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The Geomagnetic Mapping of the Romanian Territory in the Context of the WDMAM Project

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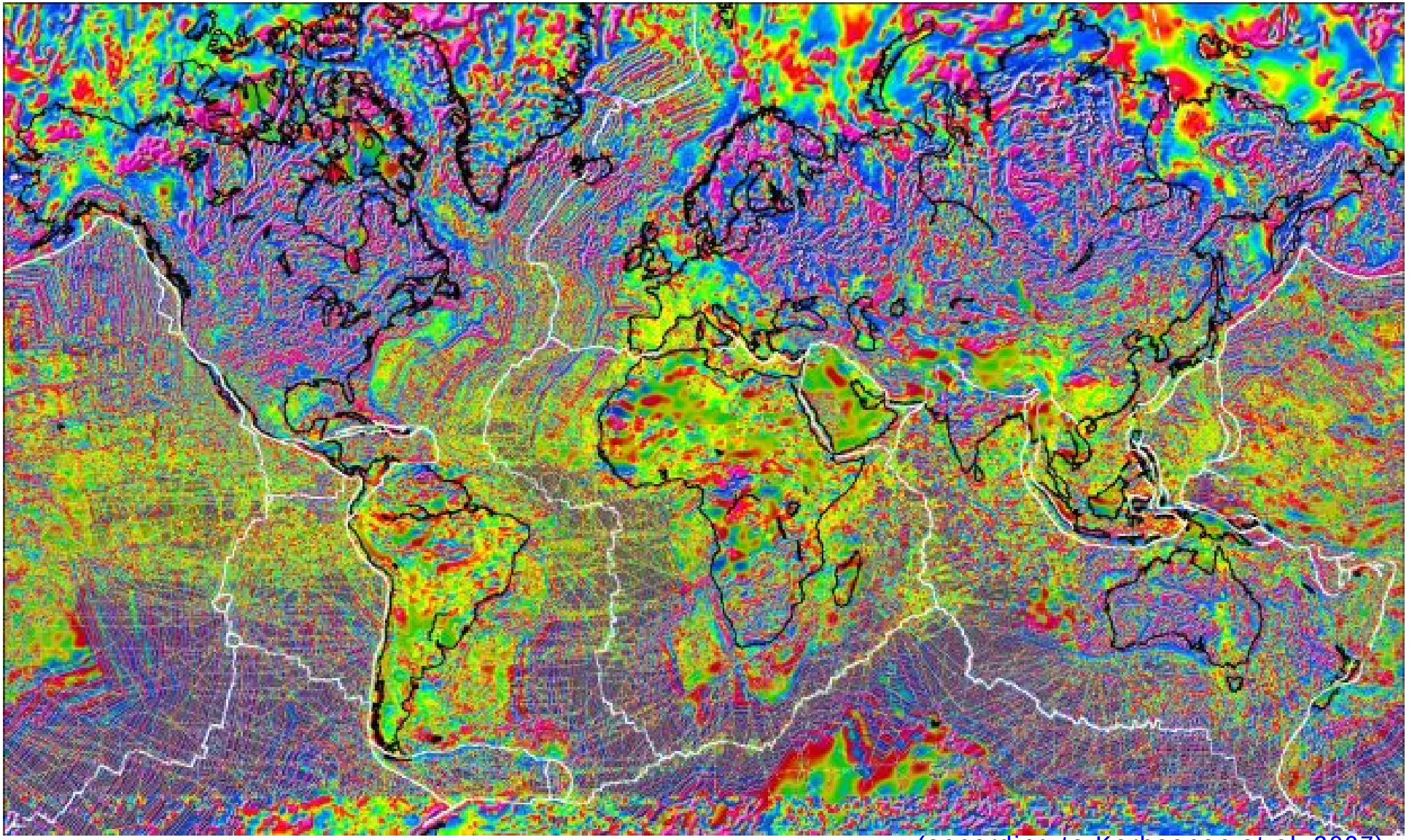
OUTLINE

- Brief on WDMAM & DYGEF project
- Rationale
- Methodology
- Results
- Quality assessment
- Added value

WDMAM: a challenge for the 21st century



(according to Korhoenen et al, 2007)

ROMANIAN CONTRIBUTION

At approx. **238,000 square kilometers**, Romania is the **ninth largest country** of the European Union **by area**

Location of **Romania** (dark green): on the European continent (incl. the EU)
in the European Union

PECULIARITIES OF THE ROMANIAN AIRBORNE GEOMAGNETIC SURVEY

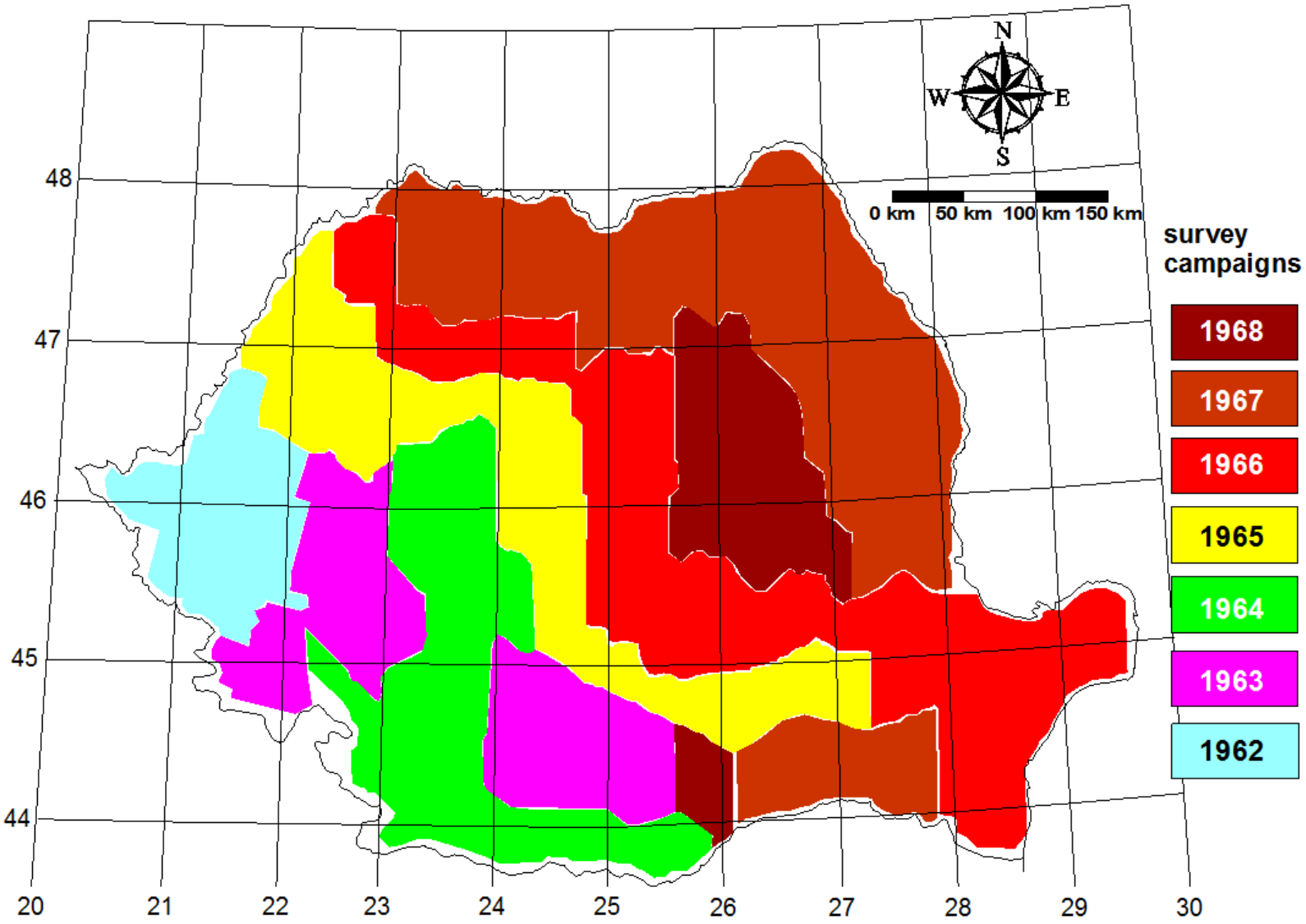
- INSTRUMENTATION: three-axial flux-gate magnetometer
  radio-beams at the edge of the lines
- SURVEY NETWORK: flight pannels of various altitudes
  - flight-lines striking N or perpendicular to the known geological structures
  - 1000 m / 500 m apart
  - terrain clearance: 300 m above the highest pannel topography
- RAW DATA: • F maps with contour lines and data points on PAPER SUPPORT

