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Consistent geomagnetic models for the Romanian territory valid at the epoch 2007.5

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STATE-OF-THE-ART

Despite about 40 years since the accomplishment of the airborne regional geomagnetic survey, so far no consistent image of the geomagnetic field for the whole Romanian territory exists. Neither of the two available versions (ground and airborne) is able to satisfy modern requirements. The published ground vertical component geomagnetic map of Romania is marked by serious distortions due to some scarcity of the observations (especially within mountainous areas), the secular variation (SV) effects, and removal of an inappropriate local geomagnetic reference field. The airborne geomagnetic map of Romania has been never published and is affected by serious space and time inconsistencies. The available image represents a puzzle of small geomagnetic maps, each corresponding to flight panels achieved at various geomagnetic epochs and different altitudes that have been never accurately merged. Besides, the reference field used for computing the geomagnetic anomaly is represented by a strange local model which does not take into account either the epoch of the geomagnetic survey, or the flight altitude.

DATABASE

Aimed at studying the space-time dynamics of the geomagnetic field on the Romanian

territory, the DYGEF project represents an attempt for accurately reconstructing a consistent geomagnetic model for the whole Romanian territory, based on the previously gathered airborne geomagnetic data. It started with the transfer of previously gathered data stored on paper support to a modern computer database for accurately and easier managing of the information. A special informatics system has been designed and achieved for handling data in order to ensure their space & time consistency.

PROVIDING SPACE CONSISTENCY

To remove space-inconsistencies due to the different altitudes of the flight panels, ranging between 300 m and 2900 m, a genuine approach, able to allow the transfer of the geomagnetic data to a unique altitude, has been found and compared with other published algorithms. Tests have been made both on a theoretical case (uniformly magnetised sphere) and by using experimental data provided within a panel flown at several altitudes. Finally, space consistency of the data was provided by upward continuation of all the observations at the highest flight altitude of the former surveys.

TIME CONSISTENCY

Providing the geomagnetic survey lasted for about 7 years (from 1962 to 1968) significant SV distortions were expected. To remove them, a national geomagnetic reference network (NGRN) was designed and achieved in a short enough period of time (less than a month) in order do not be affected by SV effect. It provided a set of consistent geomagnetic data for the epoch 2007.5 to which the whole amount of the previously gathered observations were referred within a twofold operation. In a first step, data provided by the NGRN were continued at the altitude of the flight panels, and compared with old data. Based on the deviations thus revealed, some corrective functions, depending on the co-ordinates, were inferred and applied to the raw material bringing all the data to the NGRN epoch.

PLOTTING THE MODELS

After providing space and time consistency to the previously obtained data, a consistent image of the total intensity scalar of the geomagnetic field at 3000 m altitude and valid for the epoch 2007,5 was constructed. Further on, two geomagnetic anomaly models have been computed and plotted by removing from the above-mentioned observations both IGRF and WMM models also valid for the NGRN epoch. In order to get more intuitive images, easier to correlate with geological information, some residual geomagnetic maps have been also obtained by using de-trending techniques. Finally, some considerations on the major geomagnetic effects and their related sources, as revealed by the new images are made.

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