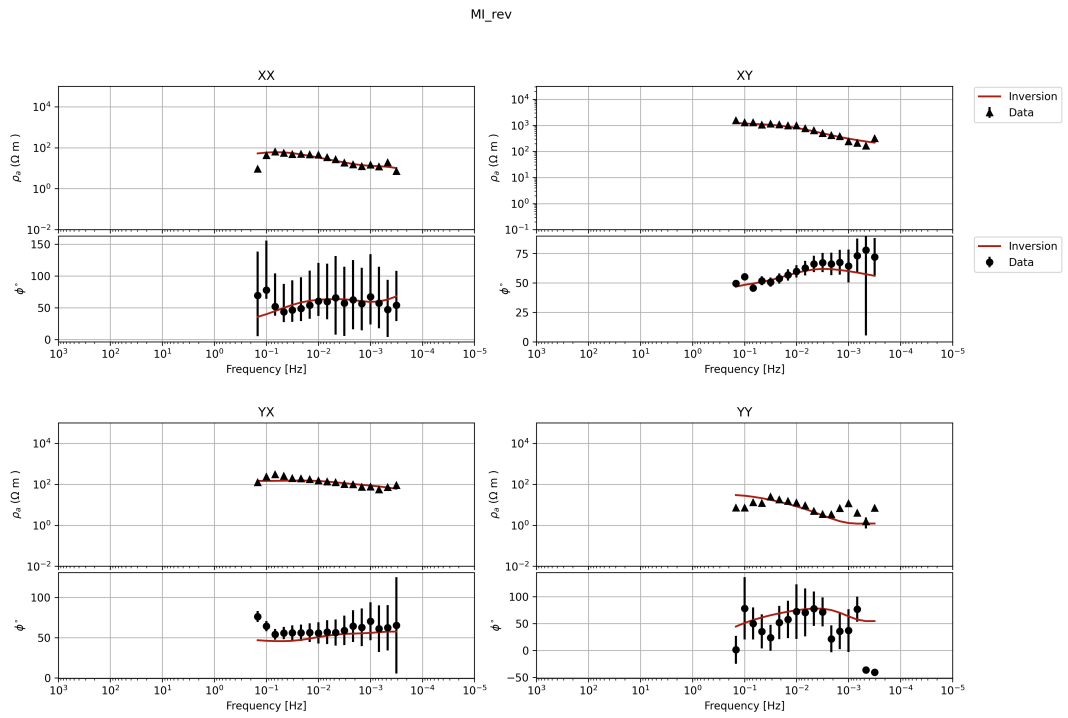


Figure S61. Apparent resistivity and phase fitting plot for the final model: Station MI

August 11, 2023, 7:50am

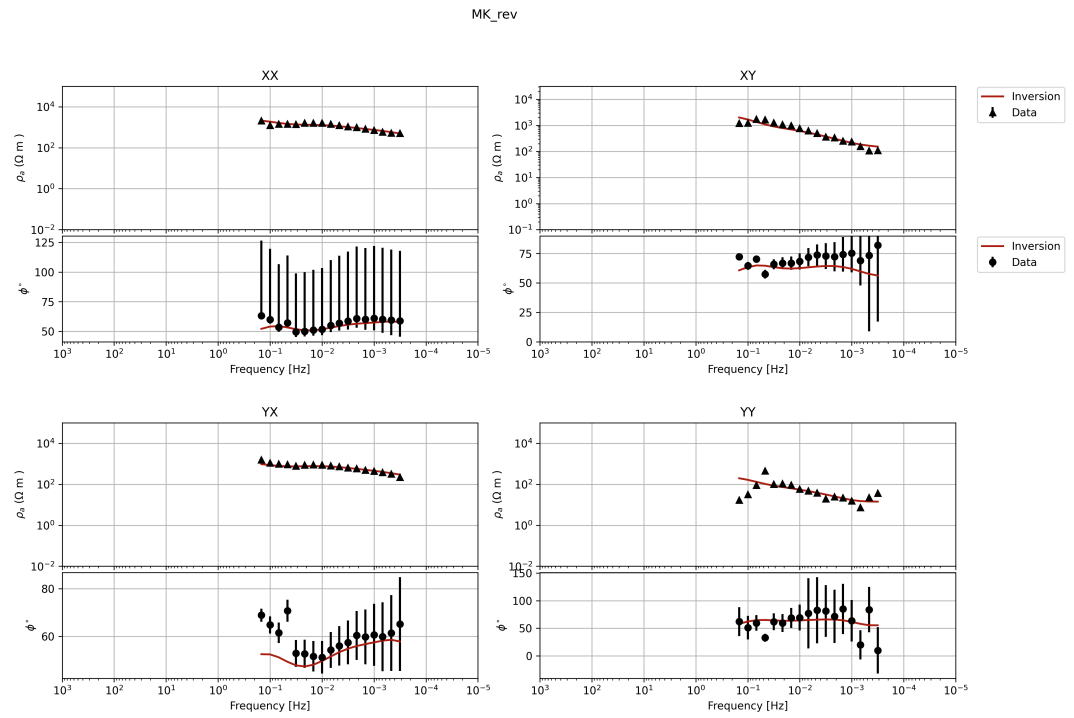


Figure S62. Apparent resistivity and phase fitting plot for the final model: Station MK

August 11, 2023, 7:50am

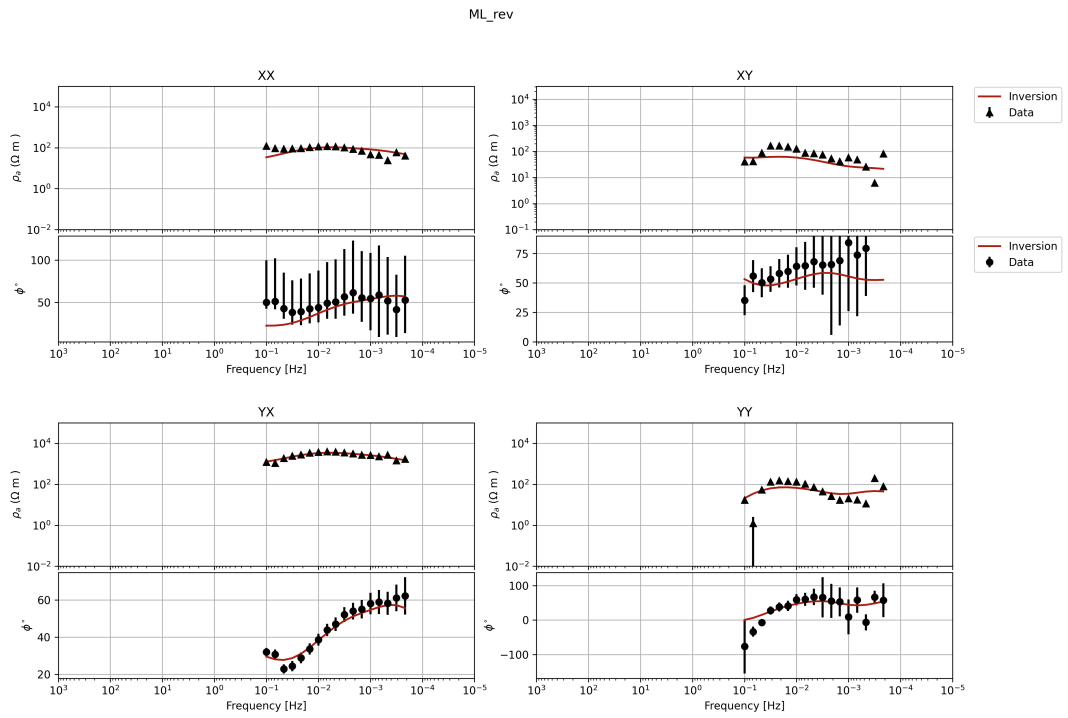


Figure S63. Apparent resistivity and phase fitting plot for the final model: Station ML

August 11, 2023, 7:50am

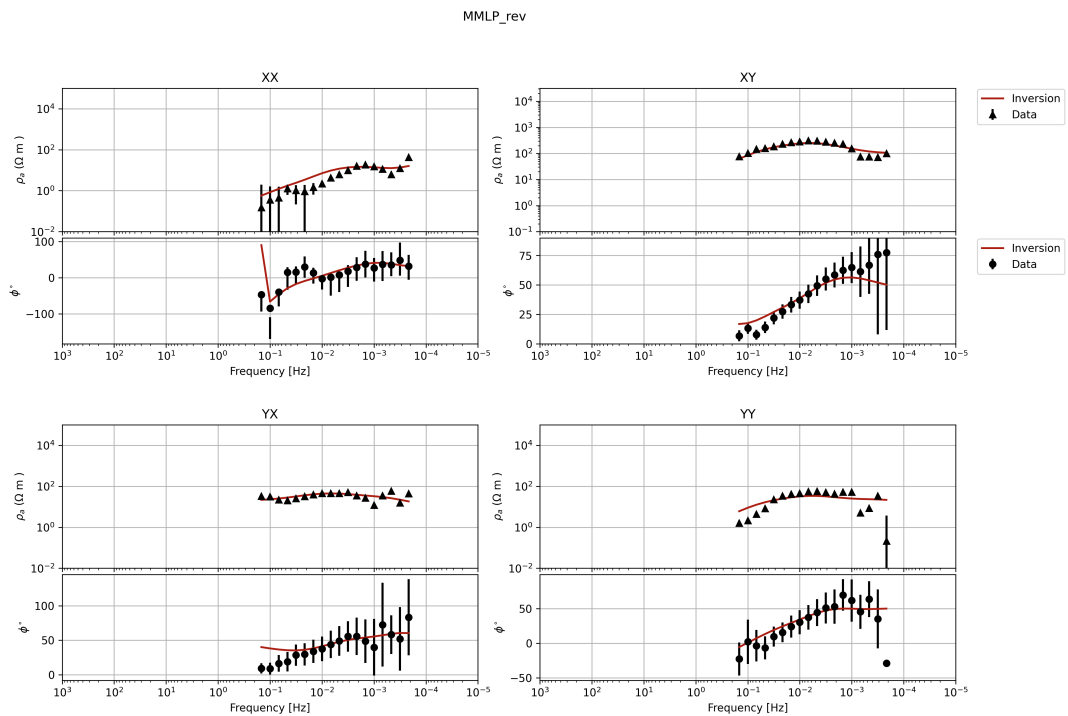


Figure S64. Apparent resistivity and phase fitting plot for the final model: Station MMLP

August 11, 2023, 7:50am

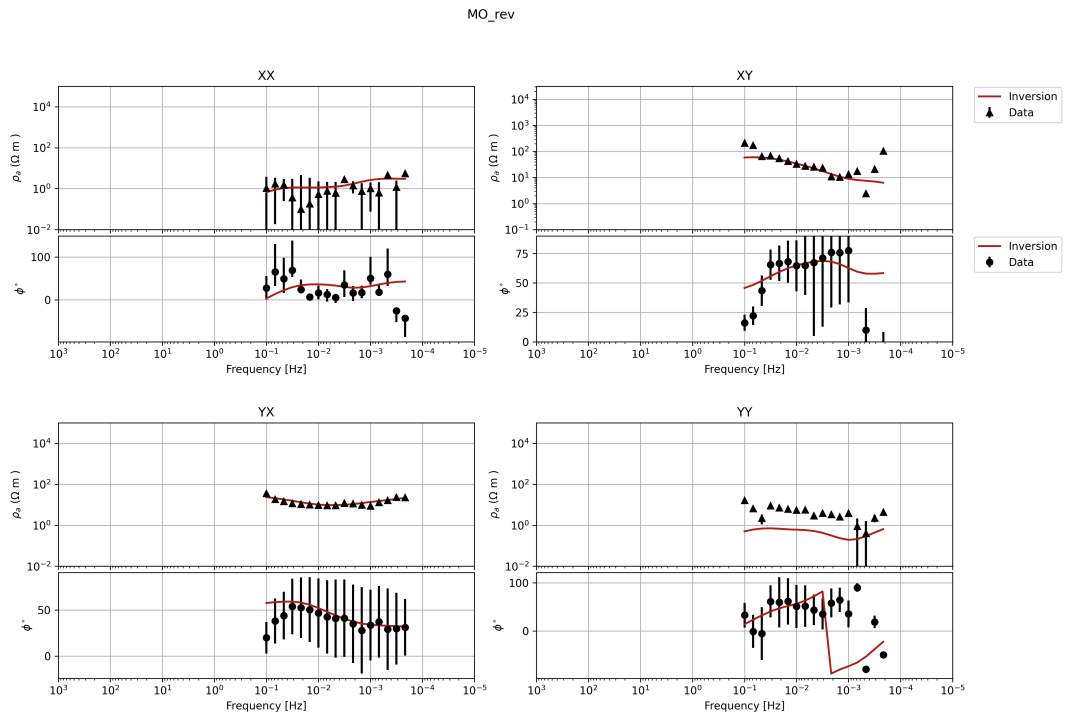


Figure S65. Apparent resistivity and phase fitting plot for the final model: Station MO

August 11, 2023, 7:50am

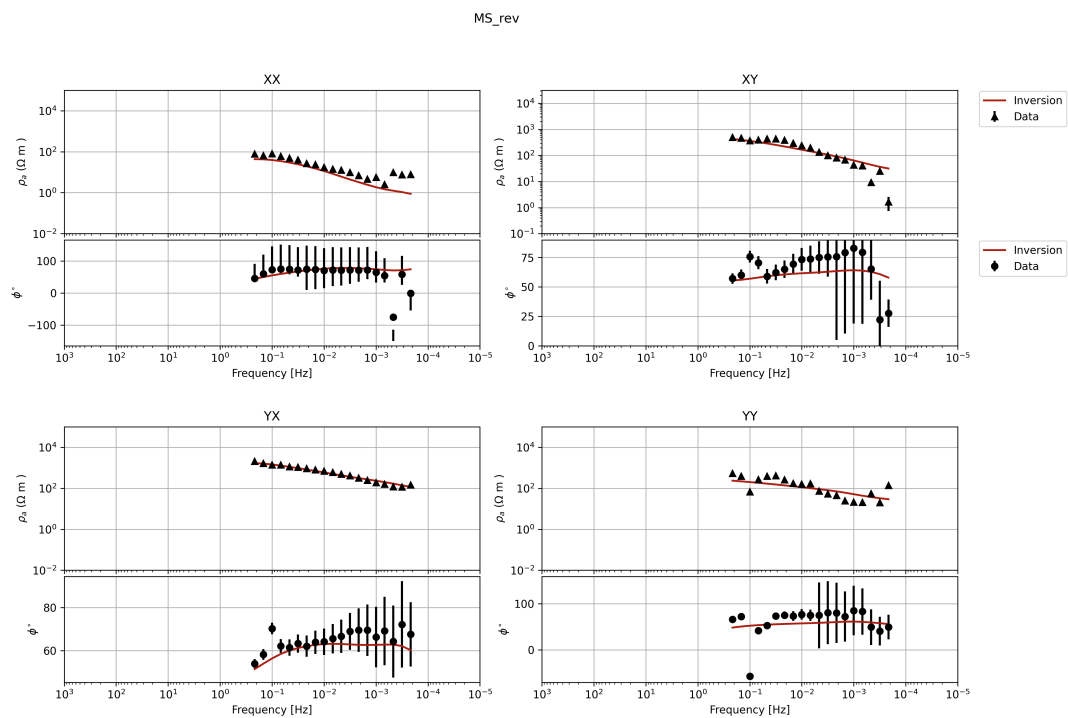


Figure S66. Apparent resistivity and phase fitting plot for the final model: Station MS

August 11, 2023, 7:50am

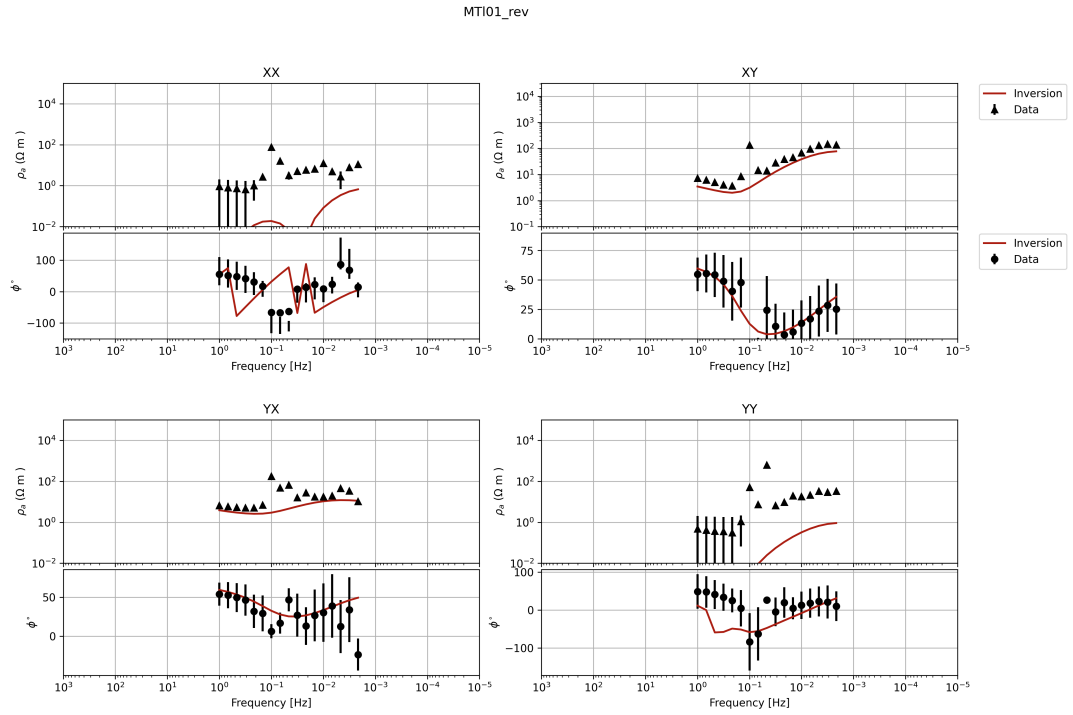


Figure S67. Apparent resistivity and phase fitting plot for the final model: Station MTI01