PUZZLE OF SMALL MAPS ACHIEVED AT VARIOUS ALTITUDES AND GEOMAGNETIC EPOCHS: DYGEF PROJECT

RATIONALE

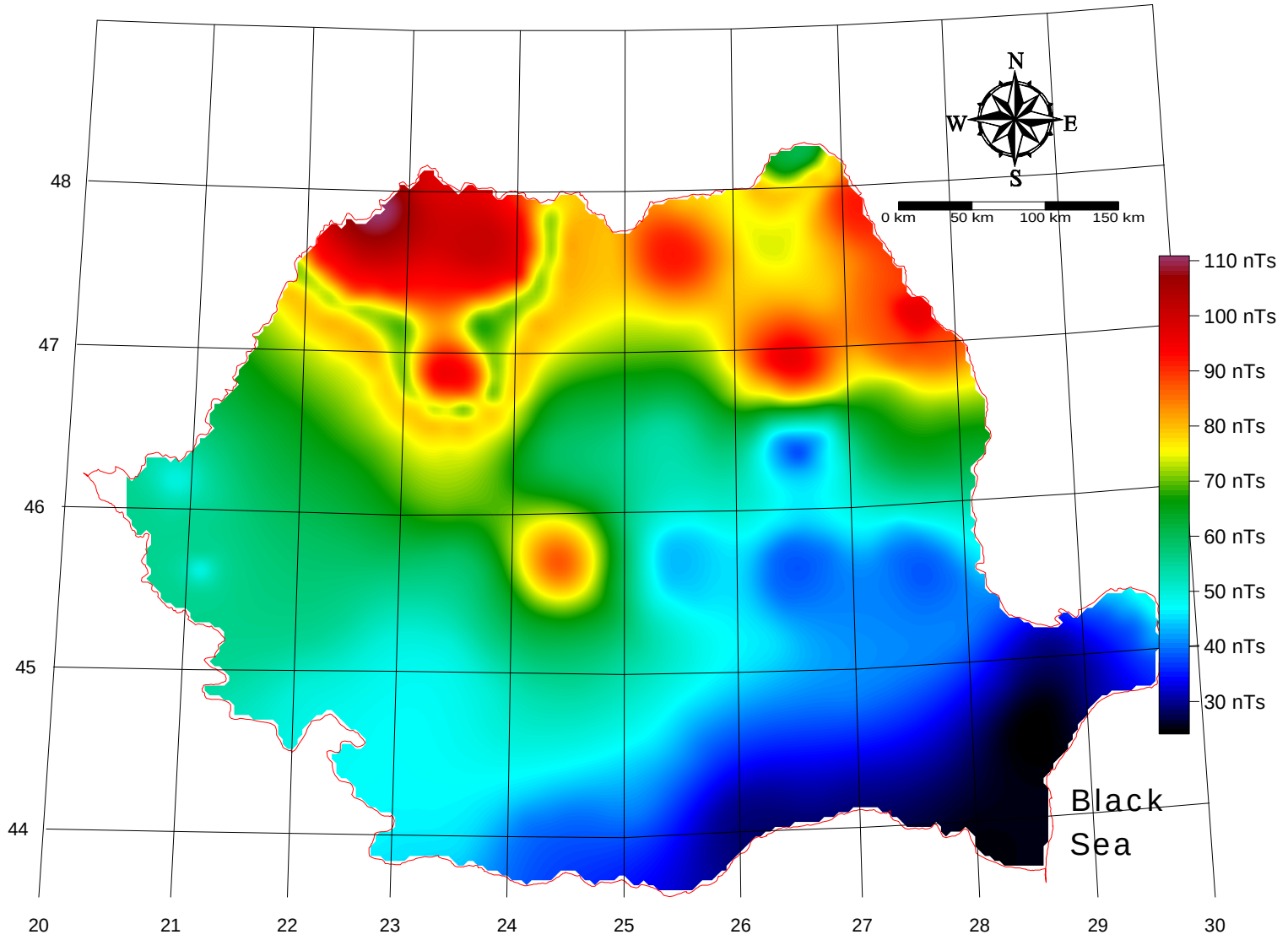
time inconsistency
space inconsistency
inappropriate geomagnetic reference field

