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Artefacts of isotropic inversion applied to anisotropic magnetotelluric data

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Two-dimensional (2D), isotropic approaches are standard for magnetotelluric (MT) data modelling and inversion. Unfortunately, the real subsurface structure is not isotropic everywhere and one should be aware of the possible consequences of applying an isotropic inversion to anisotropic data. The work presented was motivated by finding an unusual conductor that appeared to be downwarped into the lithospheric mantle compared to the neighbouring terranes, where it appeared in the mid- to lower-crust, when applying routine 2D isotropic inversion. One major difference between the terranes is the presence of the Okavango giant mafic dyke swarm (NE Botswana), beneath which the conductor is imaged to be in the lithospheric mantle. The very limited width of the dykes makes them more an anisotropic feature than a normal 2D structure at MT scale. To examine the possible effects of the dykes, synthetic data, accounting for the dyke swarm by using an anisotropic block, were generated and then inverted isotropically.
The synthetic tests showed that the normal decomposition and strike analysis techniques are not removing these large scale anisotropic effects, and that an isotropic inversion result obtained in the presence of an anisotropic structure has to be treated with caution. The comparison of the synthetic data with the presented case history strongly suggests that the conductor imaged at lithospheric depths is an artefact, and the conductor is most likely located in the lower-crust as everywhere else in that area.