August 11, 2023, 7:50am

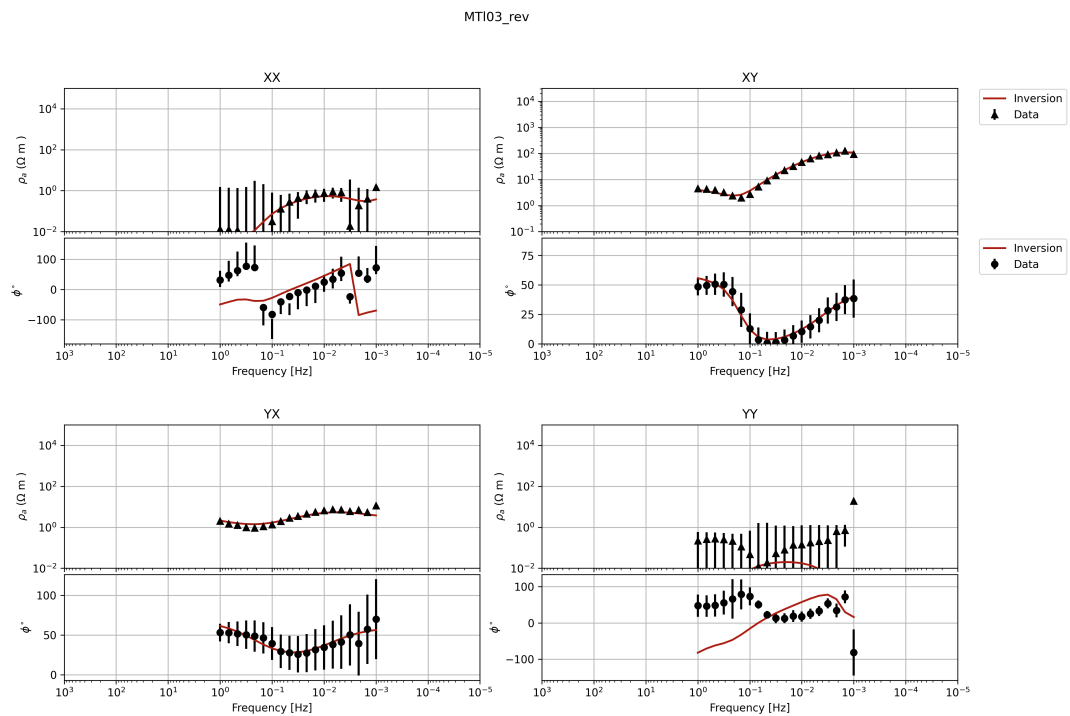


Figure S68. Apparent resistivity and phase fitting plot for the final model: Station MTI03

August 11, 2023, 7:50am

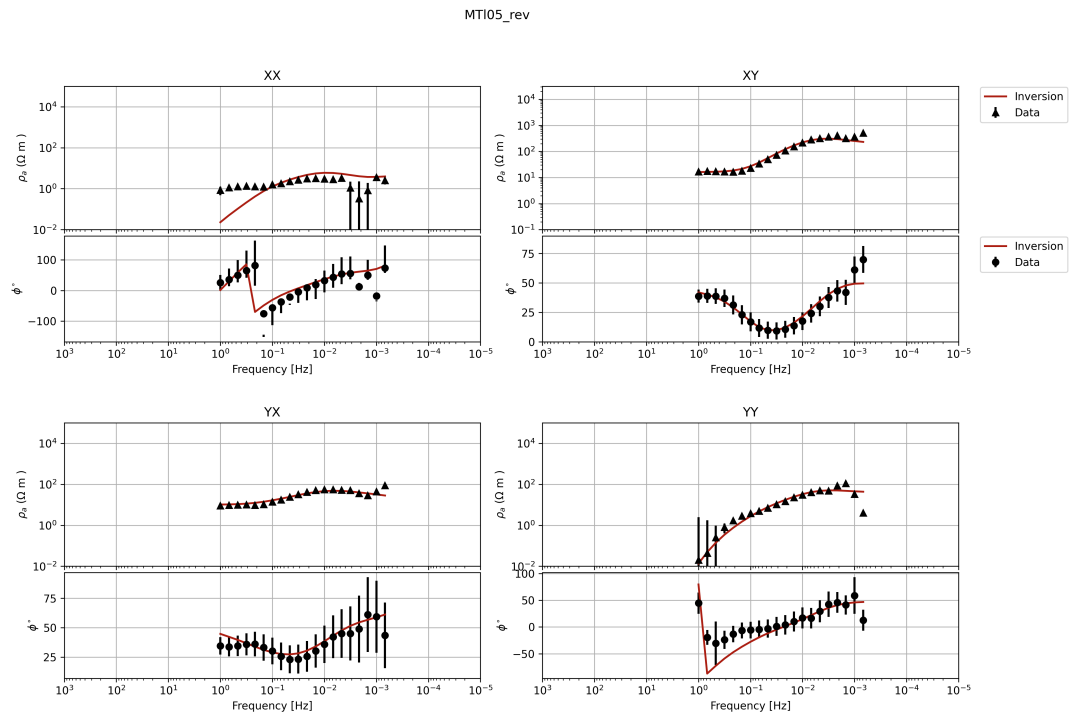


Figure S69. Apparent resistivity and phase fitting plot for the final model: Station MT105

August 11, 2023, 7:50am

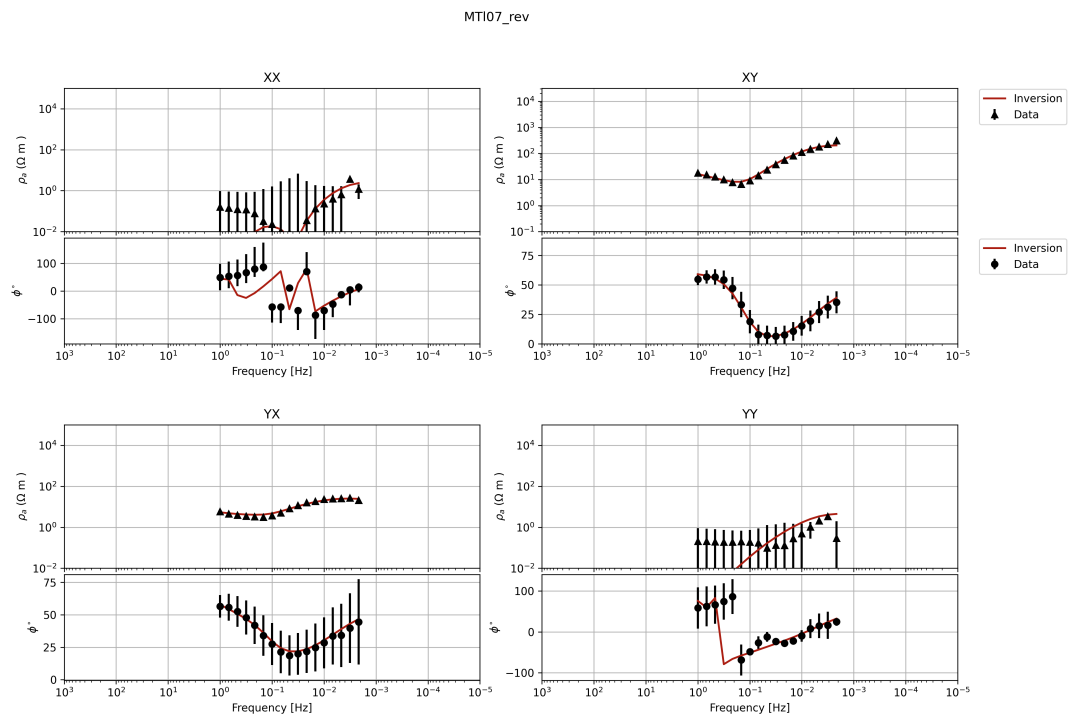


Figure S70. Apparent resistivity and phase fitting plot for the final model: Station MT107.

August 11, 2023, 7:50am

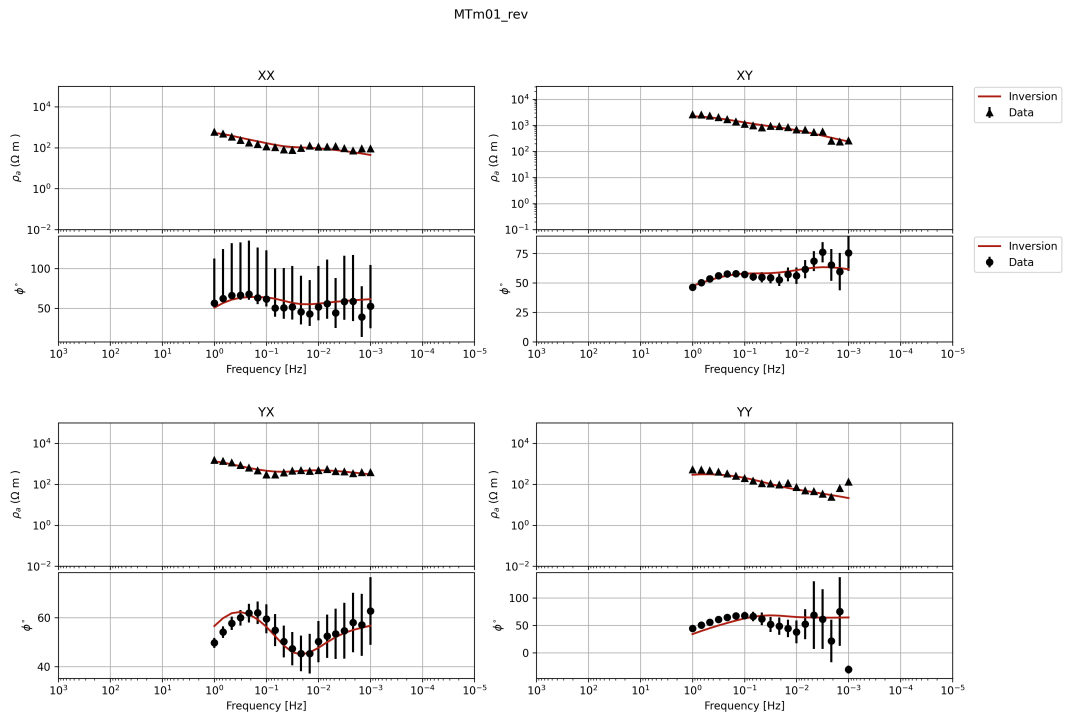


Figure S71. Apparent resistivity and phase fitting plot for the final model: Station MTm01

August 11, 2023, 7:50am

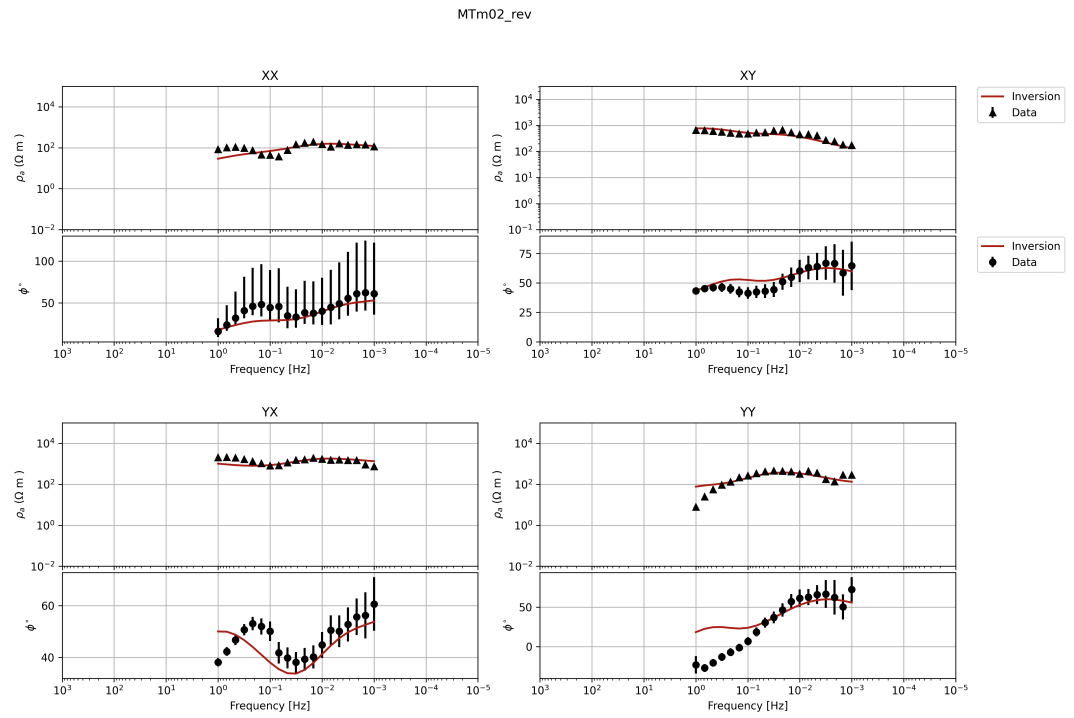


Figure S72. Apparent resistivity and phase fitting plot for the final model: Station MTm02

August 11, 2023, 7:50am

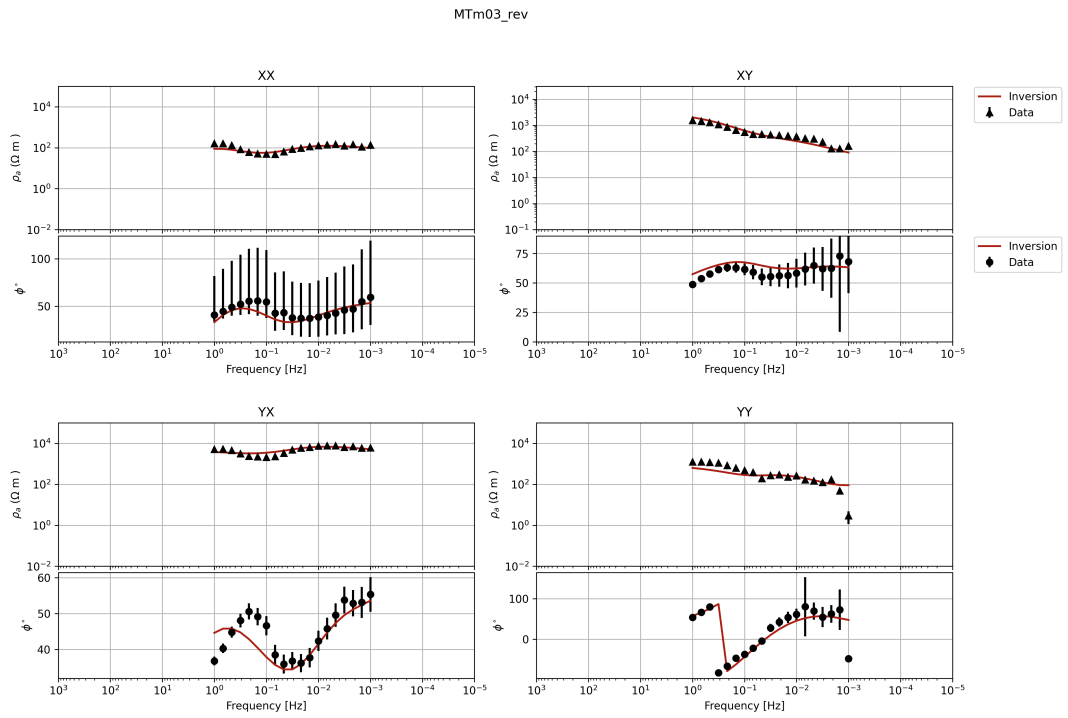


Figure S73. Apparent resistivity and phase fitting plot for the final model: Station MTm03