RATIONALE (1): time inconsistency



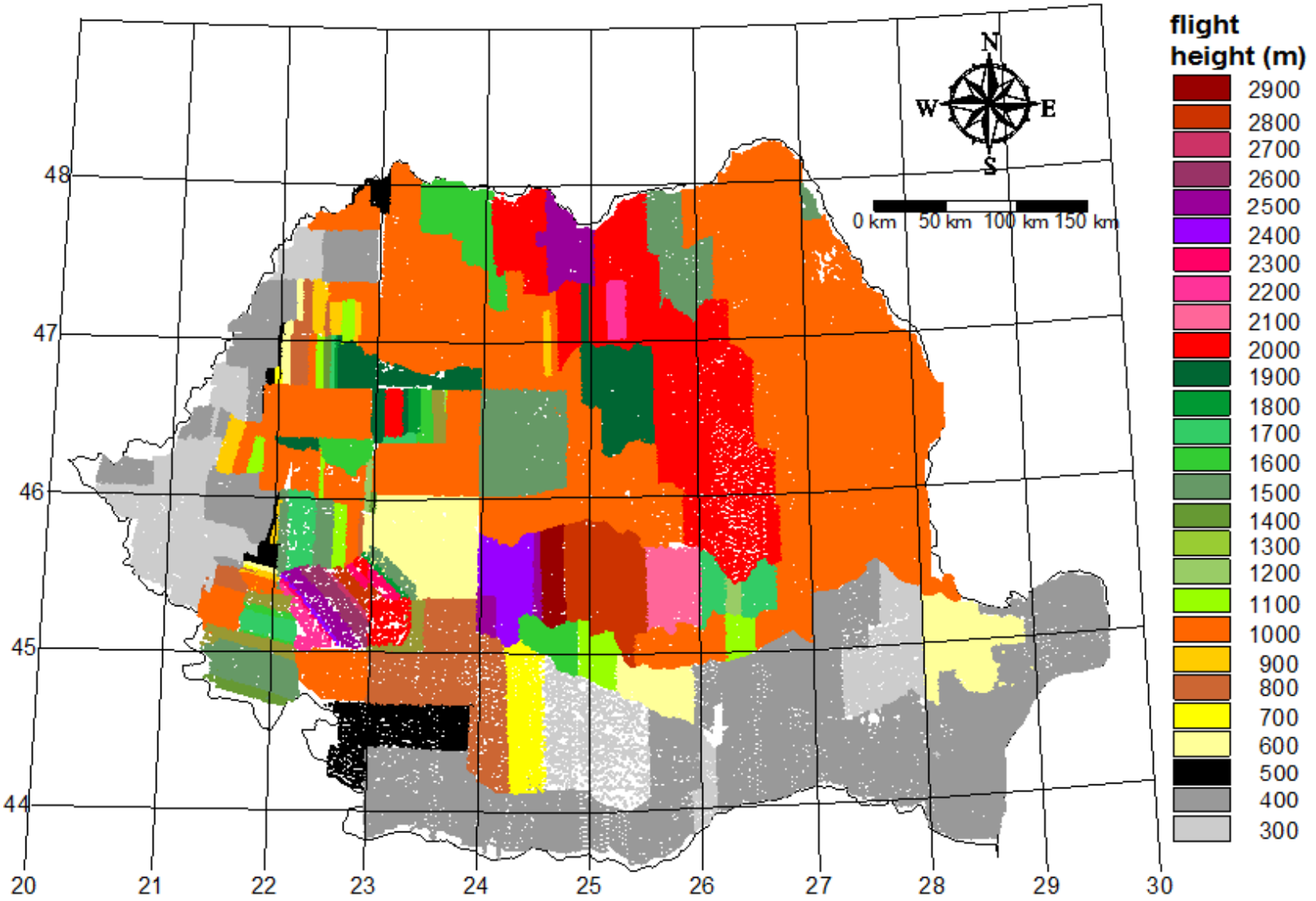
yearly panels of the Romanian airborne geomagnetic survey

RATIONALE (1): time inconsistency



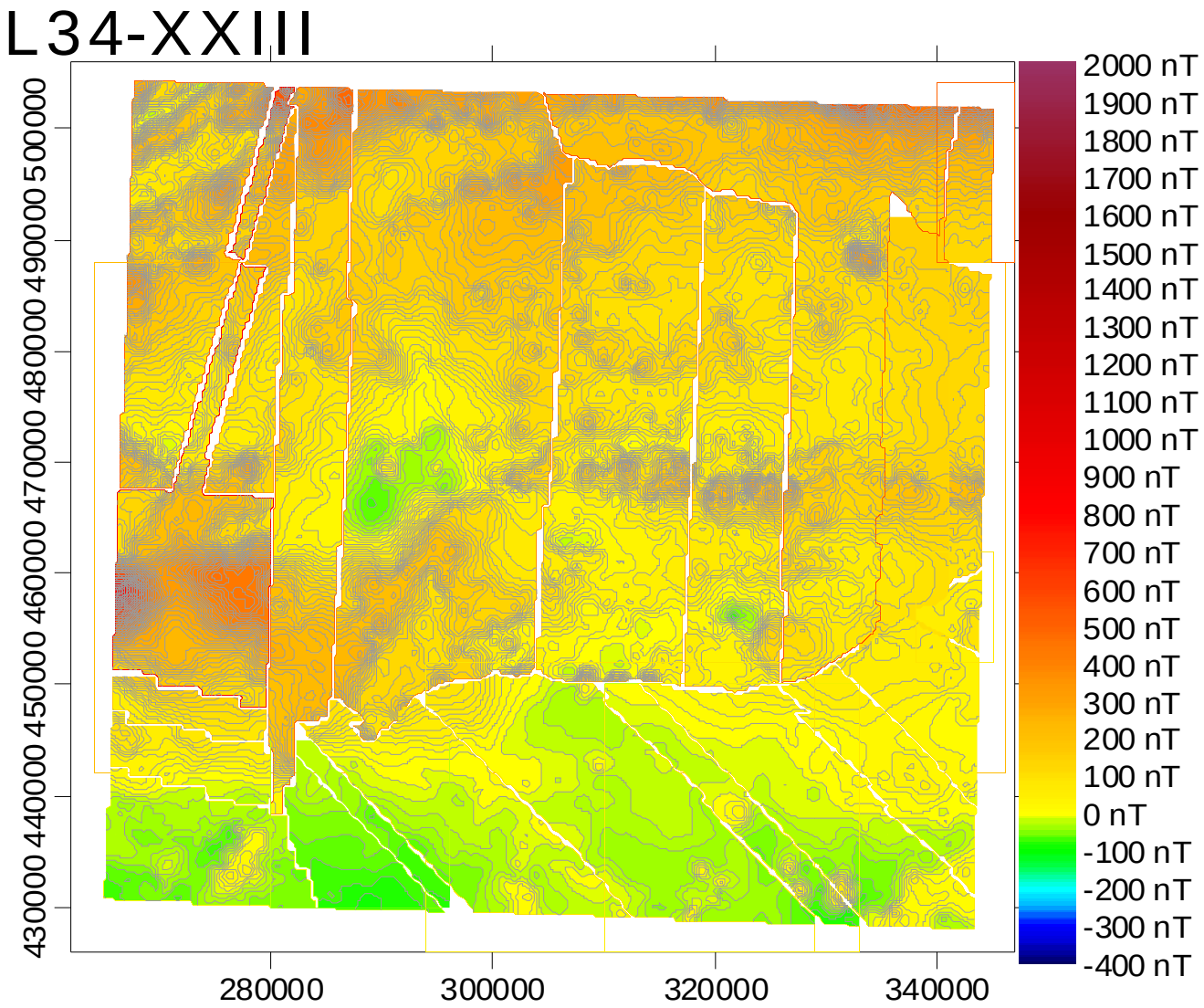
secular variation distortions in the Romanian Ground Vertical Component Geomagnetic Map
(according to Besutiu, Besutiu, 1994)

