Preliminary report on the project

"**The geomagnetic field under the heliospheric forcing. Determination of the internal structure of the Earth and evaluation of the geophysical hazard produced by solar eruptive phenomena**"

IDEI Program, Contract 93/5.10.2011

Stage III, Ist semester 2013

During the first semester of 2013 the research has been conducted to solve some of the tasks listed in the annex IV to the contract no 93/2011, as follows:

1. Geomagnetic measurements in the National Station Network for Secular Variation

Geomagnetic measurements (horizontal component, declination, inclination, total field) were performed in the 26 repeat stations of the network, in the time interval June, 19 – July, 17 and preliminary processing of field data has been started. A preliminary map of the distribution of declination on the Romanian territory is shown in Fig. 1. The next time interval will be devoted to complete the data processing (calculation of all geomagnetic elements value, correction for the diurnal and disturbed variations, calculation of values corresponding to the 1st July of the year).

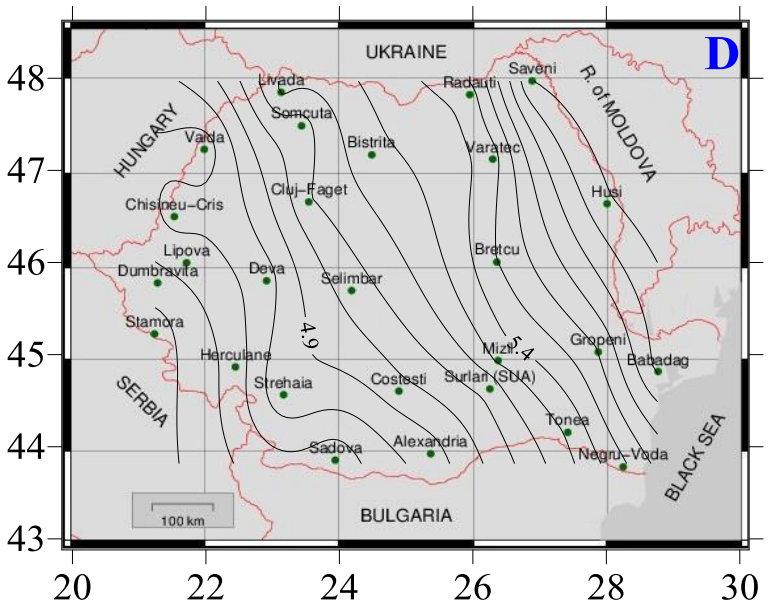

Fig.1. The isogonse (lines of equal declination) of the geomagnetic field on the Romanian territory. Preliminary map

2. *Induction and resistivity models for the crust and mantle, stage 2013*

The magnetic field of the Earth, which extends in space as magnetosphere, is in permanent interaction with the solar electromagnetic, particle and magnetic flux outputs, i.e. the solar radiation, the solar wind, and, respectively, the heliospheric magnetic field. The variable current systems that develop as a result of these interactions create the so-called field of geomagnetic variations which, in turn, induces a response of the Earth's internal magnetic and conductive structures. In this stage of the project, the geomagnetic variations at storm timescales (minutes – days) provided by the network of European geomagnetic observatories have been used for modeling the magnetic structure of the European lithosphere. Large-scale magnetic structures in the lithosphere are evidenced by means of a magnetic induction model applied to geomagnetic observatory data recorded during several intense geomagnetic storm intervals (Dst<-200 nT) in the time period 2001-2005. The magnetic induction model assumes that the induced field is a linear combination of the components of the inducing field. As the inducing external source, the magnetic field of the ring current at each observatory location was used, inferred from the Dst geomagnetic index (minute). The lateral distribution of the lithosphere magnetic properties, as described by the coefficients of the mentioned linear combination, was derived and a comparison with distributions resulted in case of other variable sources (e.g. Sq) is discussed. Some results are shown in Fig. 2.