August 11, 2023, 7:50am

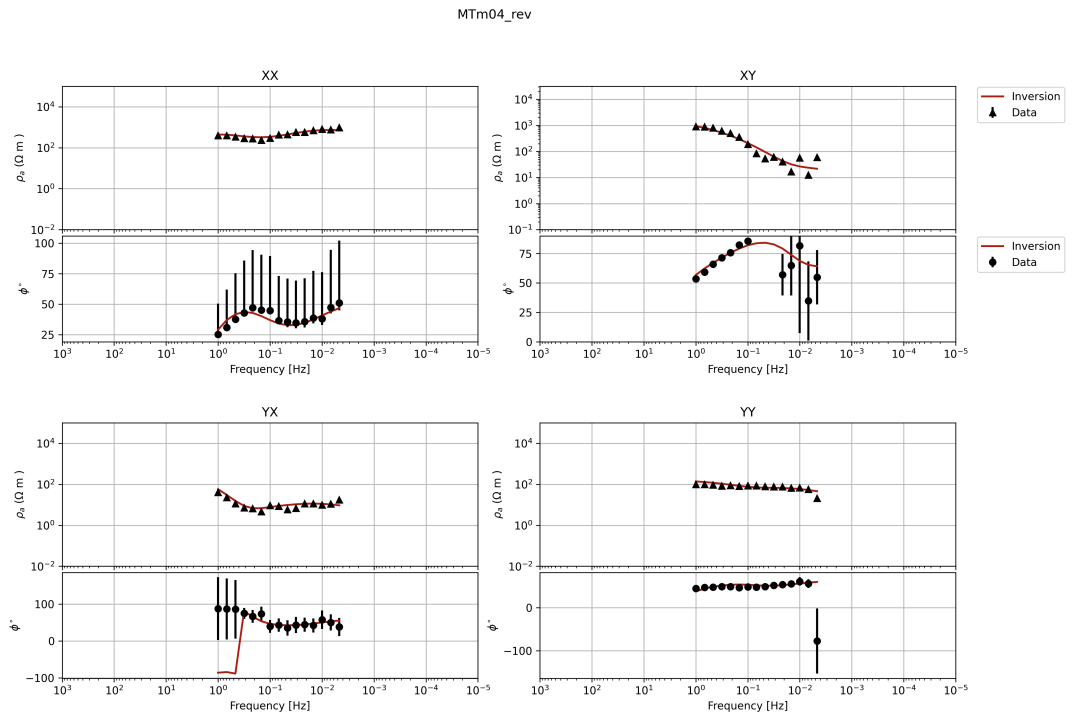


Figure S74. Apparent resistivity and phase fitting plot for the final model: Station MTm04

August 11, 2023, 7:50am

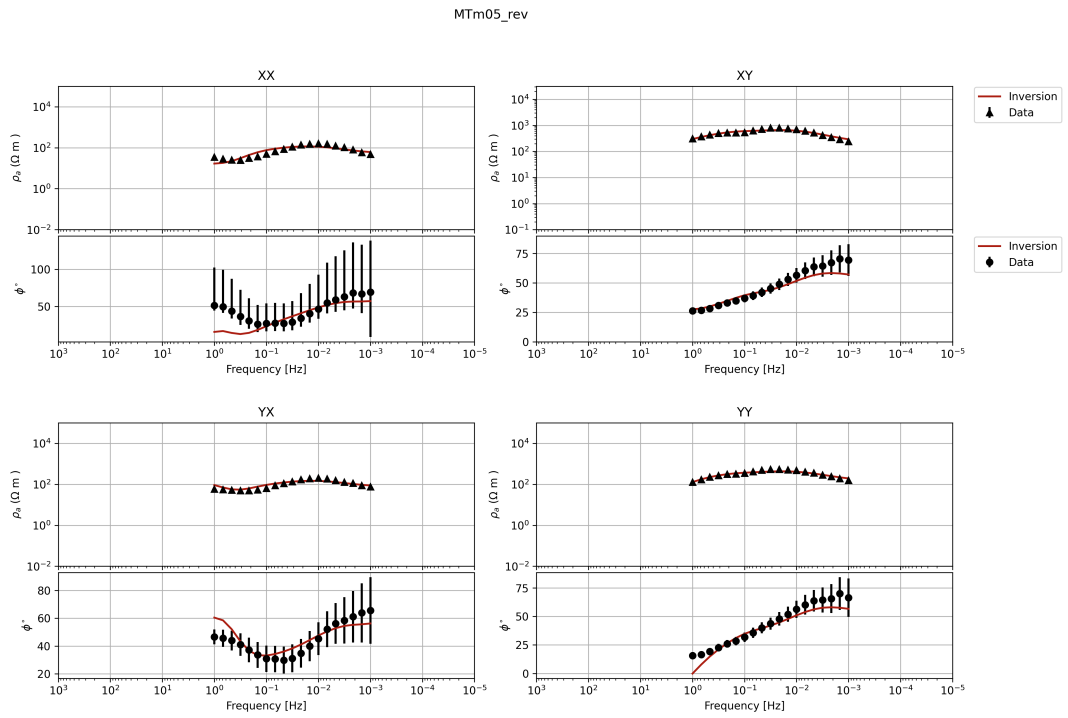


Figure S75. Apparent resistivity and phase fitting plot for the final model: Station MTm05

August 11, 2023, 7:50am

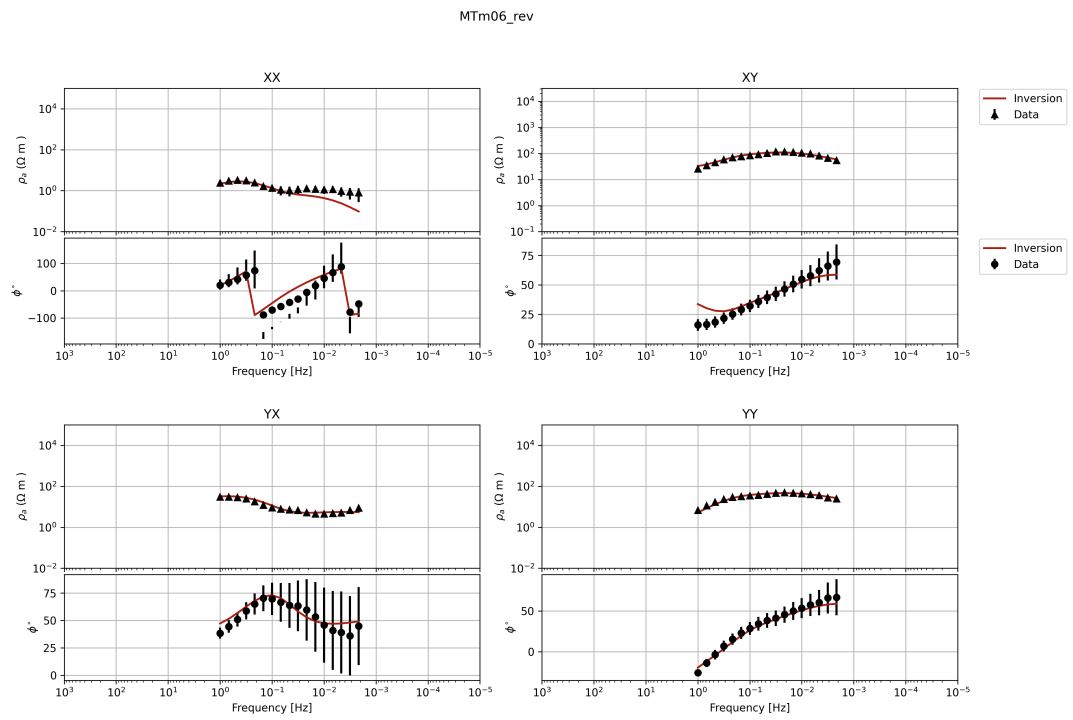


Figure S76. Apparent resistivity and phase fitting plot for the final model: Station MTm06

August 11, 2023, 7:50am

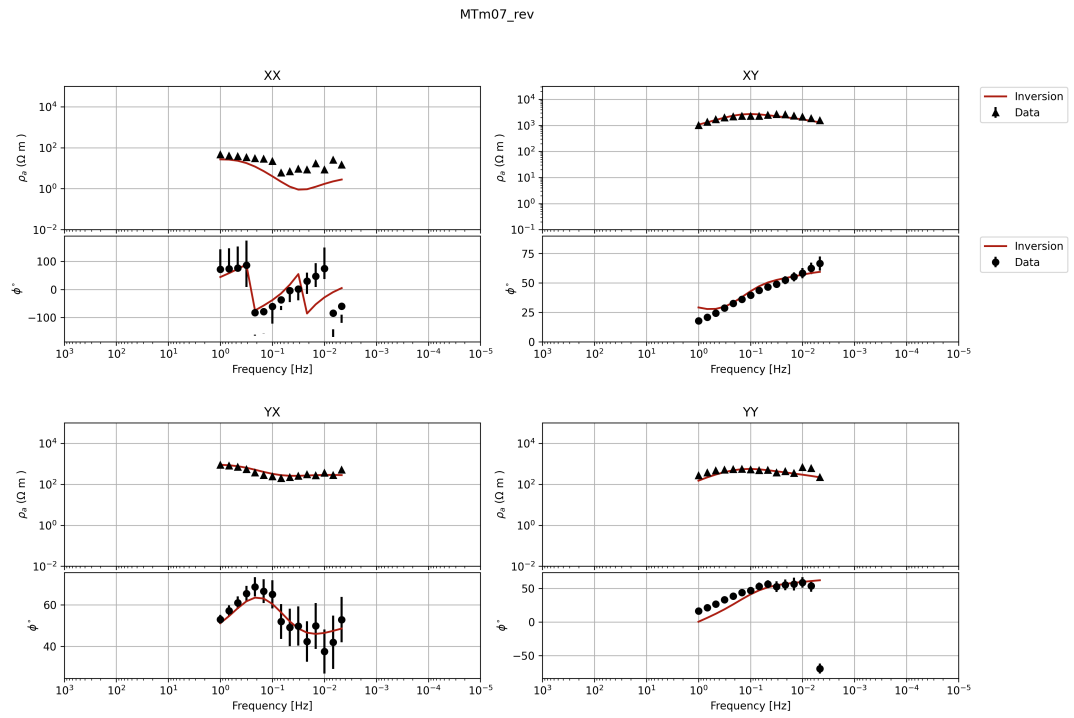


Figure S77. Apparent resistivity and phase fitting plot for the final model: Station MTm07

August 11, 2023, 7:50am

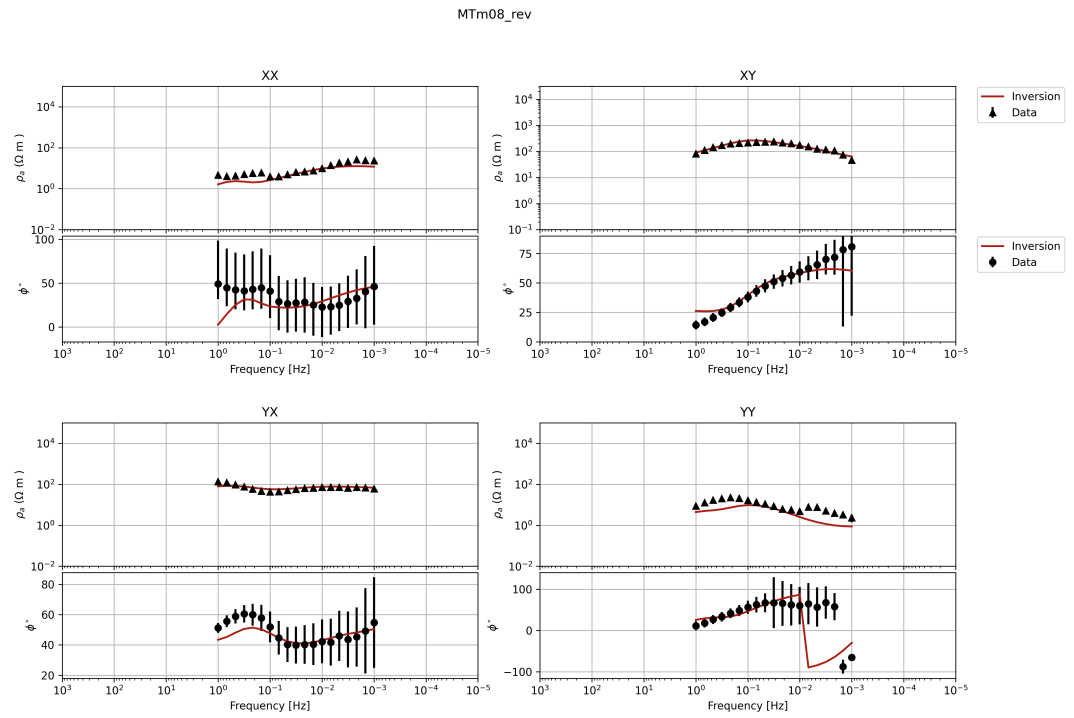


Figure S78. Apparent resistivity and phase fitting plot for the final model: Station MTm08

August 11, 2023, 7:50am

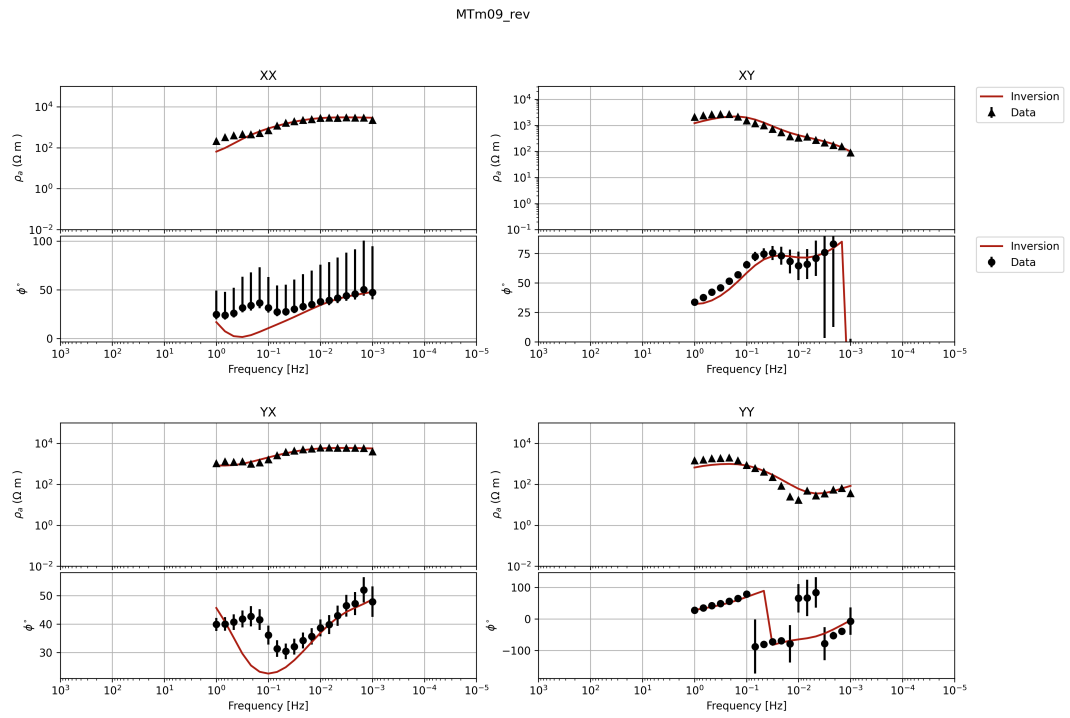


Figure S79. Apparent resistivity and phase fitting plot for the final model: Station MTm09