RATIONALE (2): space inconsistency



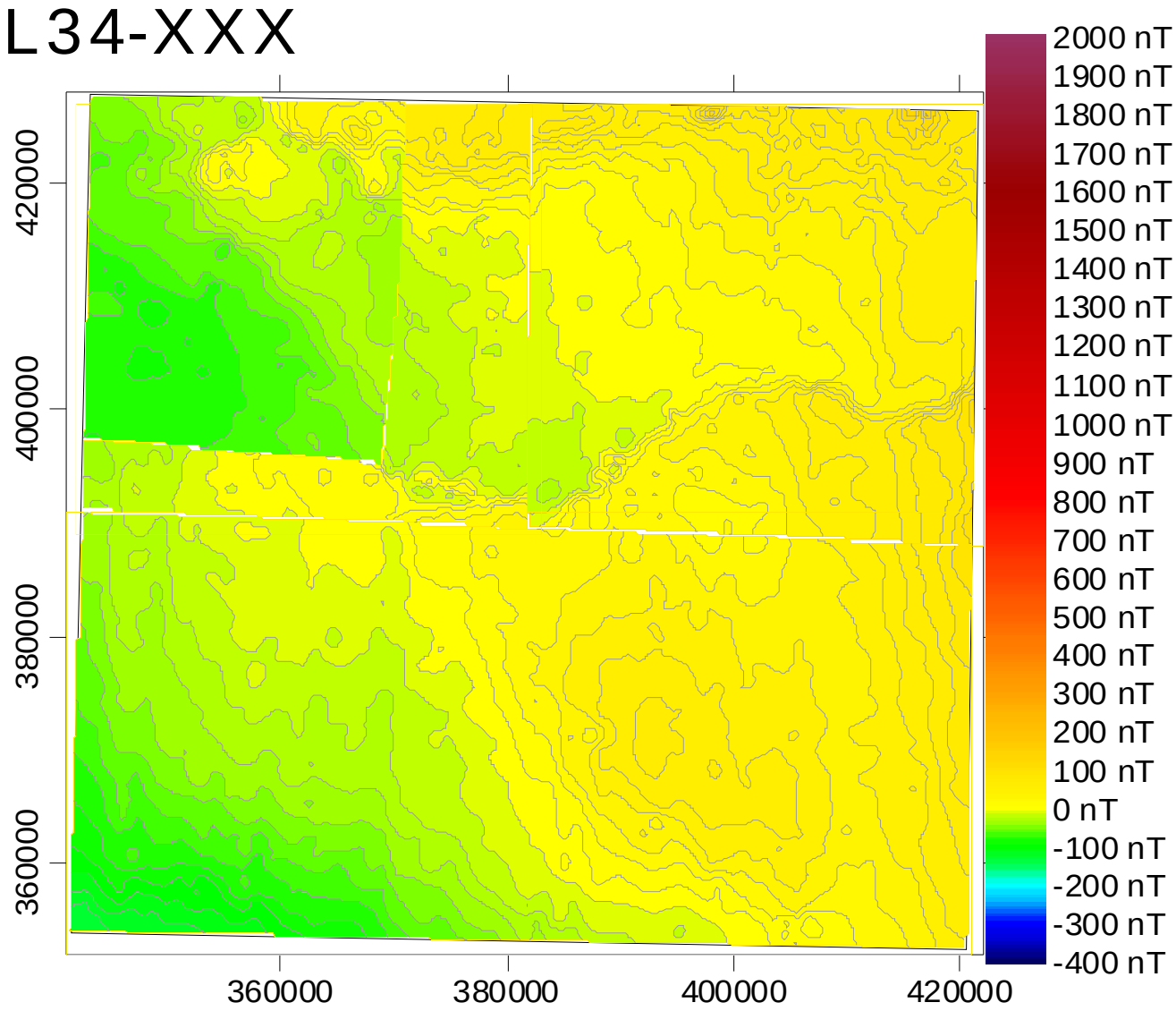
de of the flight panels of the Romanian magnetic airborne survey

Examples of space-time inconsistencies



Composite geomagnetic map using data provided by flight panels achieved at various geomagnetic epochs and altitudes

Examples of space-time inconsistencies

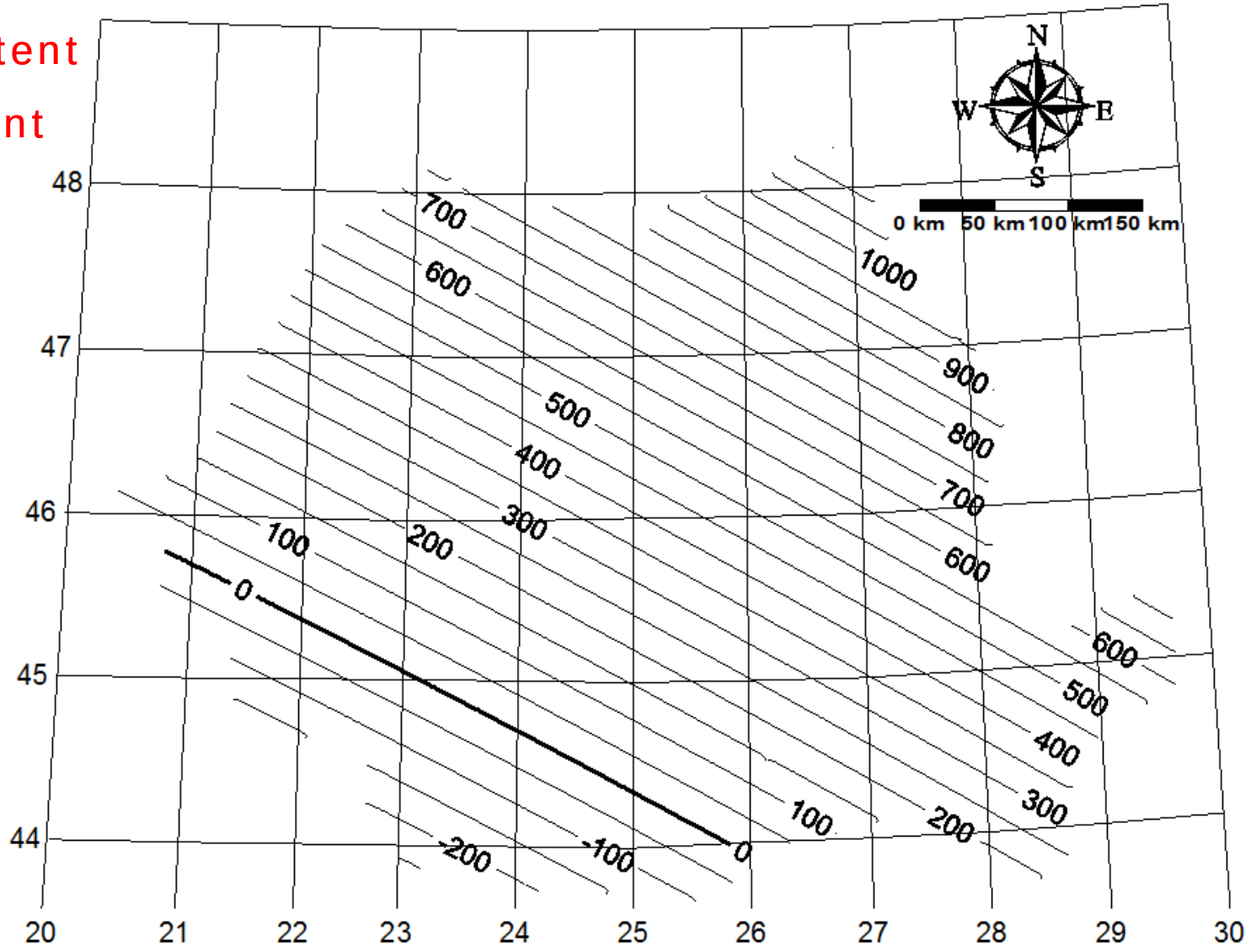


Composite geomagnetic map using data provided by flight panels achieved at various geomagnetic epochs and altitudes

