Review on the manuscript

Characterizing anomalous geomagnetic induction from coastal effects with transfer functions and gradient measurements

by András Attila Csontos

The author of the manuscript presents an idea of evaluating the anomalous electromagnetic induction, which manifests itself in the measured elements of the geomagnetic field, through the gradient of the geomagnetic field obtained in a location with extreme geomagnetic disturbance. In order to give this idea scientific depth, first in Section 1/Introduction he proposes a mechanism for the formation of disturbances at the interface of two conductivity-contrasting environments. In Section 2 he presents his approach to performing geomagnetic measurements using a Declination-Inclination magnetometer (DIM), which are intended to serve to evaluate the gradient of the geomagnetic field. In Section 3 he presents the circumstances of the measurements at 2 repeat stations near the Adriatic Sea and mentions the analysis of the geomagnetic coastal effect using the transfer functions of the electromagnetic field by the authors (Vujić and Brkić, 2016). Section 4 is devoted to his own contribution, which is discussed in Section 5 and concluded in Section 6.

In summary: Aside from the technical side of the matter, this manuscript does not represent a coherent, self-supporting text and the understanding of the author's idea depends too much on other literature. In this regard, I would like to note that the scope of the material taken from the work (Vujić and Brkić, 2016) is disproportionately large and gives the impression that it is part of the presented concept. Thus, when attempting to publish this manuscript, it encounters an ethical issue.
As for the scientific substance of the manuscript, the very idea of performing absolute measurements of the geomagnetic field in a location where it is extremely disturbed does not make sense. Moreover, this idea could not be fulfilled in principle by the presented approach, since (1) the angular measurements using DIM (declination and inclination measurements) were not combined with the total field measurements using a scalar magnetometer and (2) the angular measurements using DIM could not be realized by the procedure described in the relevant section.
The author does not state the results of the alleged measurements.
The origin of the main outcome in the form of Figure 7 is unknown and therefore it is not possible to comment on it.

Conclusion: This manuscript does not represent a scientific study and no part of its text can be part of a future scientific publication.
I explain my reasons in more detail below.

- One of the important assumptions of the study (Vujić and Brkić, 2016), on which the presented manuscript is based, is the fact that in mid-latitudes the excitation field can be considered as a plane wave propagating vertically downwards. This is an important assumption that has a physical justification and which allowed the analysis to be carried out using transfer functions in a significantly simplified form. In such a wave, the electric and magnetic field vectors oscillate in the horizontal plane. This means that the magnetic flux through the sea surface is zero and therefore the configuration of fields $\mathbf{B}$ and $\mathbf{j}$, as

drawn in Figure 1 presented in Introduction, cannot occur.
Even if we assume another external source of excitation field, which is capable of inducing currents similar to those depicted in the figure and which superimpose into a line current at the interface of the environments, as depicted, then it should be noted that the magnitude of the magnetic field of such a current decreases with the square of the distance (Biot-Savart-Laplace law). I recommend the author to make estimates of the relevant quantities based on the equations and to assess the magnitude of the resulting effect at distances of measurement sites ($O(10^4)$ m) from the sea.
This idea is therefore unable to physically explain the anomalous variation of the Z-component of the geomagnetic field.

- I would expect that in Section 2, dedicated to the actual measurement using DIM, the author would briefly state its principle. Not only does he not state it, but he does not even follow it, which raises serious doubts about his declared professional competence.
First, the declination must be measured, not only for the sake of the value sought, but also to determine the meridional plane in which the inclination is subsequently measured. However, without giving reasons and further details, the author begins by determining the inclination (and other quantities whose purpose is unclear). Without further explanation and future use, he states the relationship for the variation of the magnetic field in the vertical direction, into which the value of the magnitude of the total field enters, which, however, was not the subject of the measurements. The culmination of this theoretical part is the determination of the DIM offset, i.e. the systematic error of the instrument, which slightly modifies the measurement results. The use of this offset and misalignment errors in the horizontal and vertical planes for determining the sought-after characteristics (geomagnetic field gradient) and the formal correctness of the formulas for them will not be commented on for obvious reasons.
No values of measured declination and inclination are given.

- The entire Section 3 is an excerpt from the work (Vujić and Brkić, 2016) without any own contribution.

- There are no facts provided on the basis of which it would be possible to comment on the result in the form of Figure 7 presented in Section 4. For the same reason, I will not comment on Sections 5 and 6.

Scientific significance: Does the manuscript represent a substantial contribution to scientific progress within the scope of Geoscientific Instrumentation, Methods and Data Systems (substantial new concepts, ideas, methods, or data)?	No (4)
Scientific quality: Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)?	No (4)
Presentation quality: Are the scientific results and conclusions presented in a clear, concise, and well-structured way (number and quality of figures/tables, appropriate use of English language)?	Poor (4)