August 11, 2023, 7:50am

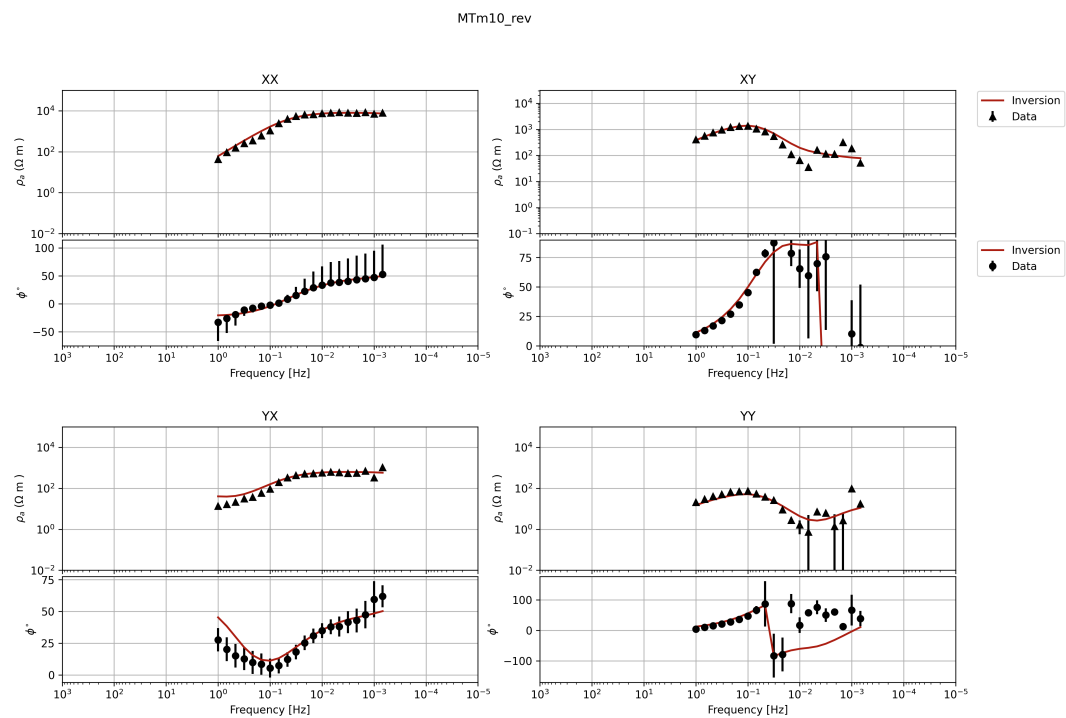
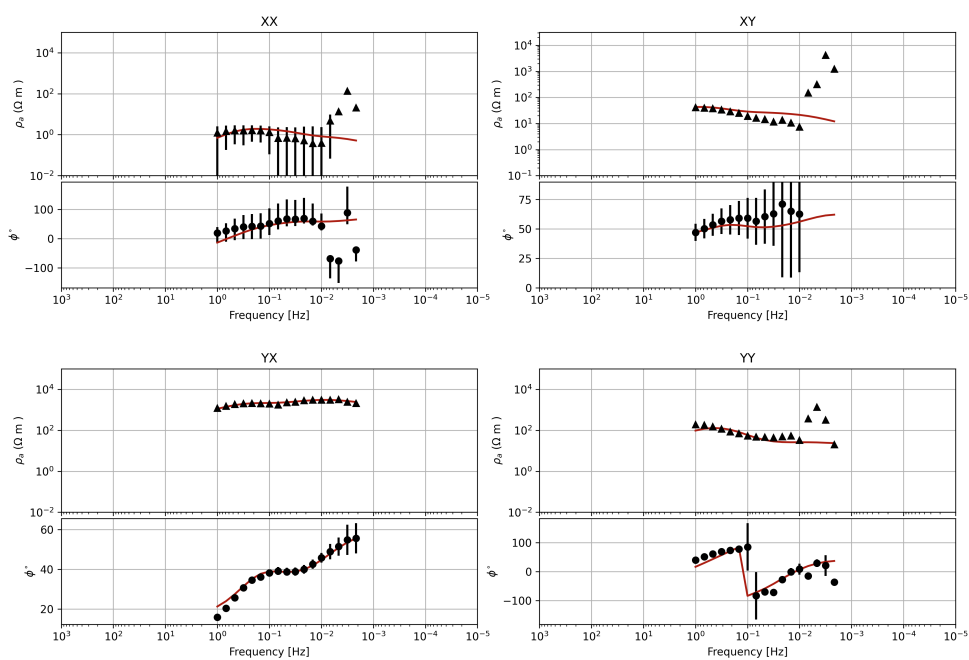


Figure S80. Apparent resistivity and phase fitting plot for the final model: Station MTm10

August 11, 2023, 7:50am

— Inversion
▲ Data

— Inversion
● Data



August 11, 2023, 7:50am

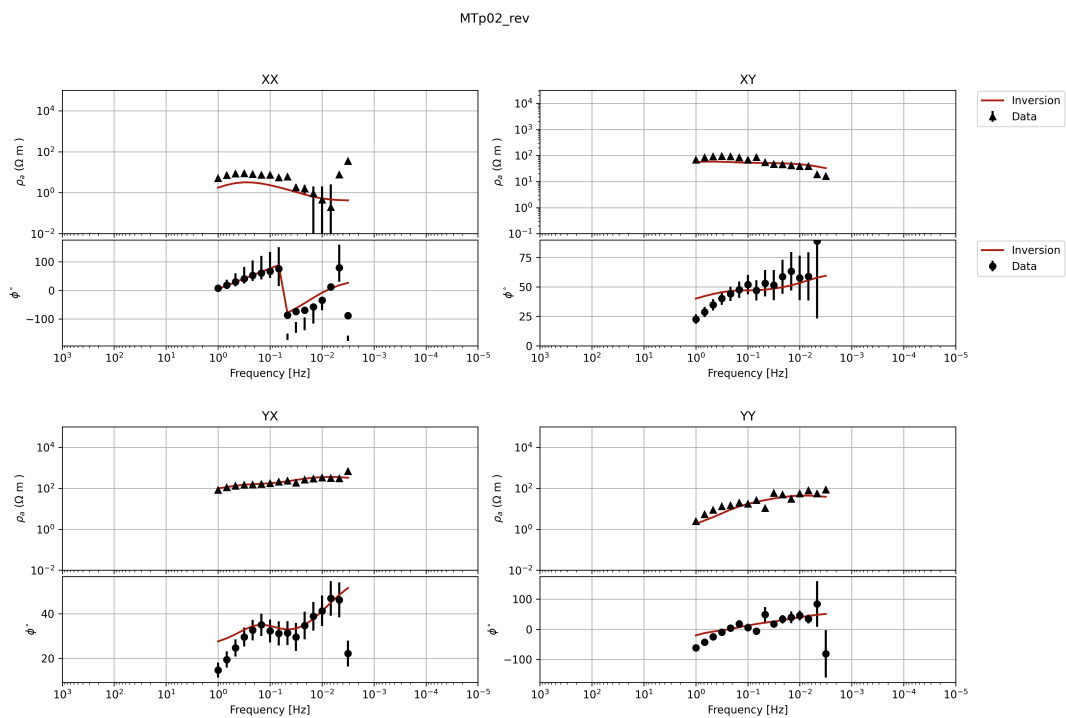


Figure S82. Apparent resistivity and phase fitting plot for the final model: Station MTp02.

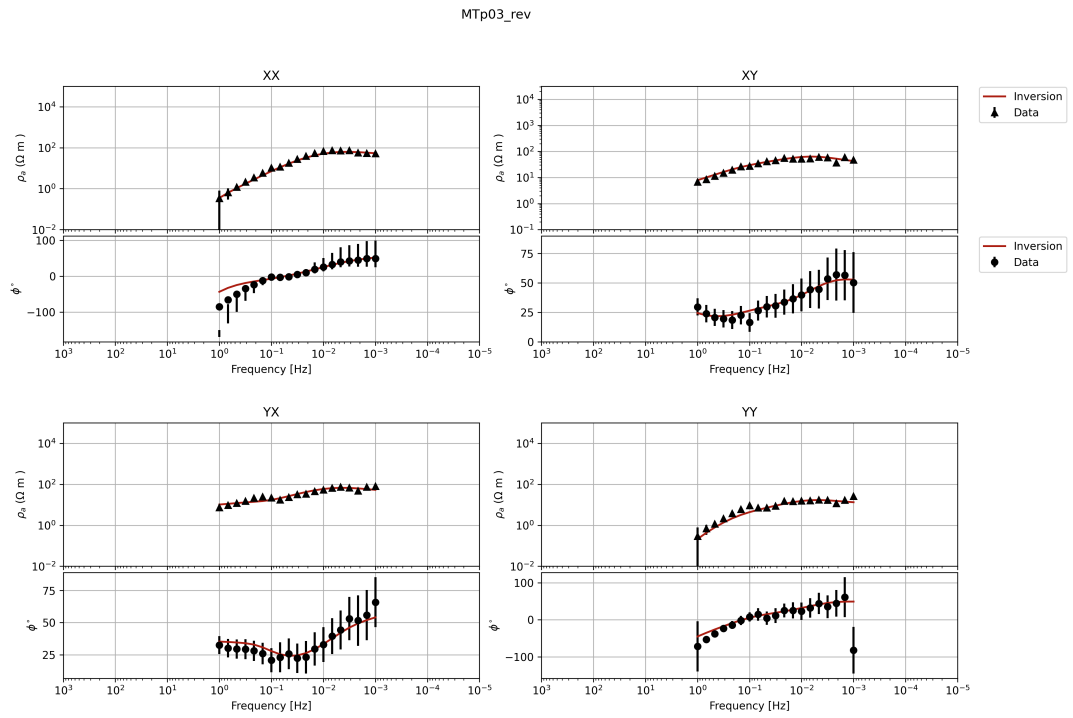


Figure S83. Apparent resistivity and phase fitting plot for the final model: Station MTp03.

August 11, 2023, 7:50am

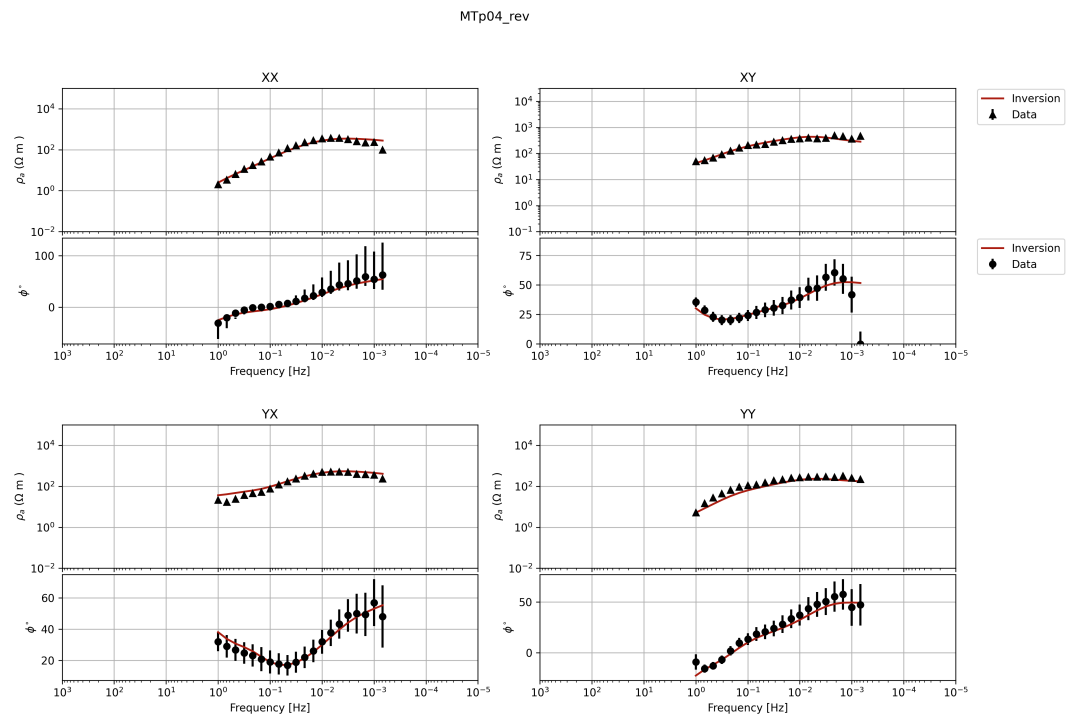


Figure S84. Apparent resistivity and phase fitting plot for the final model: Station MTp04.

August 11, 2023, 7:50am

MTp05_rev

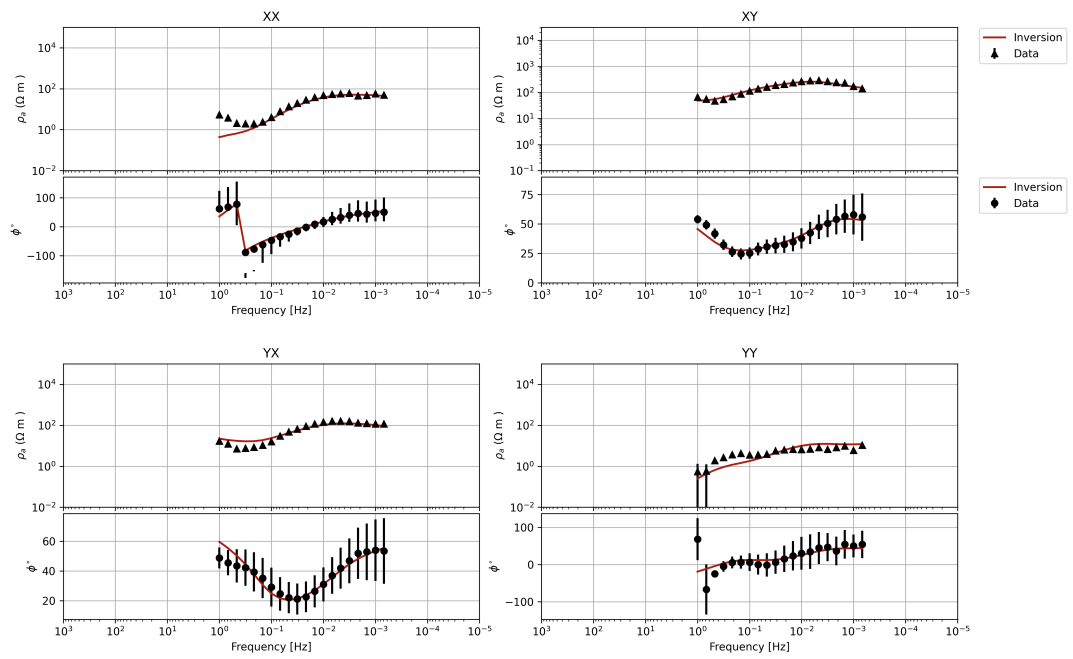


Figure S85. Apparent resistivity and phase fitting plot for the final model: Station MTp05.

August 11, 2023, 7:50am

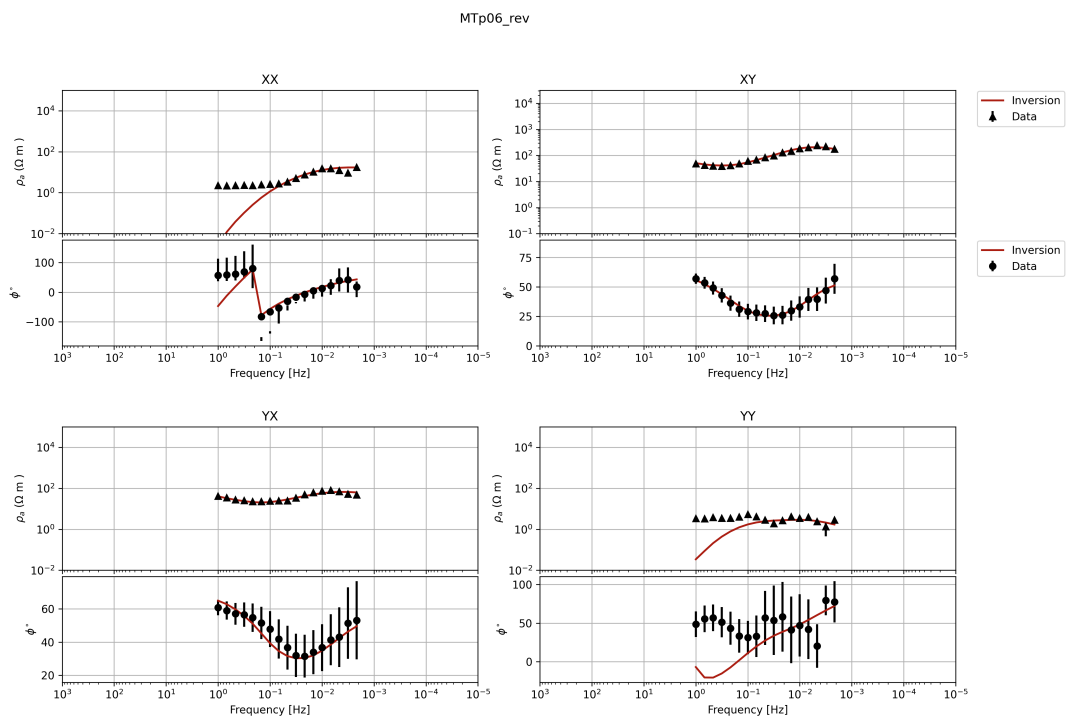


Figure S86. Apparent resistivity and phase fitting plot for the final model: Station MTp06.