RATIONALE (3): inappropriate reference geomagnetic field

space inconsistent

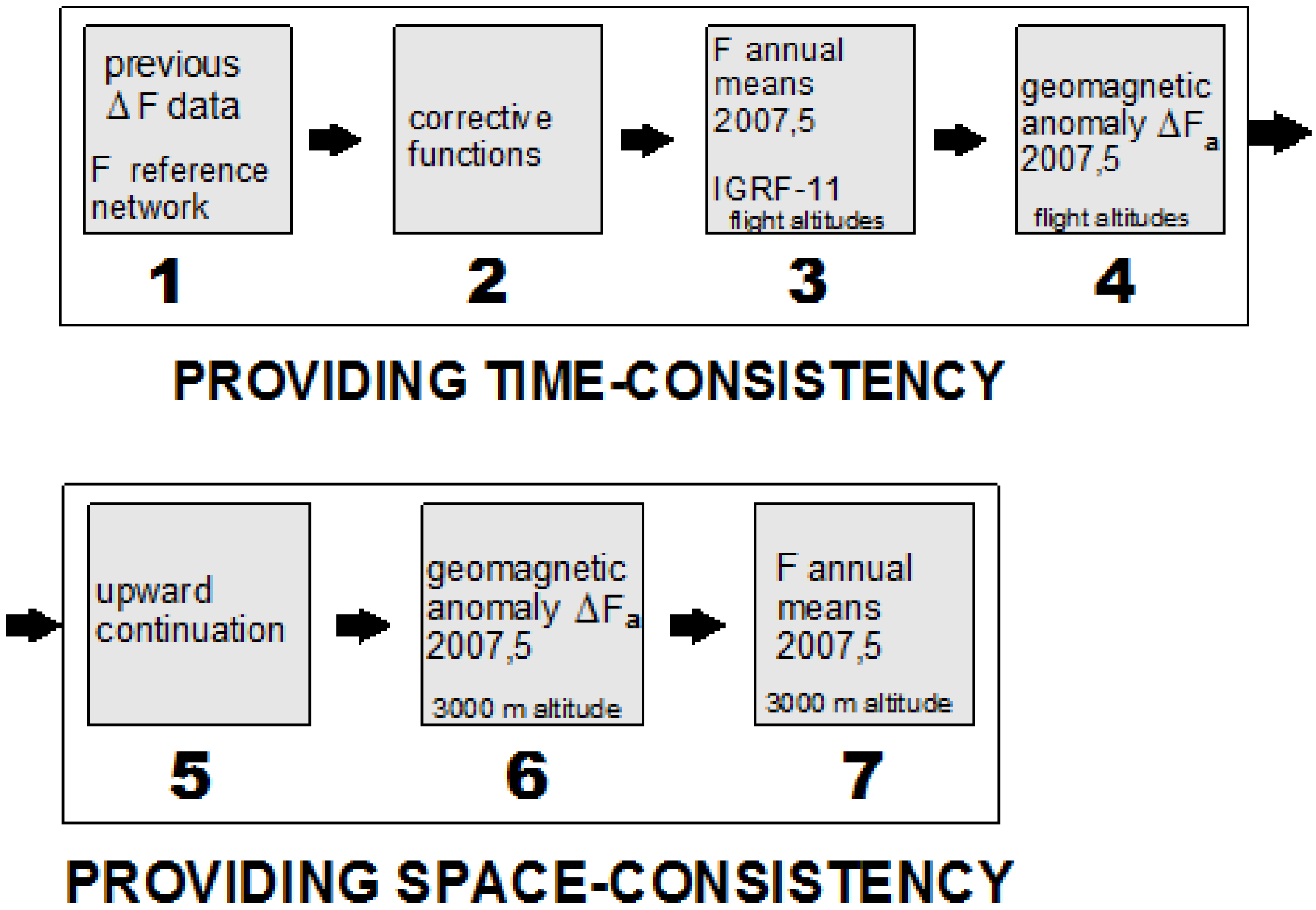
time inconsistent



computer reconstructed model of the geomagnetic reference field used to infer the former version of the geomagnetic anomaly

METHODOLOGY

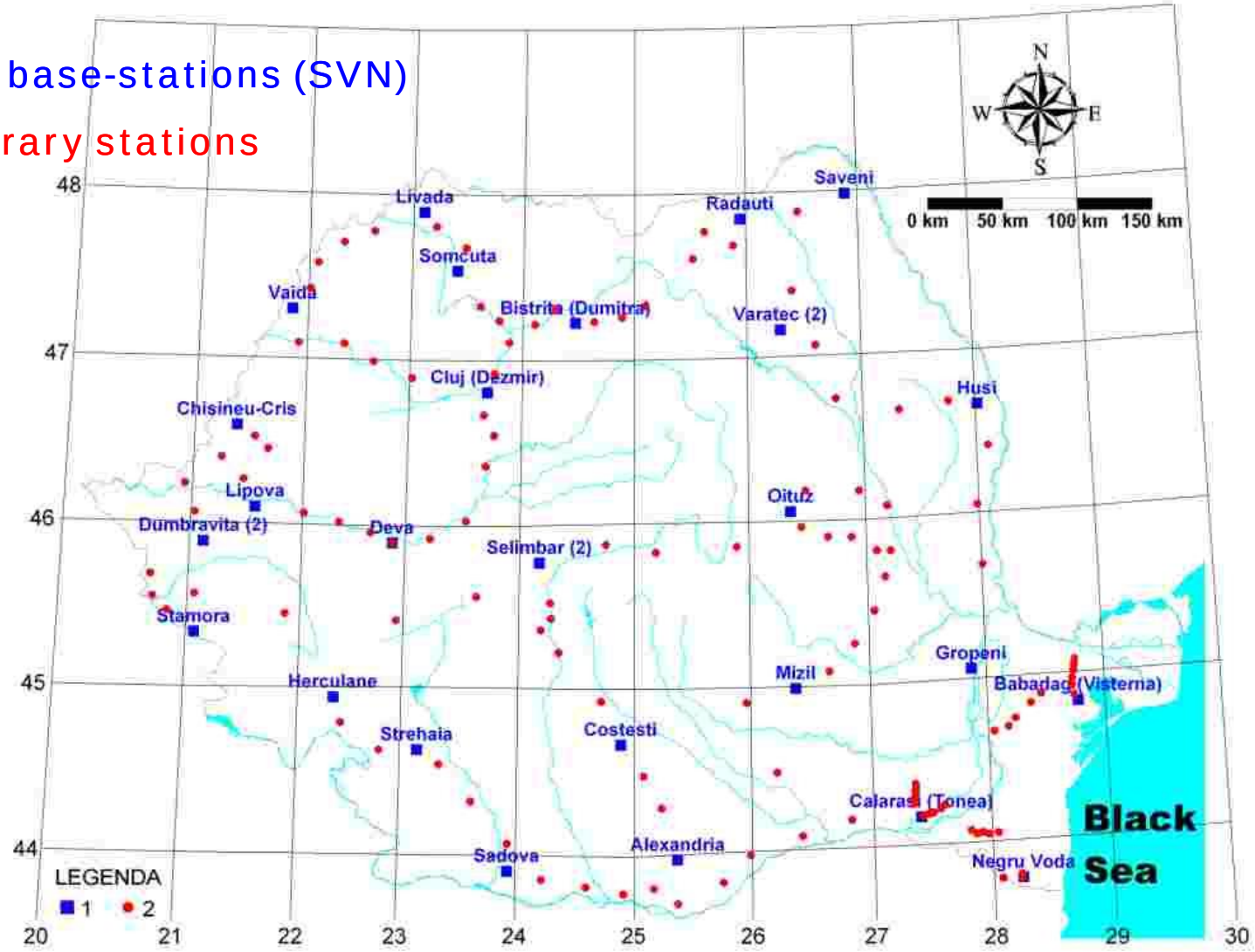
METHODOLOGY: research flow



METHODOLOGY: National Geomagnetic Reference Network (NGRN) aimed at providing a time-consistent geomagnetic datum