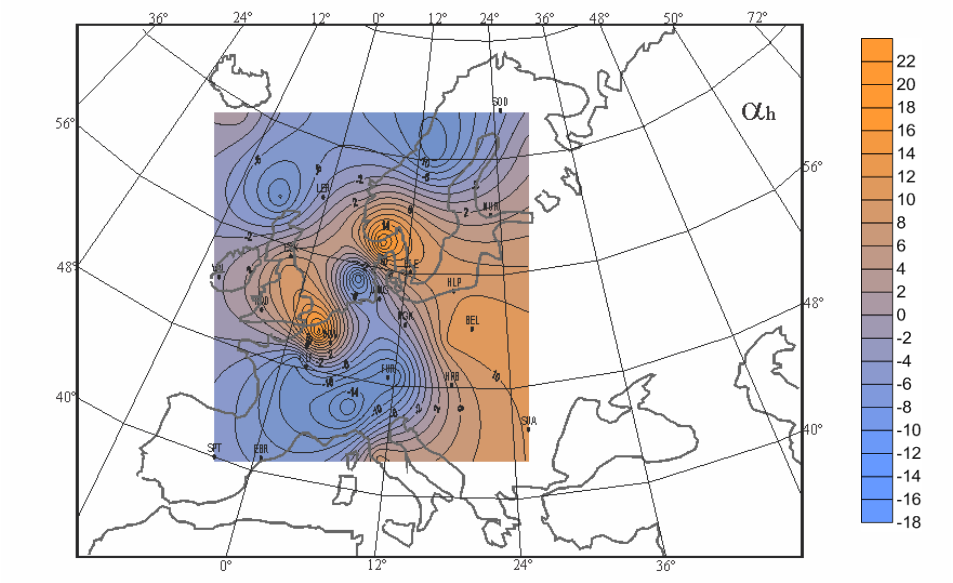

Fig.2. The lateral variation of the magnetic properties of the western part of the European crust

We also analyzed long-term observatory data in terms of external effects present in the annual averages of recorded values and model the corresponding time series by means of a combination of geomagnetic indices as proxy for various current systems in ionosphere and magnetosphere that add external effects to the internal field. We showed that the external contribution leaks into main field models based (mainly) on observatory data (gufm 1, IGRF, CM4) and discuss its evolution since 1600. Some results are presemted in the next figures.

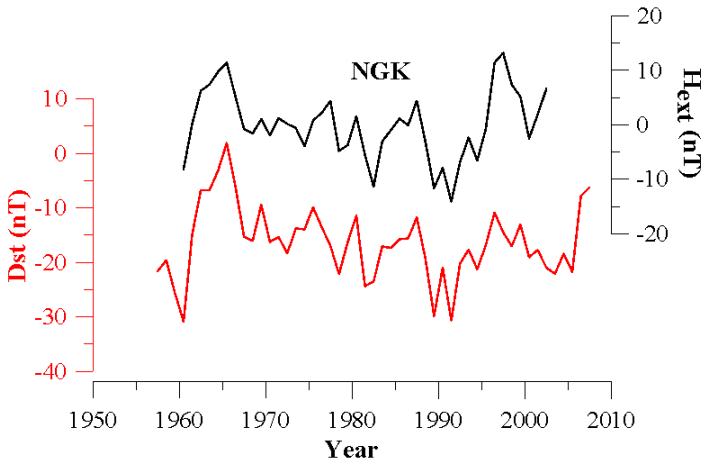

Fig. 3. The external contribution in annual means for the time-span 1960-2002 at Niemegk observatory

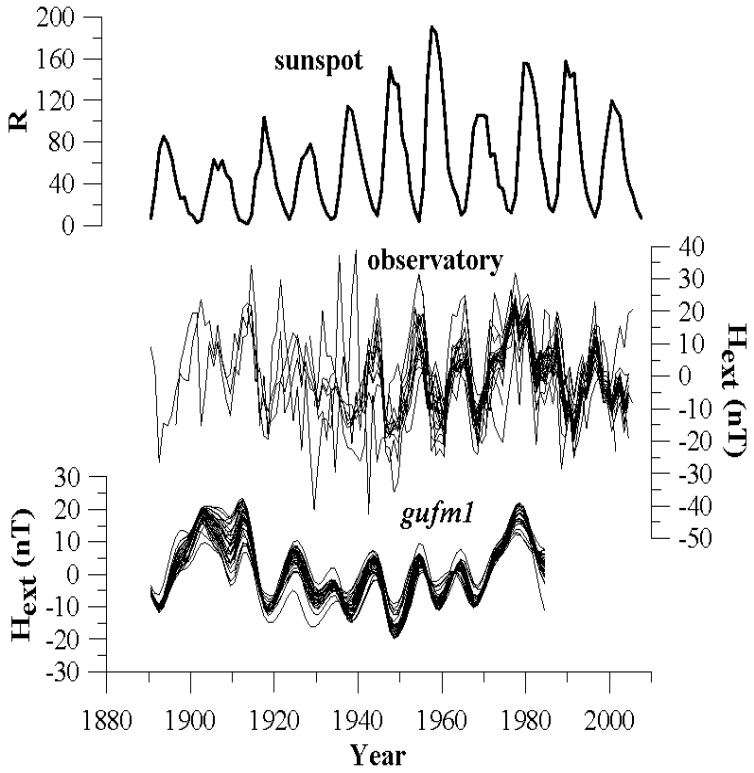

Fig.4. The sunspot number and the 11-year variation at European observatories and in the main field global model *gufm1*