August 11, 2023, 7:50am

MTP07_rev

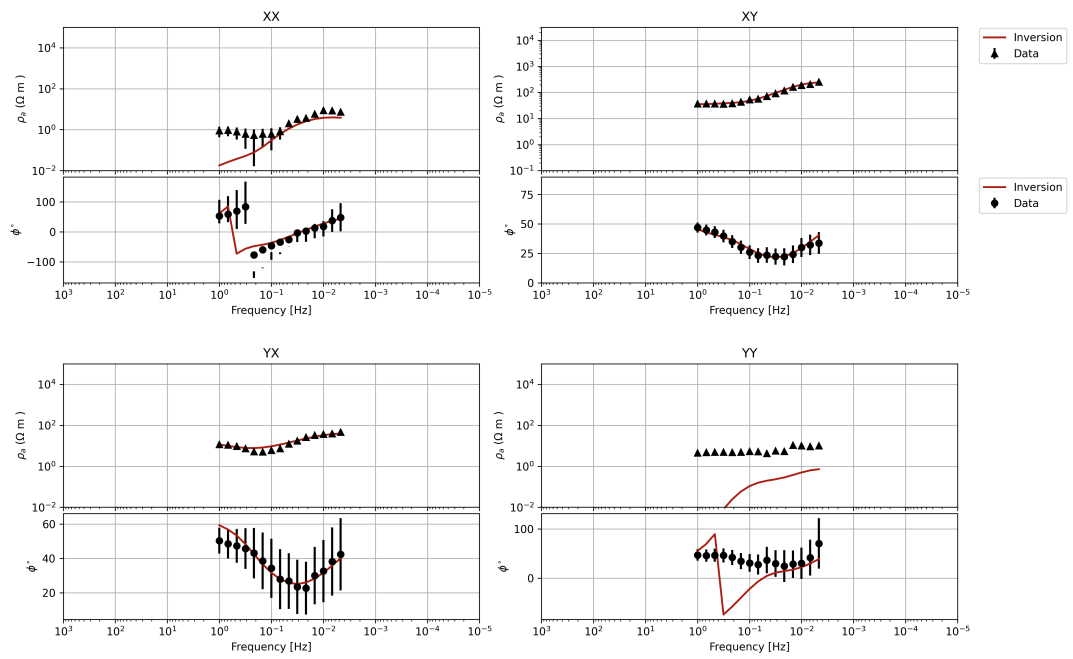


Figure S87. Apparent resistivity and phase fitting plot for the final model: Station MTP07.

August 11, 2023, 7:50am

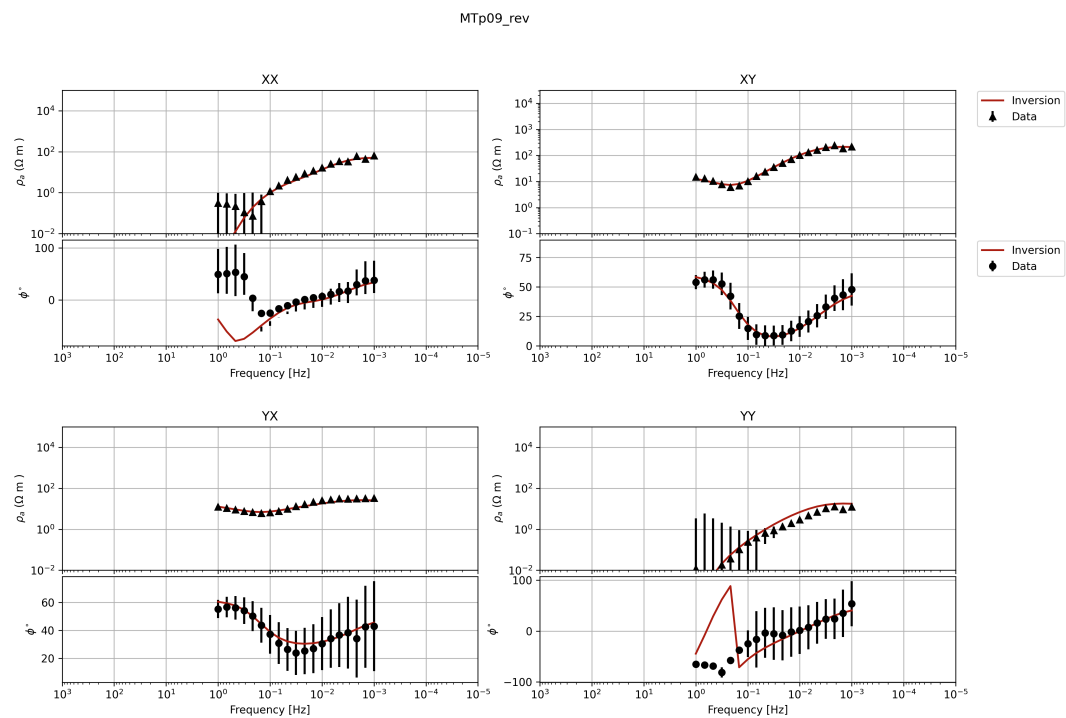


Figure S88. Apparent resistivity and phase fitting plot for the final model: Station MTp09.

August 11, 2023, 7:50am

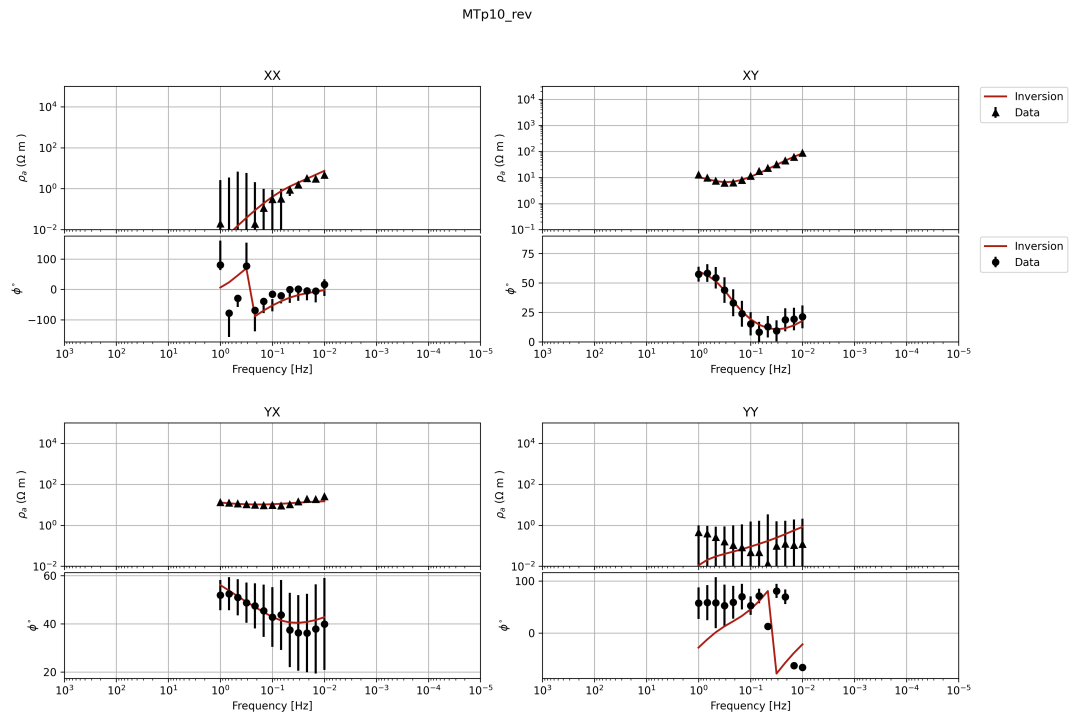


Figure S89. Apparent resistivity and phase fitting plot for the final model: Station MTP10.

August 11, 2023, 7:50am

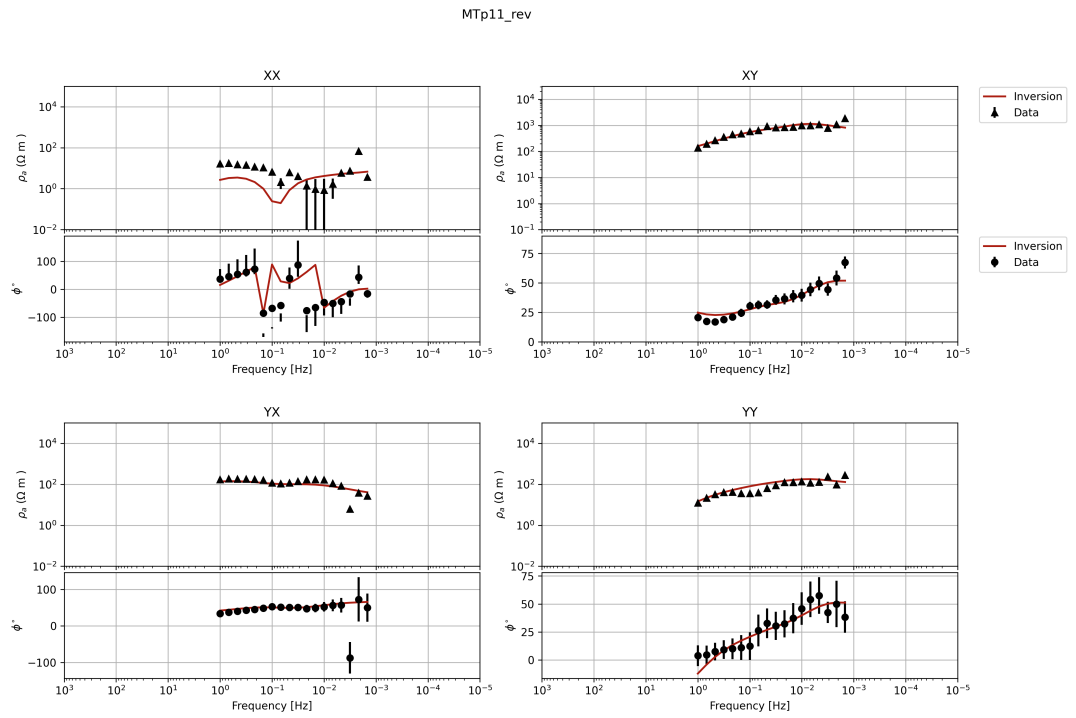


Figure S90. Apparent resistivity and phase fitting plot for the final model: Station MTp11.

August 11, 2023, 7:50am

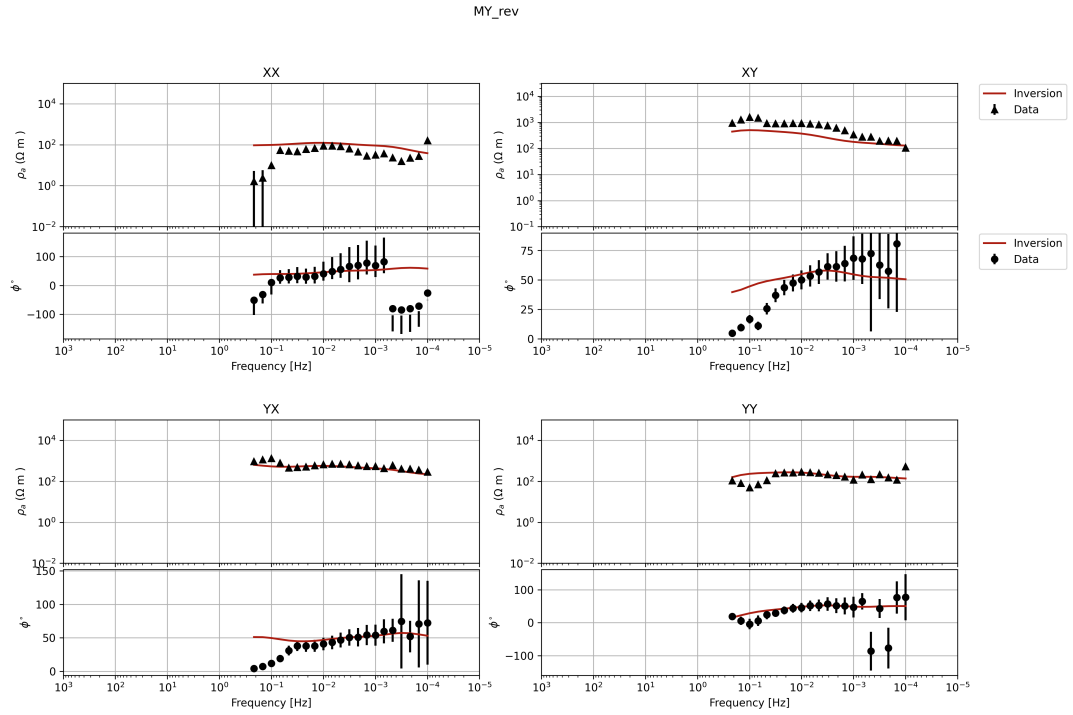


Figure S91. Apparent resistivity and phase fitting plot for the final model: Station MY.

August 11, 2023, 7:50am

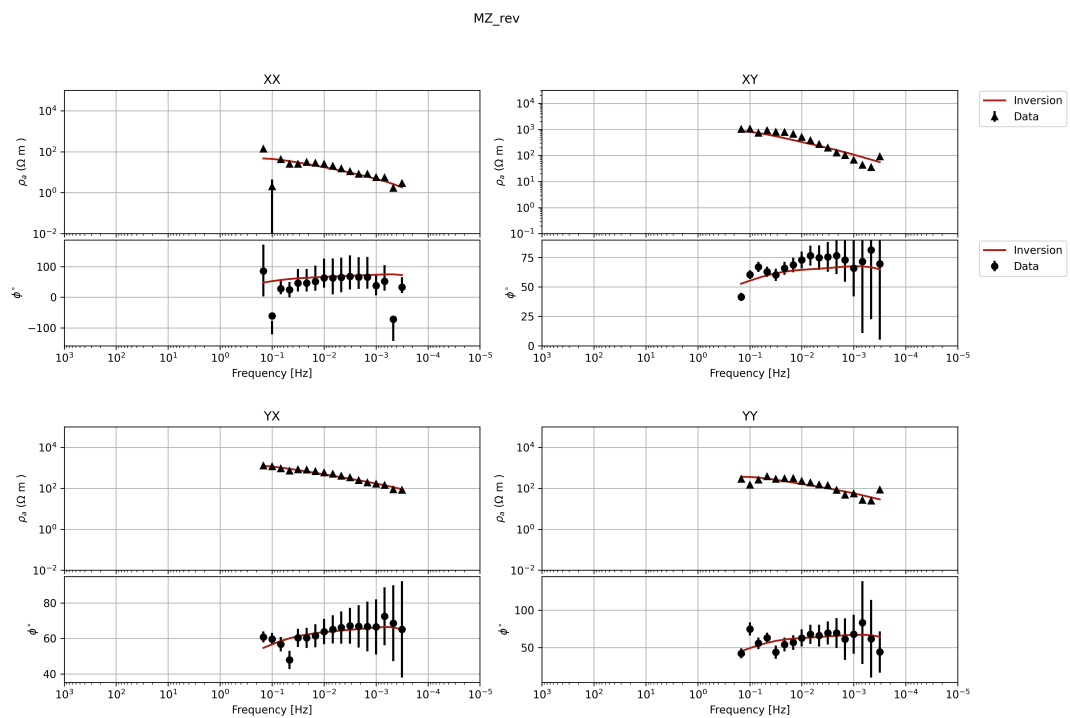


Figure S92. Apparent resistivity and phase fitting plot for the final model: Station MZ.

August 11, 2023, 7:50am

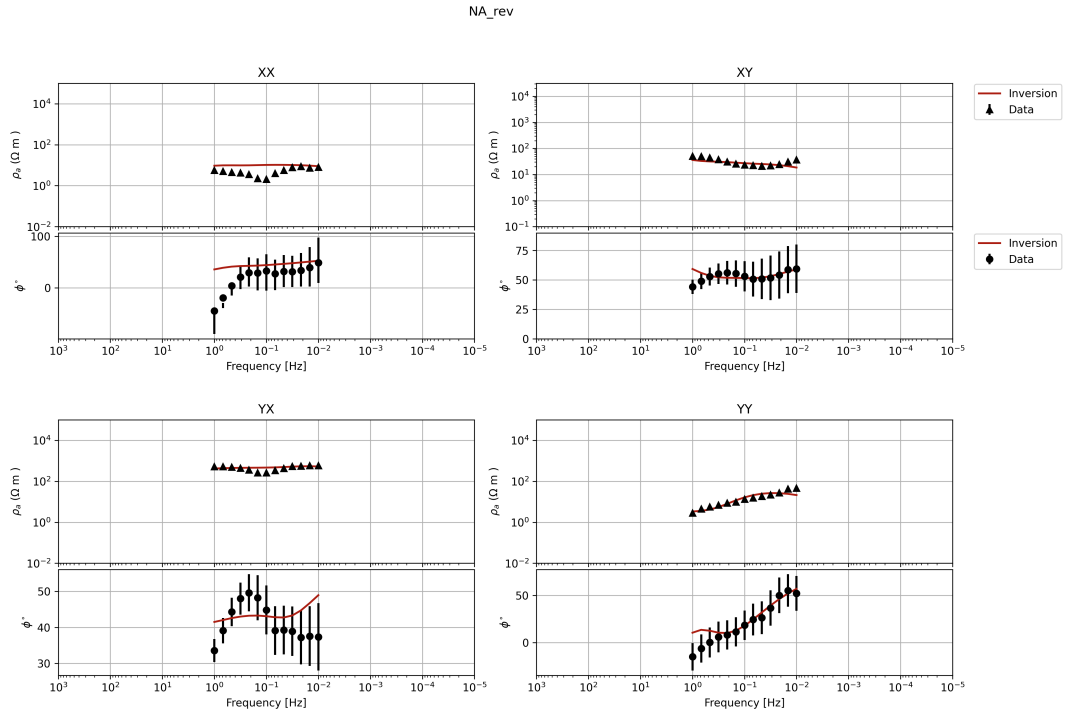


Figure S93. Apparent resistivity and phase fitting plot for the final model: Station NA.