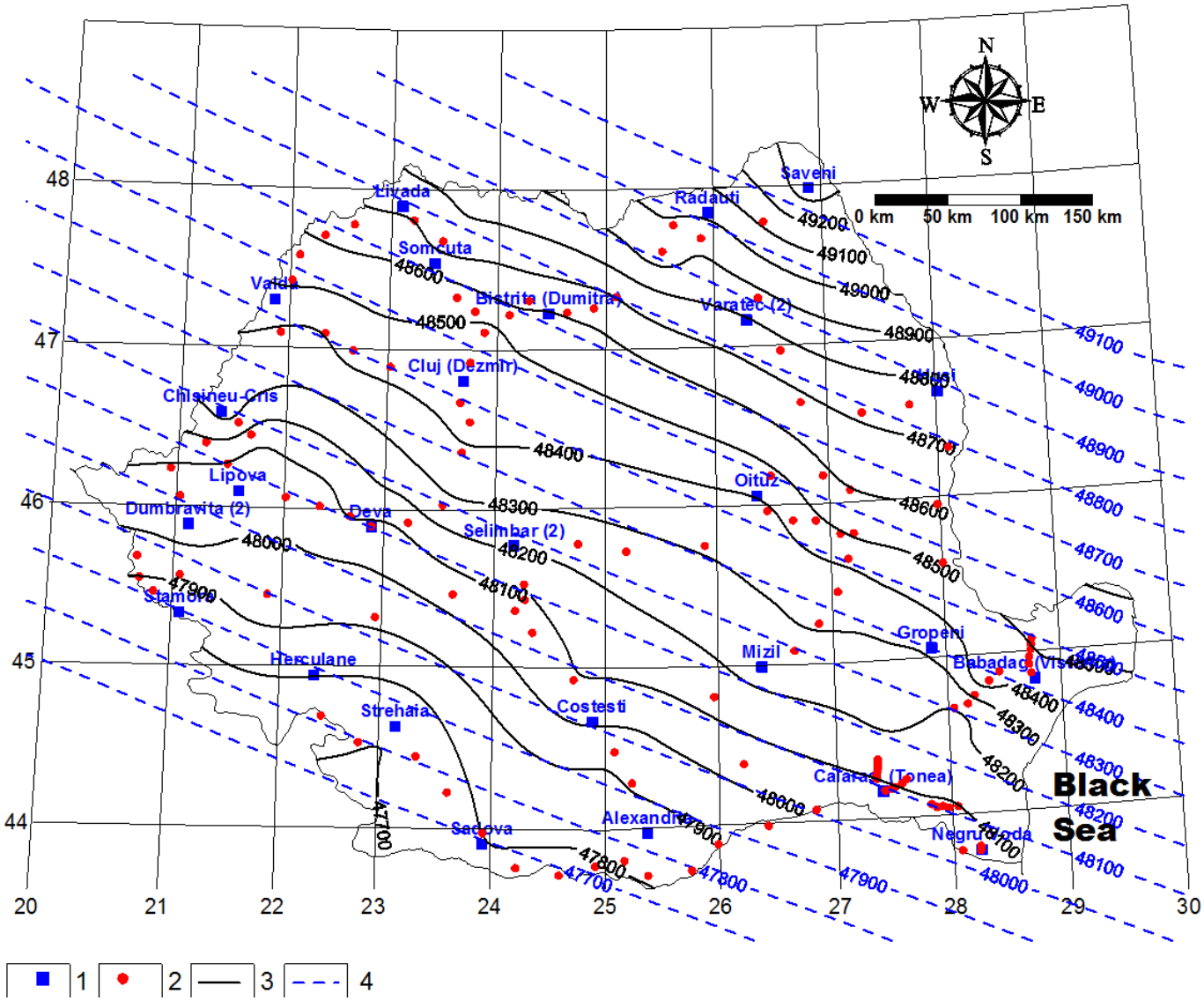
27 epoch base-stations (SVN)

120 temporary stations



METHODOLOGY National Geomagnetic Reference Network:

quality assessment = **checking up for local geomagnetic effects**



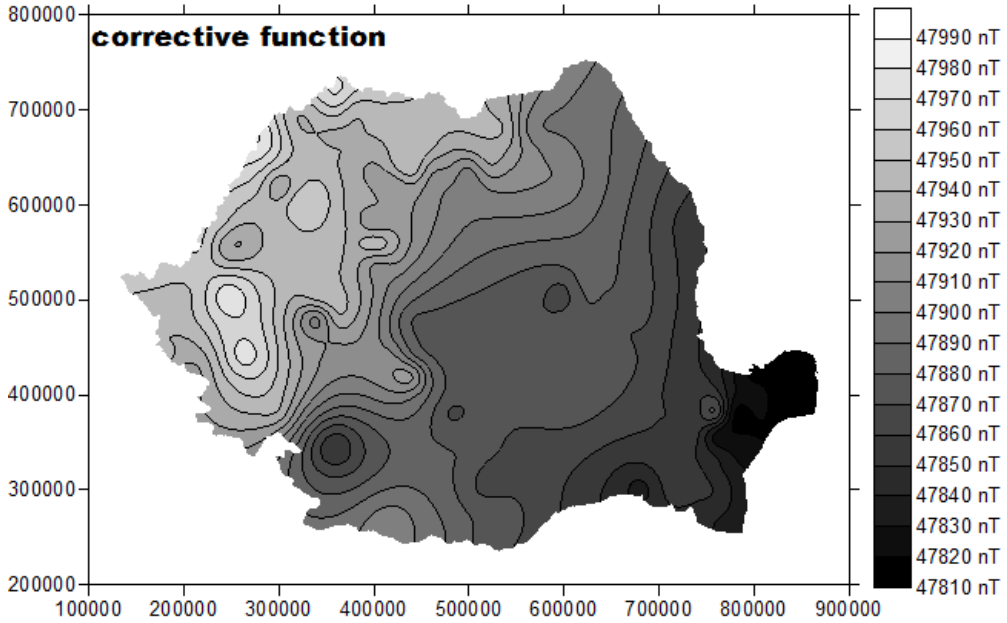
METHODOLOGY: corrective functions

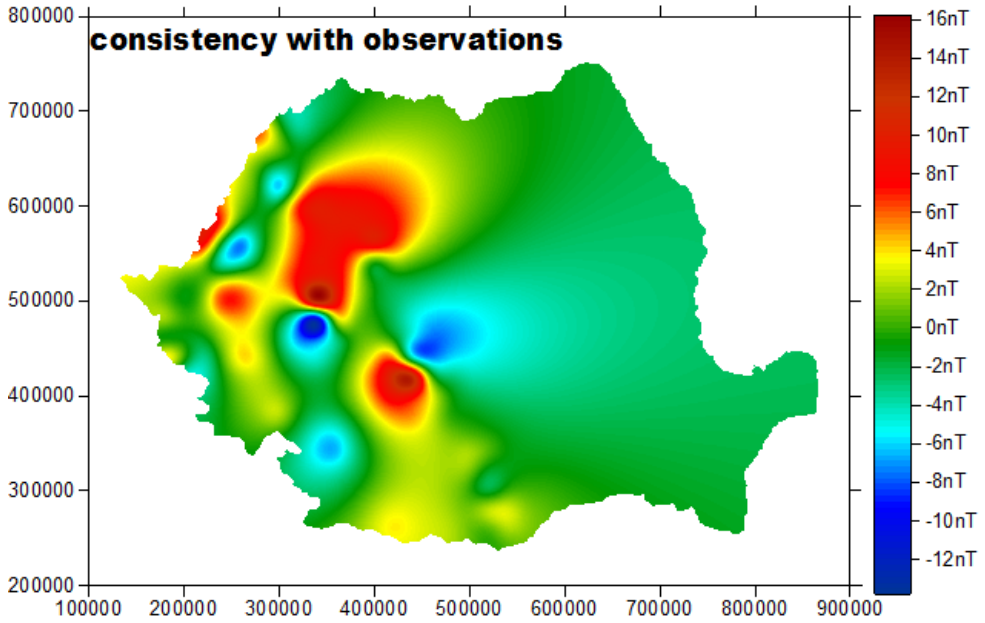
Data provided by NGRN were:

