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Validation of the interpolation of geomagnetic field measurements over Southern Africa by means of Spherical Equivalent Current Systems

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Geomagnetically Induced Currents (GICs) are considered to be one of the major space weather related threats to terrestrial technological systems. The change of magnetic flux and induced geoelectric field along power lines is the key driver of GICs in power distribution systems. The electric field is derived from the local geomagnetic field and the local surface impedance under the power lines. One of the key steps in deriving the electric field, and in turn, induced currents, is the interpolation of the geomagnetic field from the locations of the nearest geomagnetic observatories to the location of the power lines.

A commonly used approach to finding the geomagnetic field at the location of the power lines, is to apply the method of Spherical Equivalent Current Systems (SECS). The SECS method estimates the characteristics of a hypothetical array of current elements in the ionosphere, based on measurements of the geomagnetic field at several locations on the ground, typically at magnetic observatories. The Biot-Savart Law is then applied to the x- and y- components of the currents to find the B_y and B_x components, respectively, of the magnetic field on the ground at any points of interest.

There are four geomagnetic observatories in Southern Africa, which are located at Hermanus (19.43°E, 33.22°S), Hartebeesthoek (25.88°E, 27.70°S), Tsumeb (19.20°E, 17.58°S), and Keetmanshoop (26.32°E, 18.06°S). The interpolation of the measurements from these observatories, as done by means of the SECS method, is validated by comparing the interpolated field with measured fields at the locations of a number of Magnetotelluric stations, and by comparing a modelled geomagnetic field over the region, as derived by means of the Space Weather Modelling Forum (SWMF) from the University of Michigan, with the interpolated field at a 2 x 2 degree grid over Southern Africa.

This approach provides an estimate of the accuracy of the SECS-interpolation vs. location over Southern Africa, in order to provide an estimate of the accuracy of the GICs that may be inferred from these observations.

Apply to be considered for a student award (Yes / No)?

No

Level for award (Hons, MSc, PhD, N/A)?

N/A

Would you like to submit a short paper for the Conference Proceedings (Yes / No)?

No

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