August 11, 2023, 7:50am

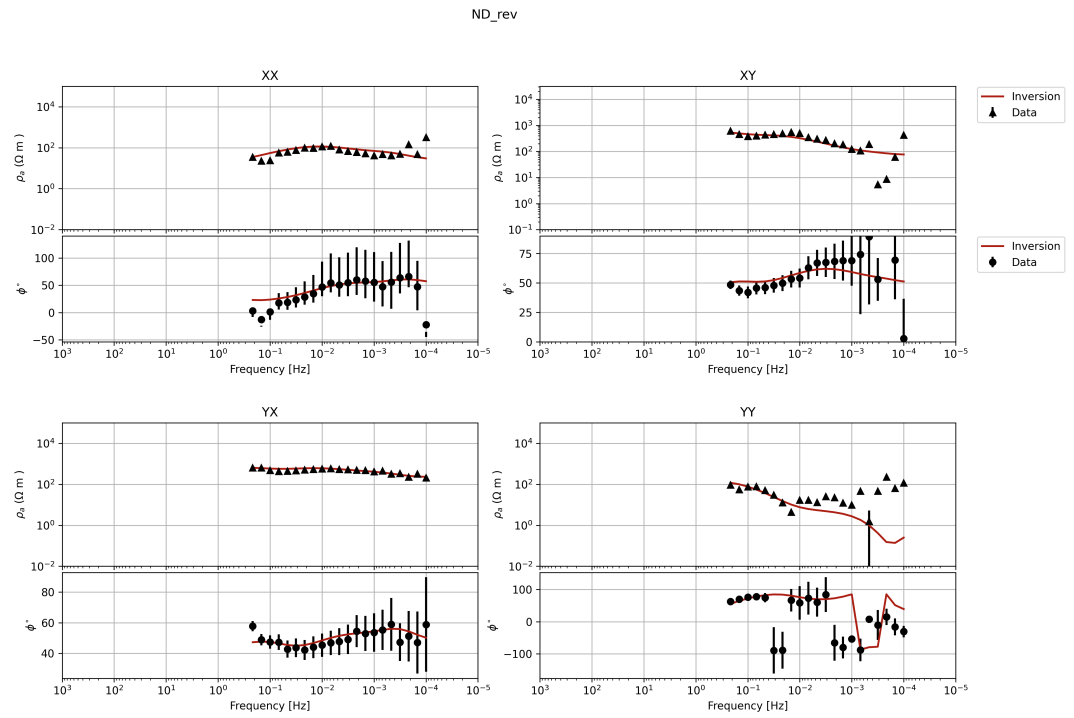


Figure S94. Apparent resistivity and phase fitting plot for the final model: Station ND.

August 11, 2023, 7:50am

SG_rev

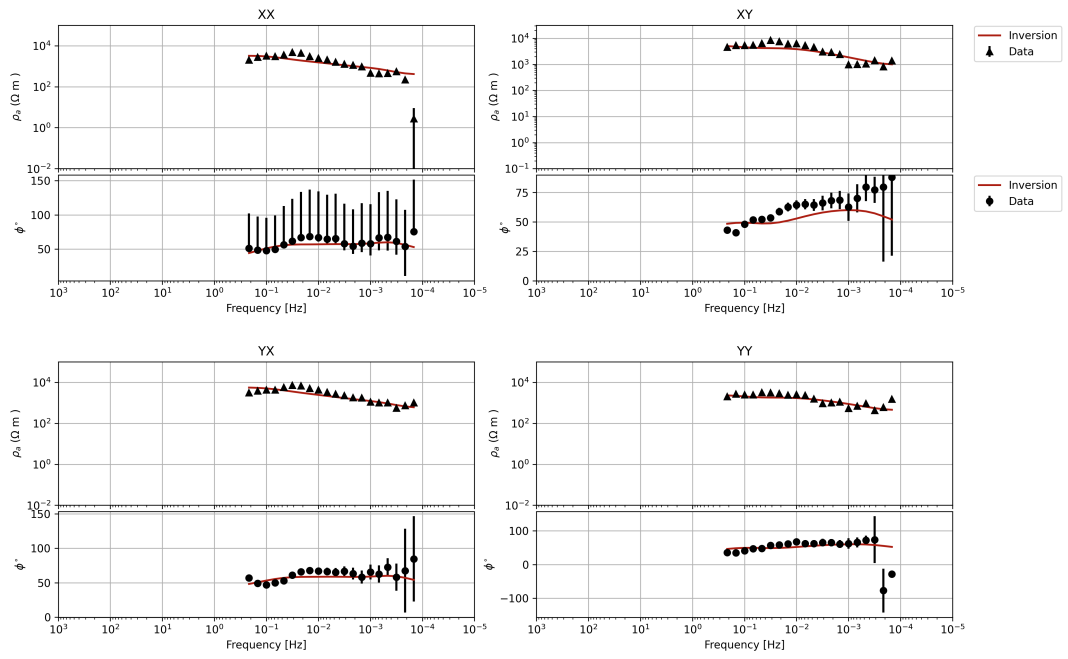


Figure S95. Apparent resistivity and phase fitting plot for the final model: Station SG.

August 11, 2023, 7:50am

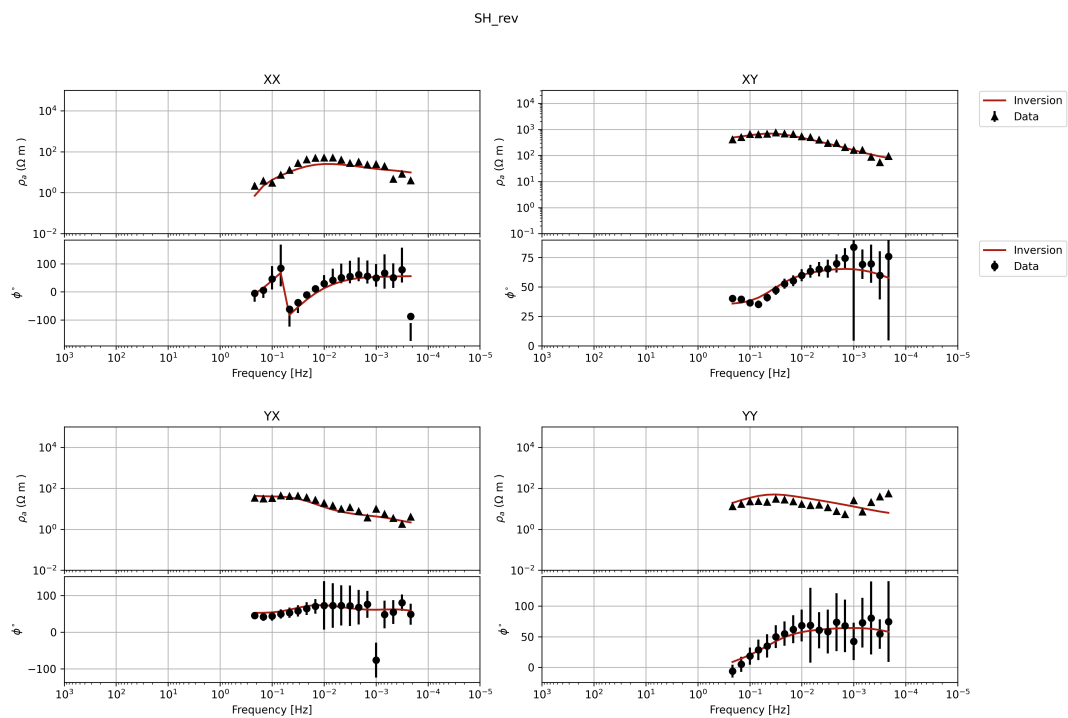


Figure S96. Apparent resistivity and phase fitting plot for the final model: Station SH.

August 11, 2023, 7:50am

SI_rev

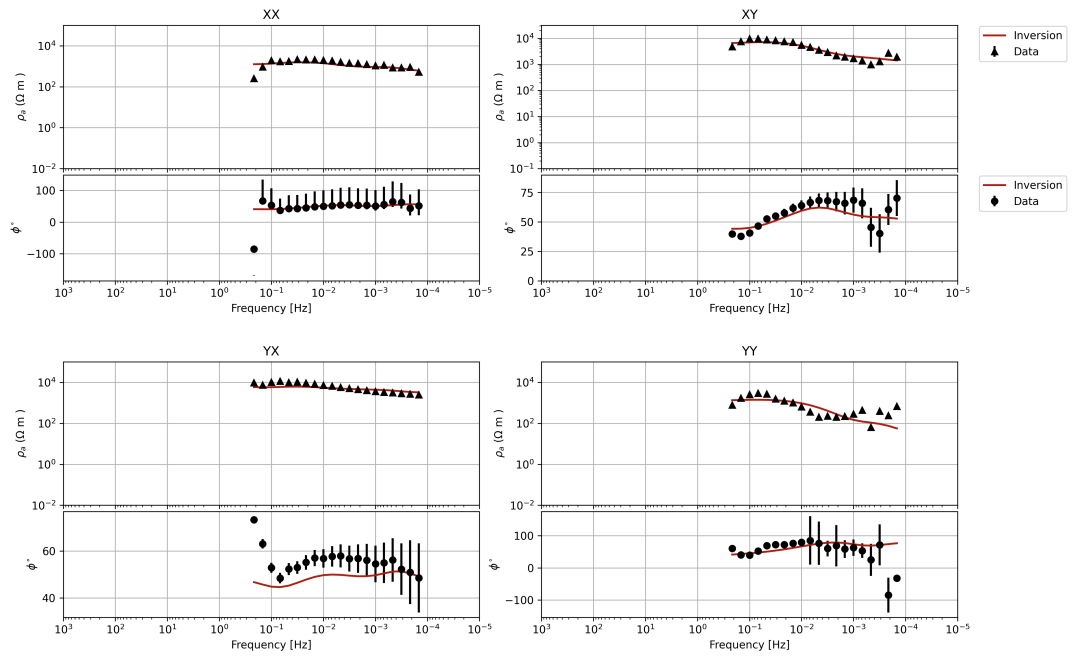


Figure S97. Apparent resistivity and phase fitting plot for the final model: Station SI.

August 11, 2023, 7:50am

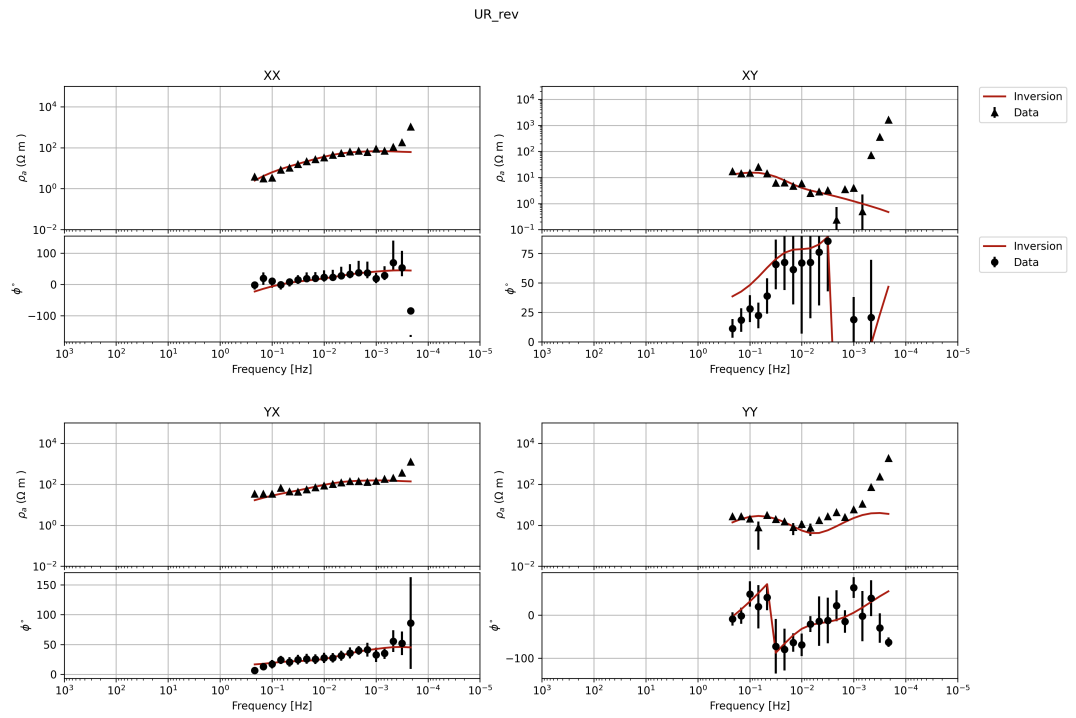


Figure S98. Apparent resistivity and phase fitting plot for the final model: Station UR.

August 11, 2023, 7:50am

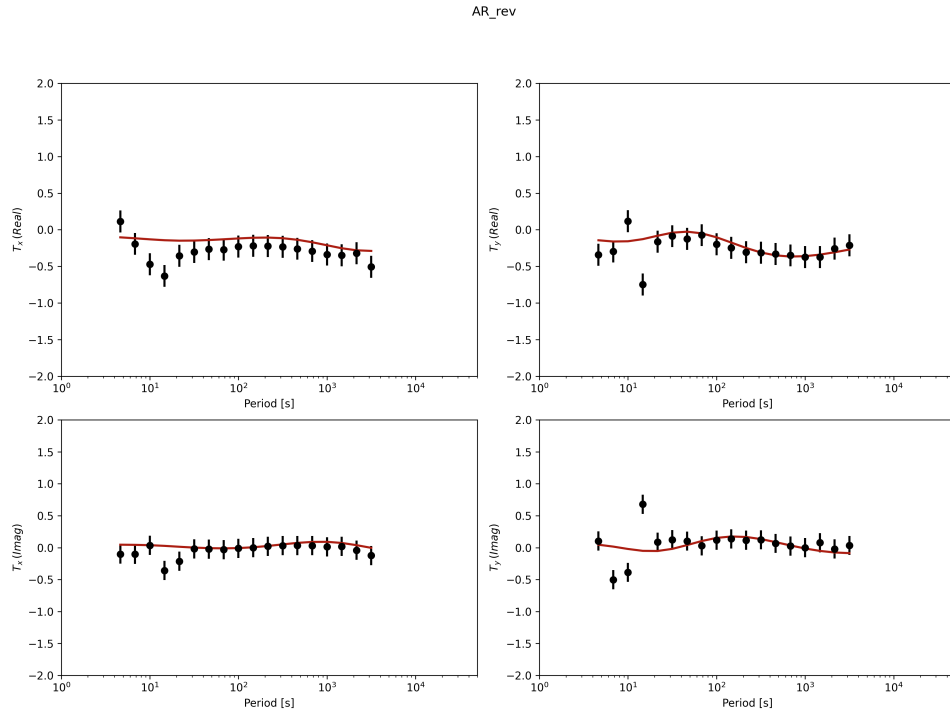


Figure S99. Tipper fitting plot for the final model: Station AR.

August 11, 2023, 7:50am

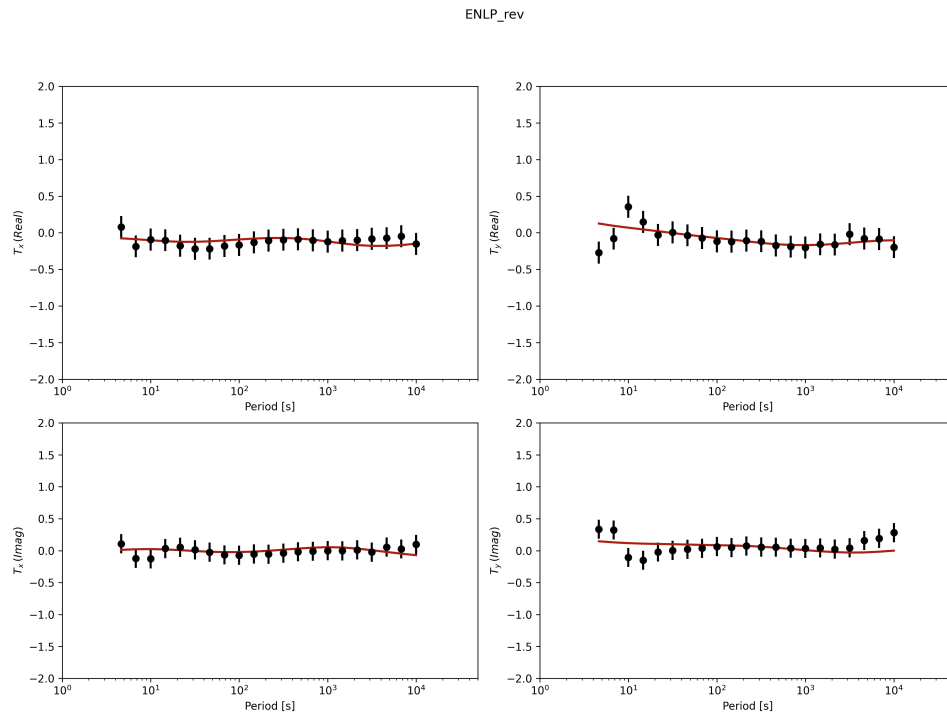


Figure S100. Tipper fitting plot for the final model: Station ENLP.