1) upward continued at the flight level ;
2) deviations set by comparing with previous aeromagnetic data;
3) based on these deviations, corrective functions were constructed by using various approaches (polynomial regression of various orders, and krigging), and compared for consistency with the observations within NGRN

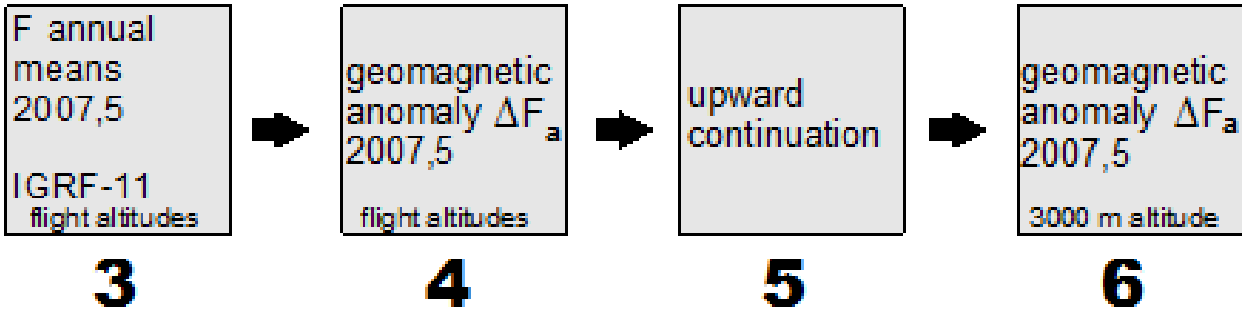
METHODOLOGY: corrective functions

the best fit with
krigging interpolator





II. PROVIDING SPACE-CONSISTENCY



After applying corrective functions

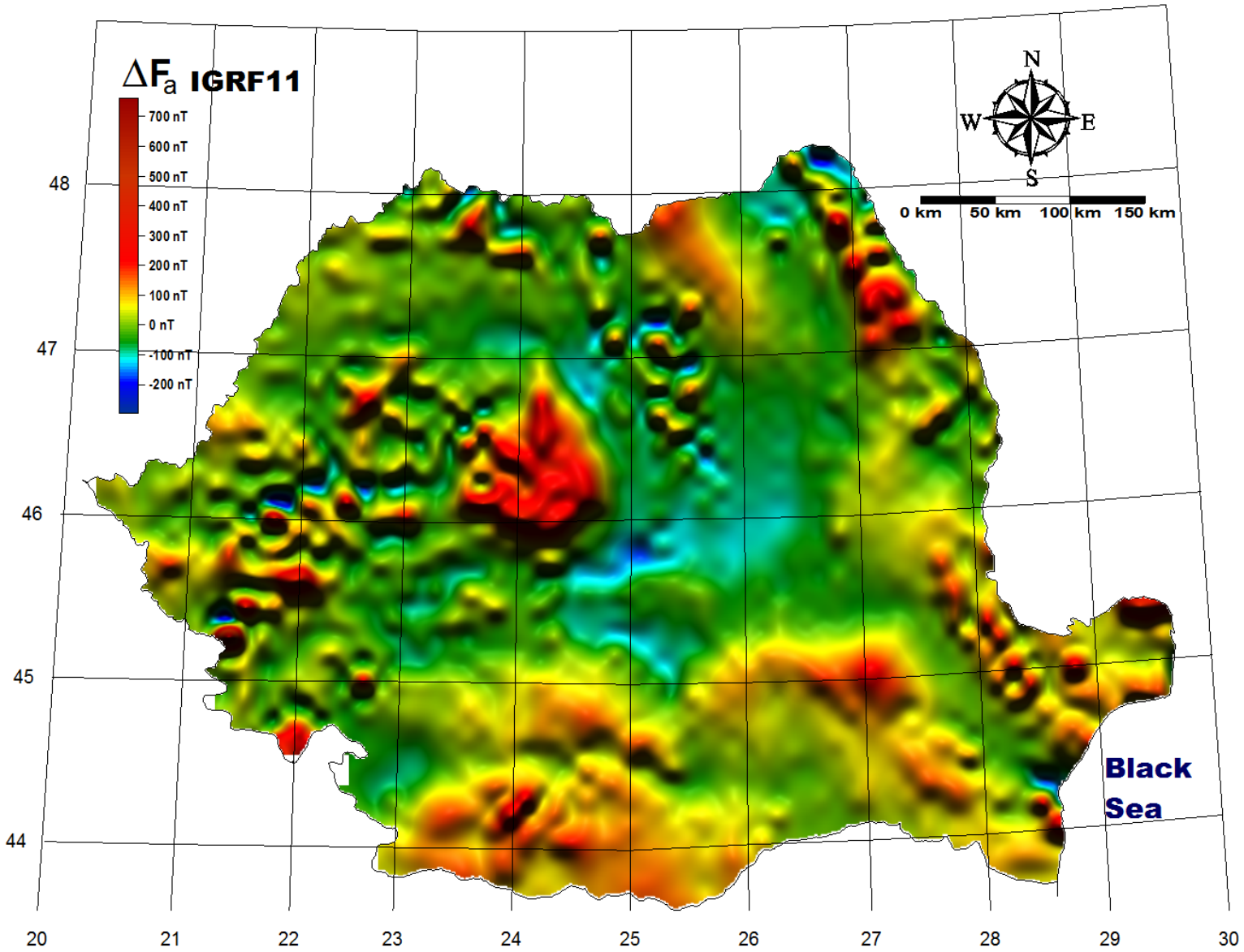
3. time-consistent set of F values for the epoch 2007.5, but at the flight altitude of each panel (ranging between 300m – 2900m) was obtained

