

## Three-Dimensional Inversion of Magnetotelluric Data from Mt. Ruapehu, New Zealand

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### SUMMARY

The andesite–dacite stratovolcano Mt. Ruapehu has formed ~230 ka ago at the southern termination of the Taupo Volcanic Zone (TVZ), a rifted arc and a centre of active rhyolitic volcanism. In the last century, Mt. Ruapehu has been frequently active with the last large phreatomagmatic eruption in 1995/96 and a steam driven eruption in 2007.

To image the magmatic system beneath Mt. Ruapehu, 40 magnetotelluric (MT) measurements were acquired in the area between 2007 and 2009. Previous 2-D and 3-D modelling of these data show the underlying electrical resistivity structure. However, due to the relatively sparse site distribution and the use of a finite difference 3-D inversion code that does not include topography, the resolution of existing models is coarse. To improve these resistivity models, in 2023, 28 new MT measurements were acquired at Mt. Ruapehu to fill gaps in the existing data, and achieve a uniform coverage of measurements around the volcano.

Here, we present preliminary results of the 3-D inverse modelling of the complete set of MT data acquired at Mt. Ruapehu using FEMALY: A Finite Element MATLAB LibrarY for Electromagnetics. Impedances were inverted for 18 periods between 3 ms and 341 s with particular emphasis on an appropriate representation of the rugged topography. In a first attempt, we adapted the level of detailedness of the topography using an inverse distance weighting scheme, which resolves the main topographic features that are important for this particular survey setup.

We will illustrate the impact of selecting different orders of Nedelec elements and inversion strategies on inversion outcomes using a synthetic example that encompasses the primary anticipated characteristics. Additionally, we will compare our initial inversion findings from Mt. Ruapehu with the latest detailed models from the adjacent Mt. Tongariro.

**Keywords:** Magnetotellurics, Taupo Volcanic Zone, Finite Elements, Unstructured Grids, Topography

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