August 11, 2023, 7:50am

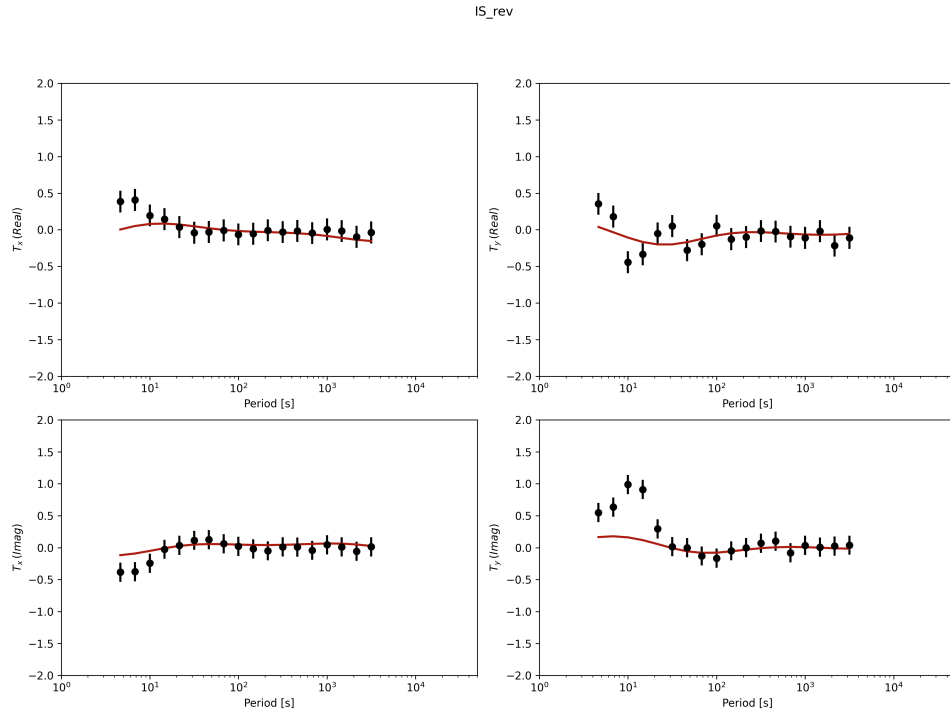


Figure S101. Tipper fitting plot for the final model: Station IS.

August 11, 2023, 7:50am

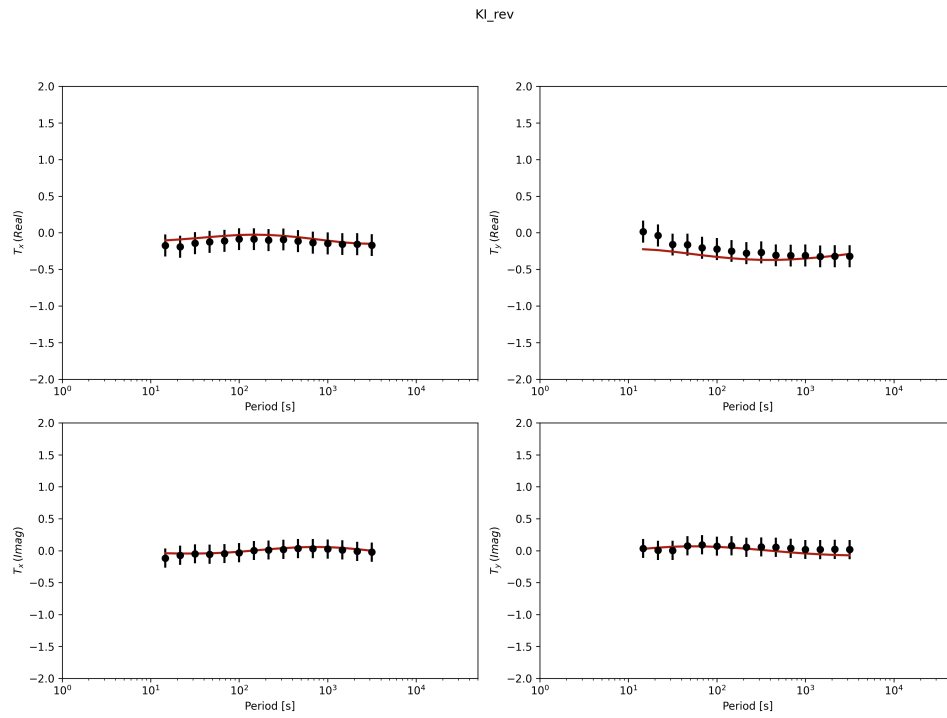


Figure S102. Tipper fitting plot for the final model: Station KI.

August 11, 2023, 7:50am

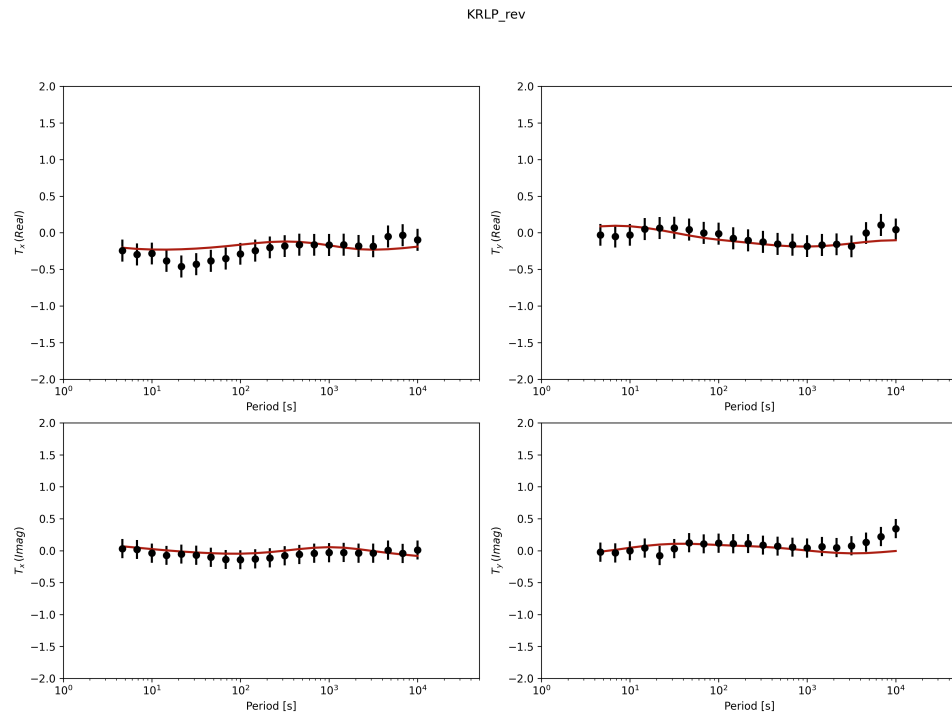


Figure S103. Tipper fitting plot for the final model: Station KRLP.

August 11, 2023, 7:50am

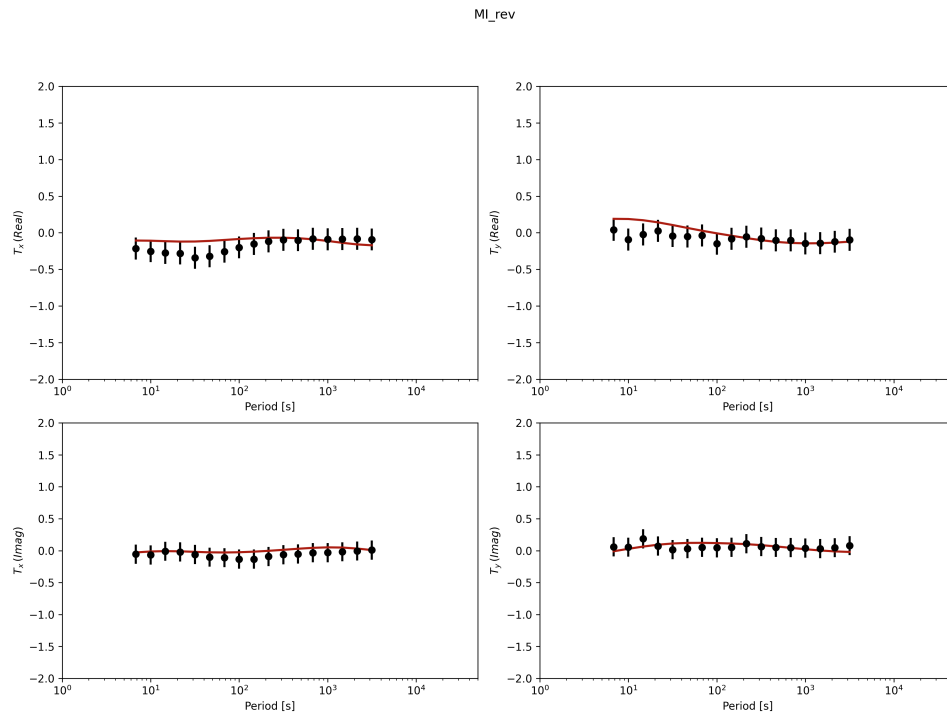


Figure S104. Tipper fitting plot for the final model: Station MI.

August 11, 2023, 7:50am

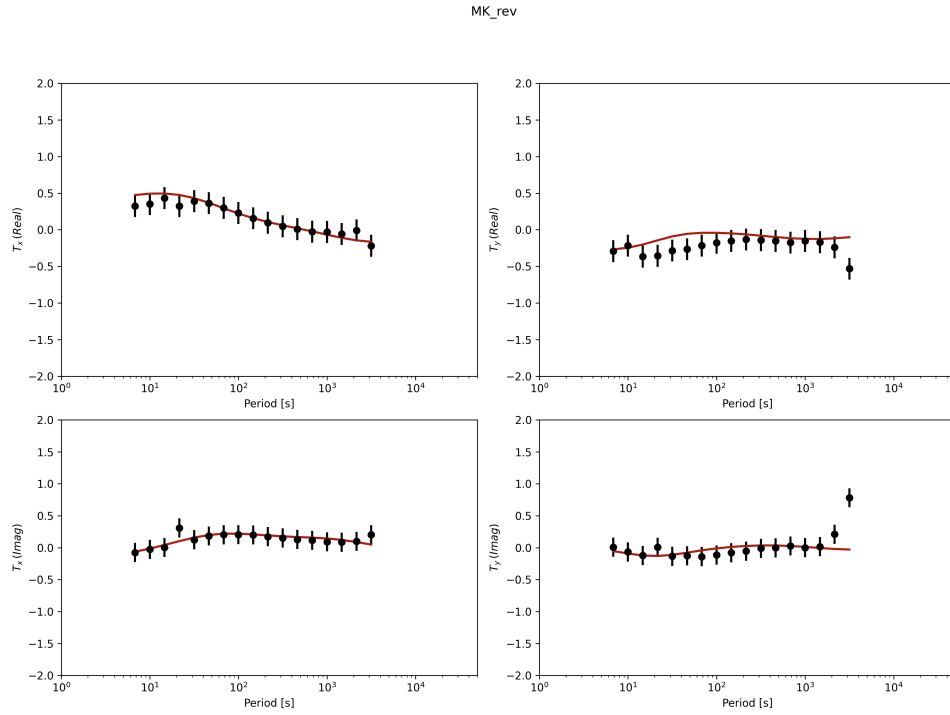


Figure S105. Tipper fitting plot for the final model: Station MK.

August 11, 2023, 7:50am

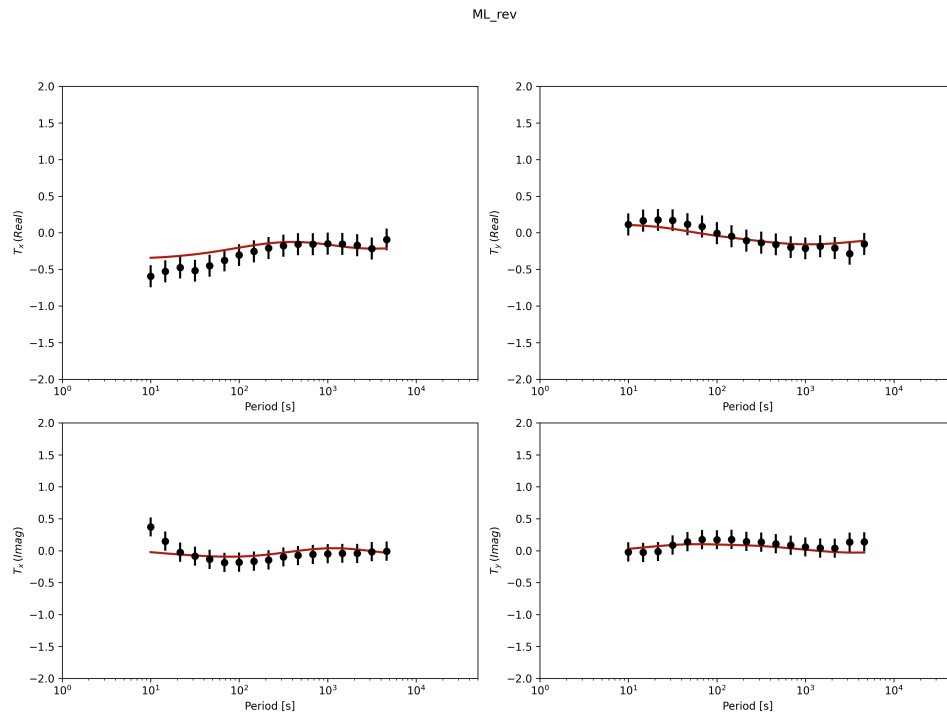


Figure S106. Tipper fitting plot for the final model: Station ML.

August 11, 2023, 7:50am

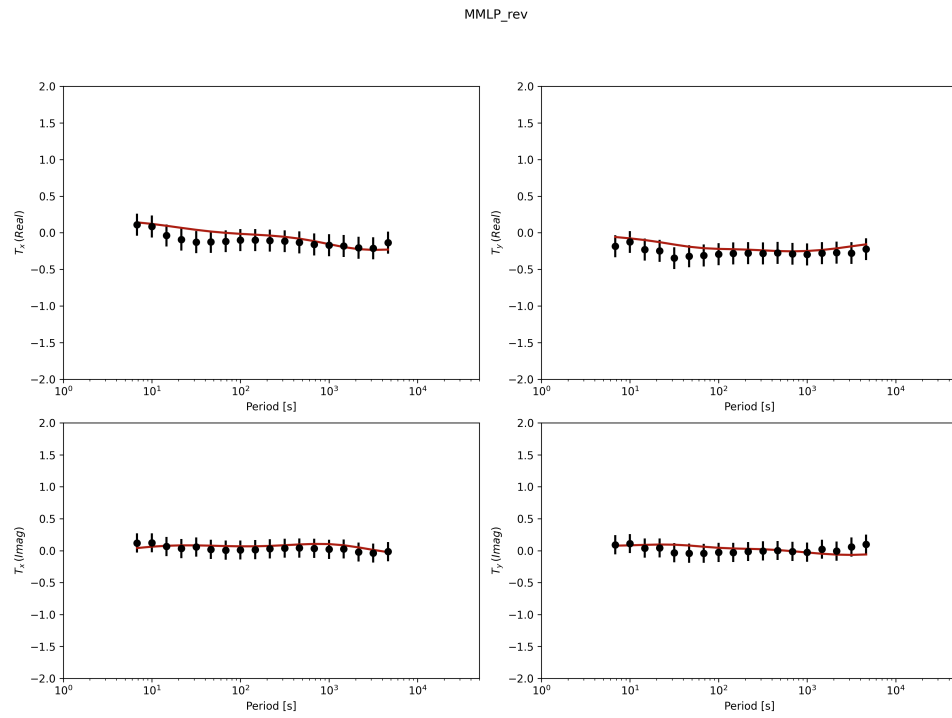


Figure S107. Tipper fitting plot for the final model: Station MMLP.