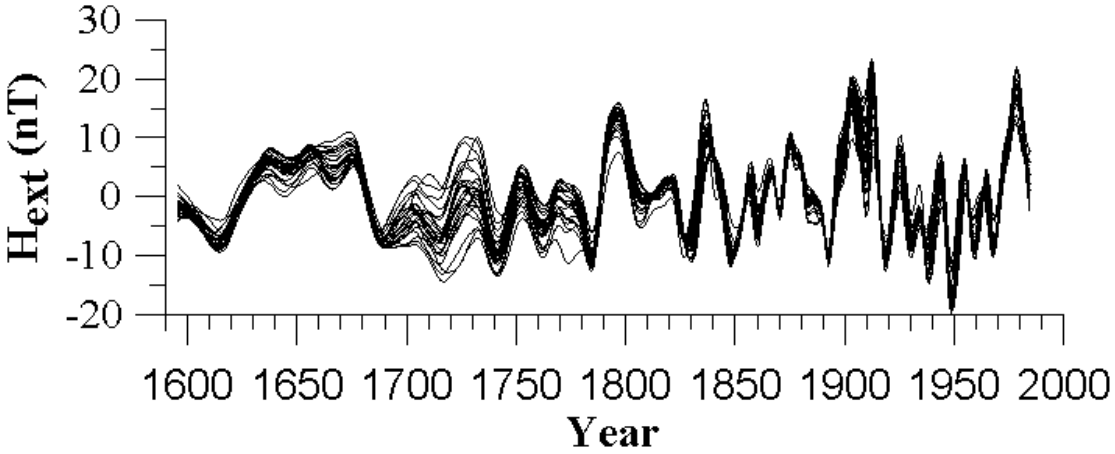

Fig. 5. The 11-year variation in Europe since 1600, based on the *gufm1* model

3. Dissemination of results

Team members presented results obtained so far, as follows:

C. Demetrescu, V. Dobrica, Space climate characterization via geomagnetic indices. An attempt of integrating solar, heliospheric, and geomagnetic indices at various time-scales, European Geoscientists Union (EGU) General Assembly, Vienna, Austria, 7-13 April 2013.

V. Dobrica, C. Demetrescu, Large-scale lithospheric magnetic anomalies in Europe as revealed by recorded geomagnetic storms at the observatory network, European Geoscientists Union (EGU) General Assembly, Vienna, Austria, 7-13 April 2013.

C. Stefan, C. Demetrescu, V. Dobrica, Long-term external effects in annual means from observatory and main field models, European Geoscientists Union (EGU) General Assembly, Vienna, Austria, 7-13 April 2013.

R. Greculeasa, V. Dobrica, C. Demetrescu, Auroral electrojet and magnetospheric ring current effects in the disturbance field recorded at European Observatories, European Geoscientists Union (EGU) General Assembly, Vienna, Austria, 7-13 April 2013.

V. Dobrica, R. Greculeasa, C. Demetrescu, On sources of the disturbance field recorded at European geomagnetic observatories, The 6th MagNetE Workshop, Prague, Czech Republic, 2 – 6 June 2013.

R. Greculeasa, V. Dobrica, C. Demetrescu, The Romanian network of repeat stations. Geomagnetic measurements 2011-2012, The 6th MagNetE Workshop, Prague, Czech Republic, 2 – 6 June 2013.

C. Demetrescu, C. Ștefan, V. Dobrică, Magnetosphere response to solar activity during the Maunder Minimum, The Fifth Workshop Solar Influences on the Magnetosphere, Ionosphere and Atmosphere, Nesebar, Bulgaria, 3-7 June 2013.

G. Maris Muntean, O. Maris., D. Besliu-Ionescu, M. Mierla, Long-term variability of the high speed solar wind, The Fifth Workshop Solar Influences on the Magnetosphere, Ionosphere and Atmosphere, Nesebar, Bulgaria, 3-7 June 2013.

C. Stefan, V. Dobrica, C. Demetrescu, The magnetopause standoff distance: Short- and long-term variability, The Fifth Workshop Solar Influences on the Magnetosphere, Ionosphere and Atmosphere, Nesebar, Bulgaria, 3-7 June 2013.