August 11, 2023, 7:50am

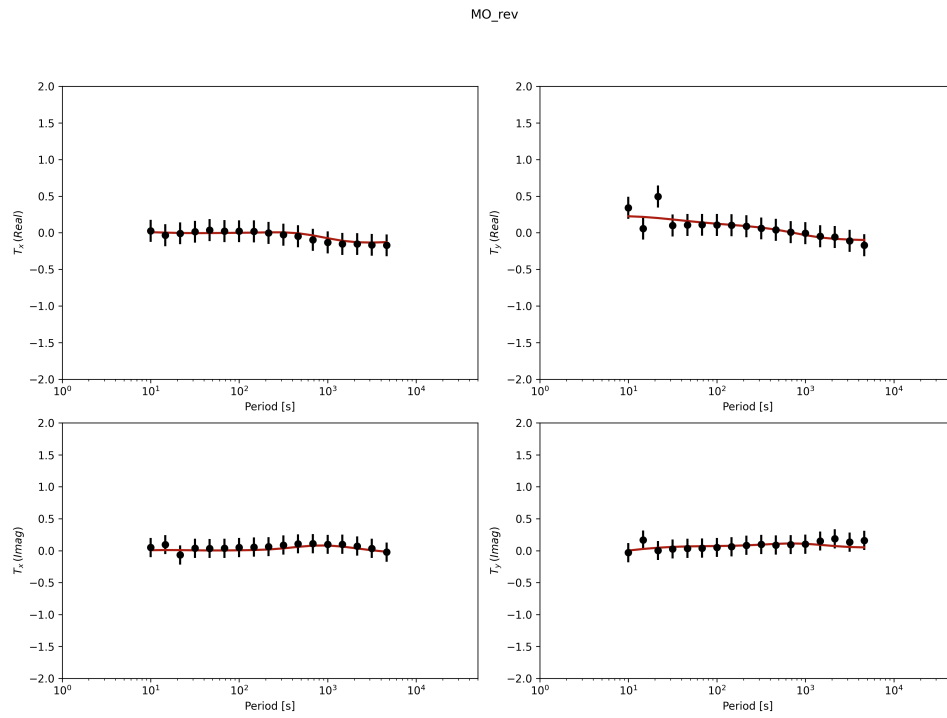


Figure S108. Tipper fitting plot for the final model: Station MO.

August 11, 2023, 7:50am

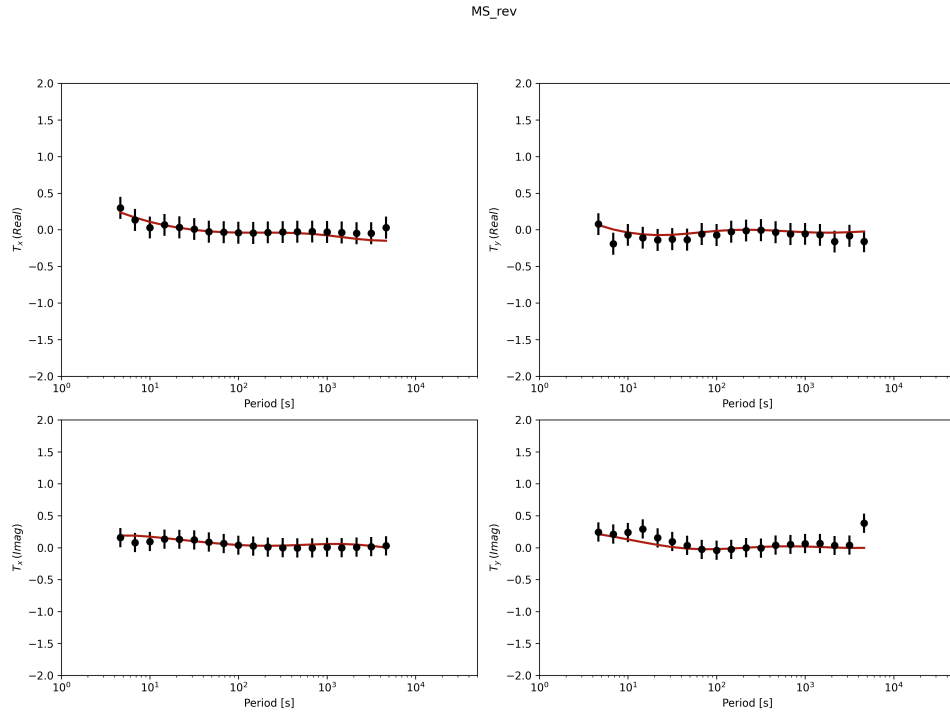


Figure S109. Tipper fitting plot for the final model: Station MS.

August 11, 2023, 7:50am

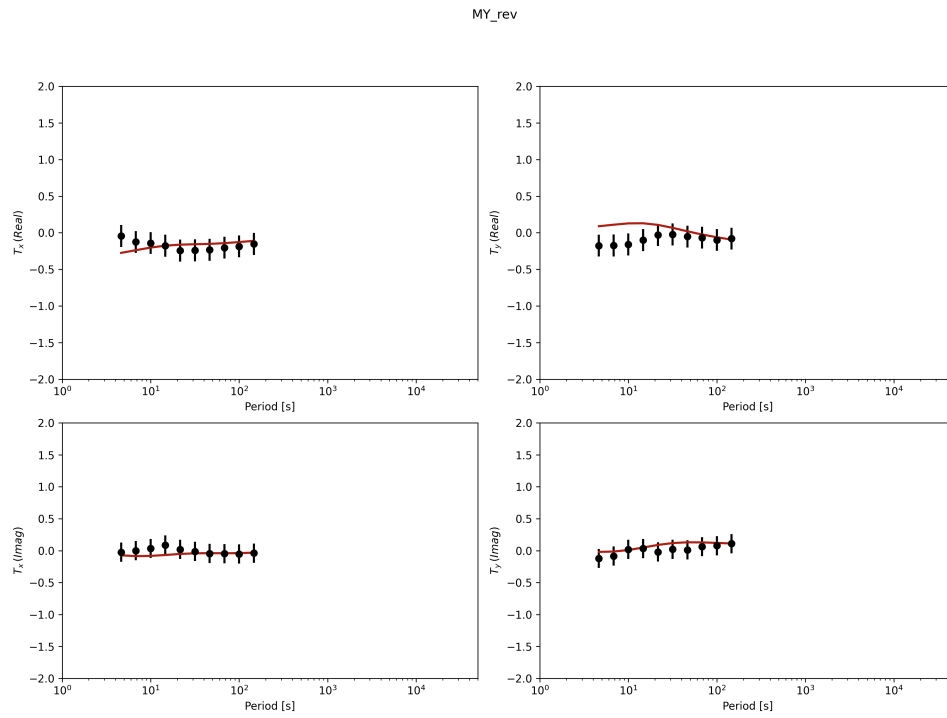


Figure S110. Tipper fitting plot for the final model: Station MY.

August 11, 2023, 7:50am

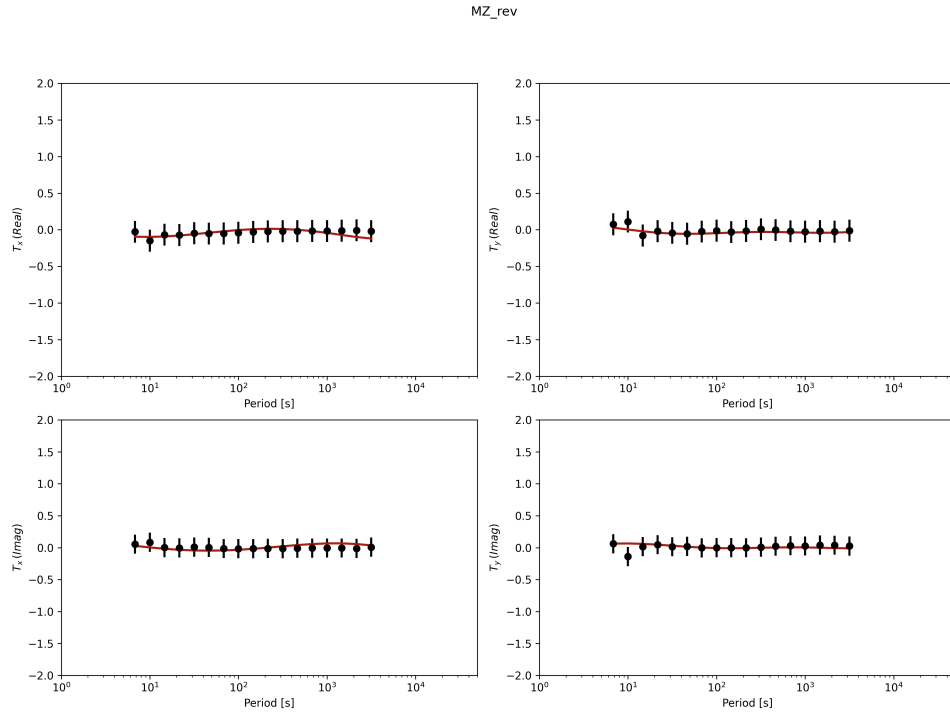


Figure S111. Tipper fitting plot for the final model: Station MZ.

August 11, 2023, 7:50am

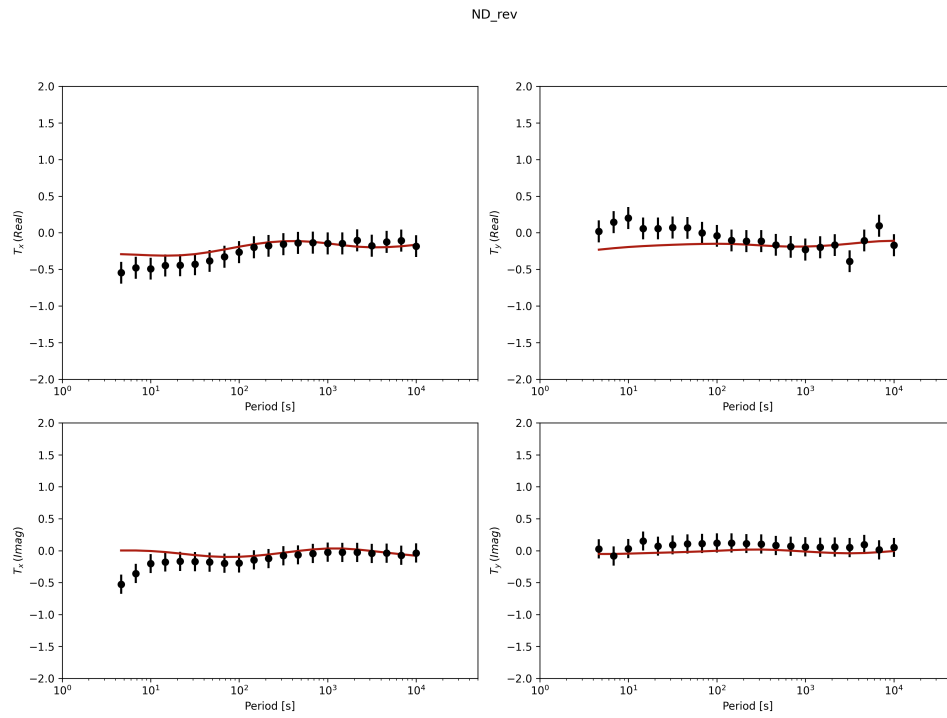


Figure S112. Tipper fitting plot for the final model: Station ND.

August 11, 2023, 7:50am

SG_rev

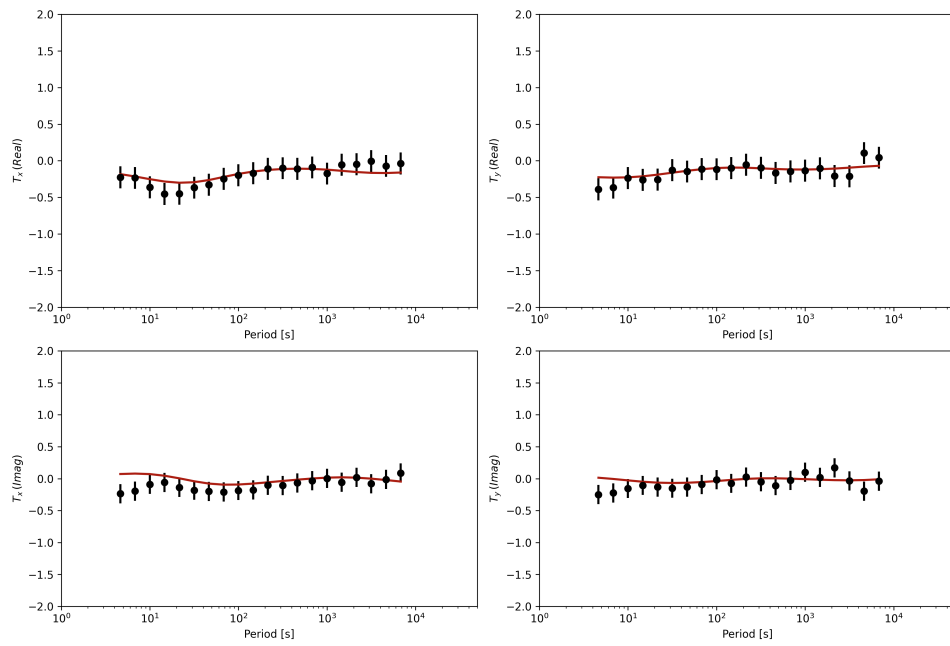


Figure S113. Tipper fitting plot for the final model: Station SG.

August 11, 2023, 7:50am

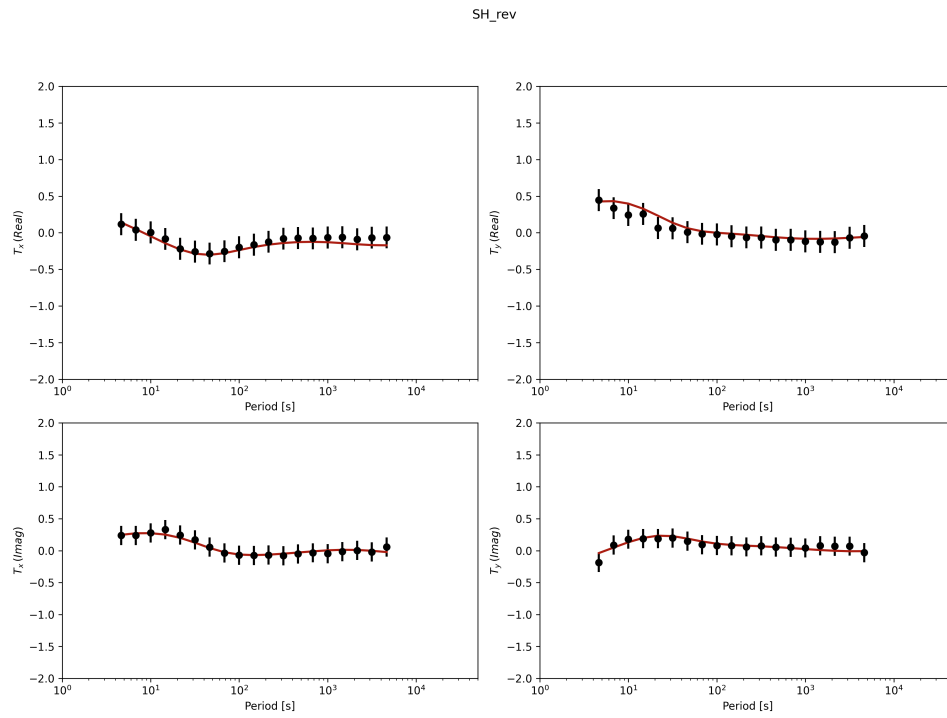


Figure S114. Tipper fitting plot for the final model: Station SH.

August 11, 2023, 7:50am

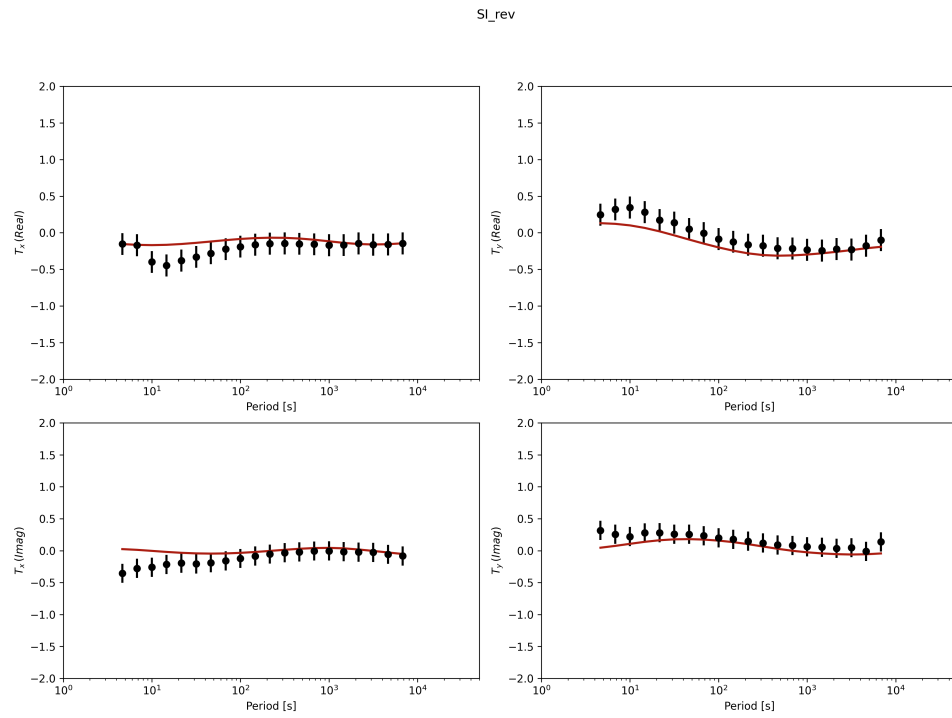


Figure S115. Tipper fitting plot for the final model: Station SI.

August 11, 2023, 7:50am