4. the geomagnetic anomaly at each flight altitude with IGRF 11

5. the geomagnetic anomaly for each flight-panel was upward continued at 3000 m

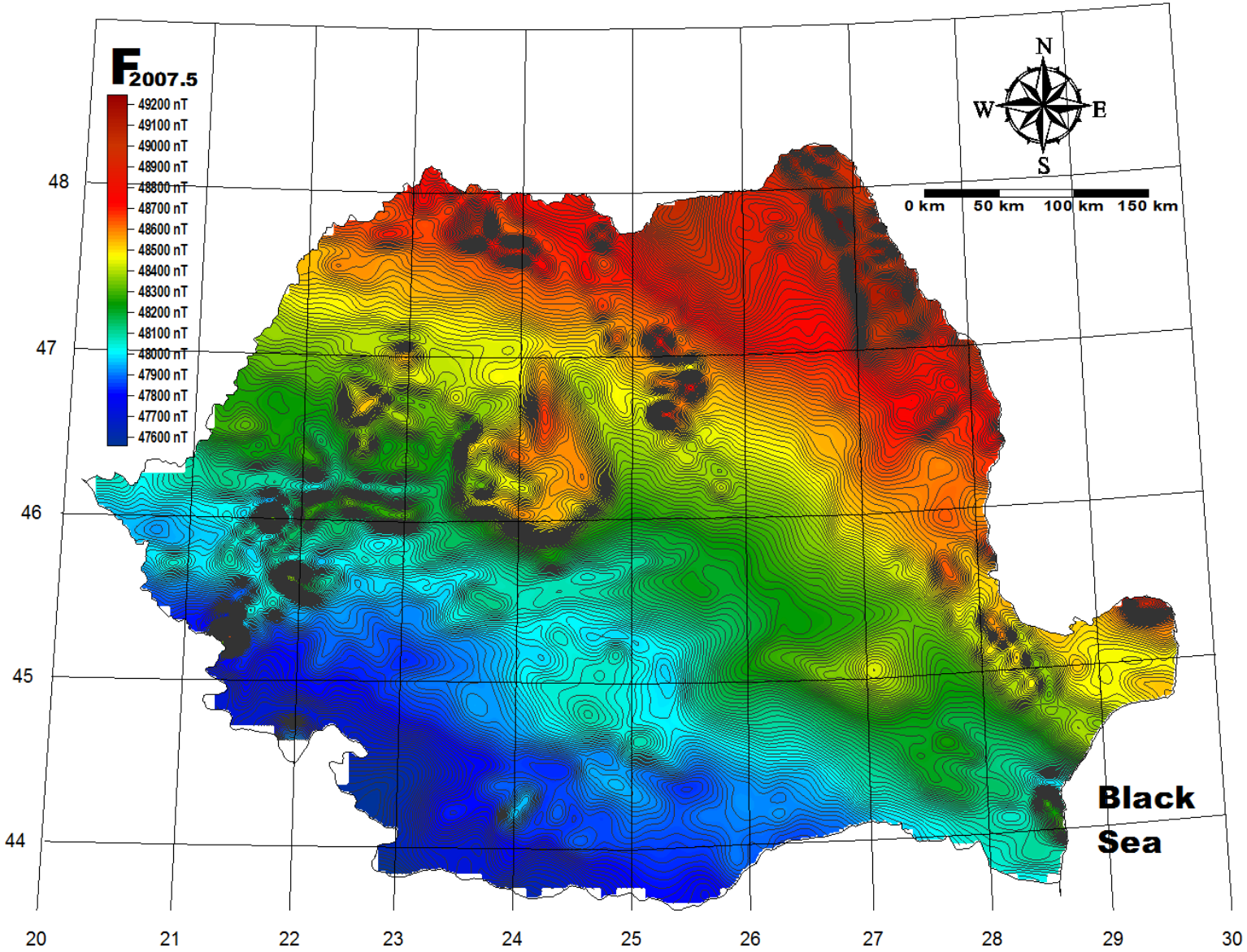
RESULTS

RESULTS (1): The geomagnetic anomaly



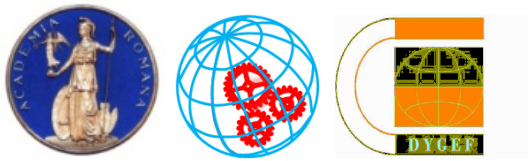
total intensity scalar geomagnetic anomaly for the 2007.5 epoch at the 3000 m altitude

RESULTS (2): The total intensity geomagnetic field



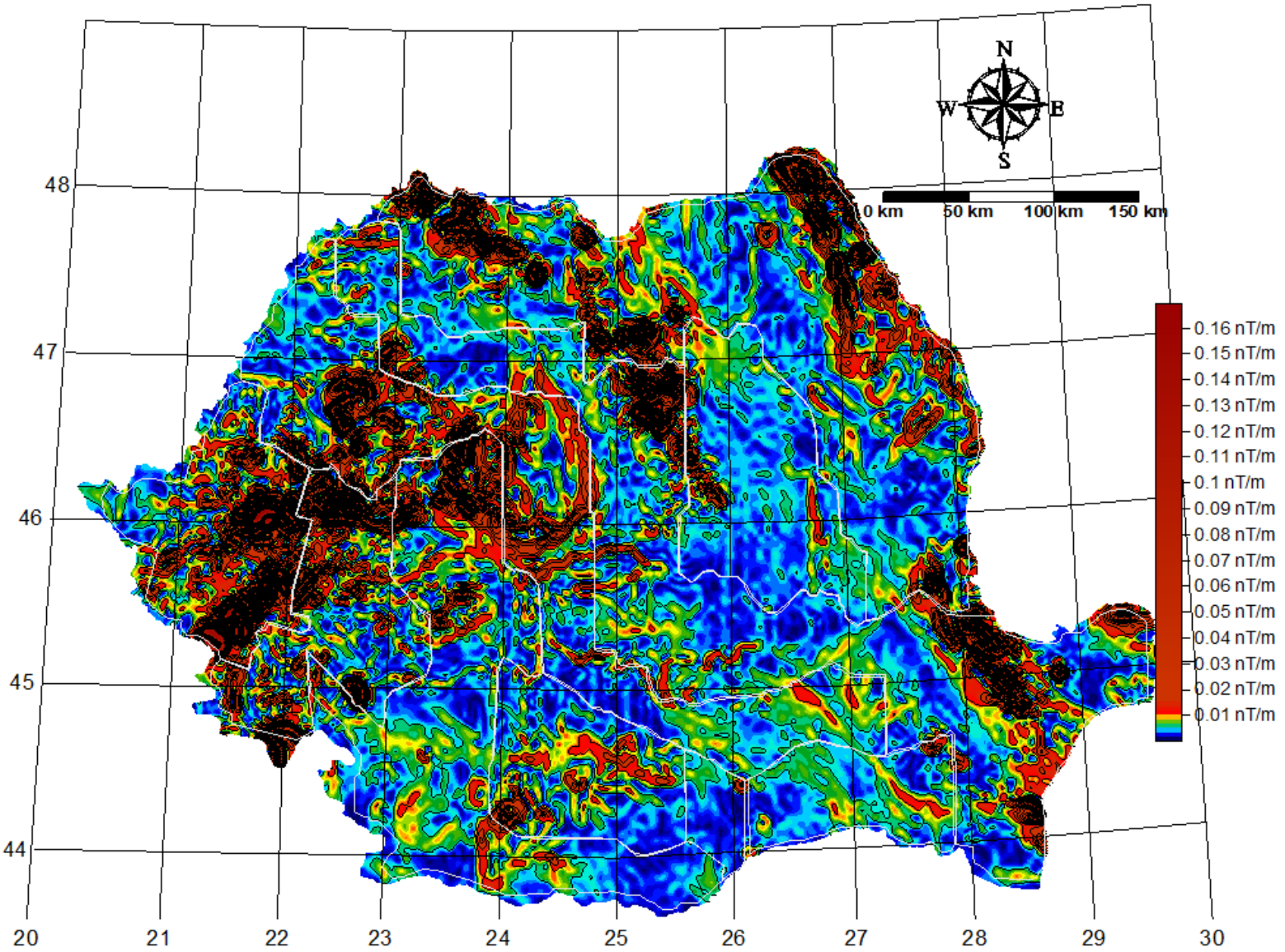
total intensity scalar of the geomagnetic field for the 2007.5 epoch at the 3000 m altitude

QUALITY ASSESSMENT



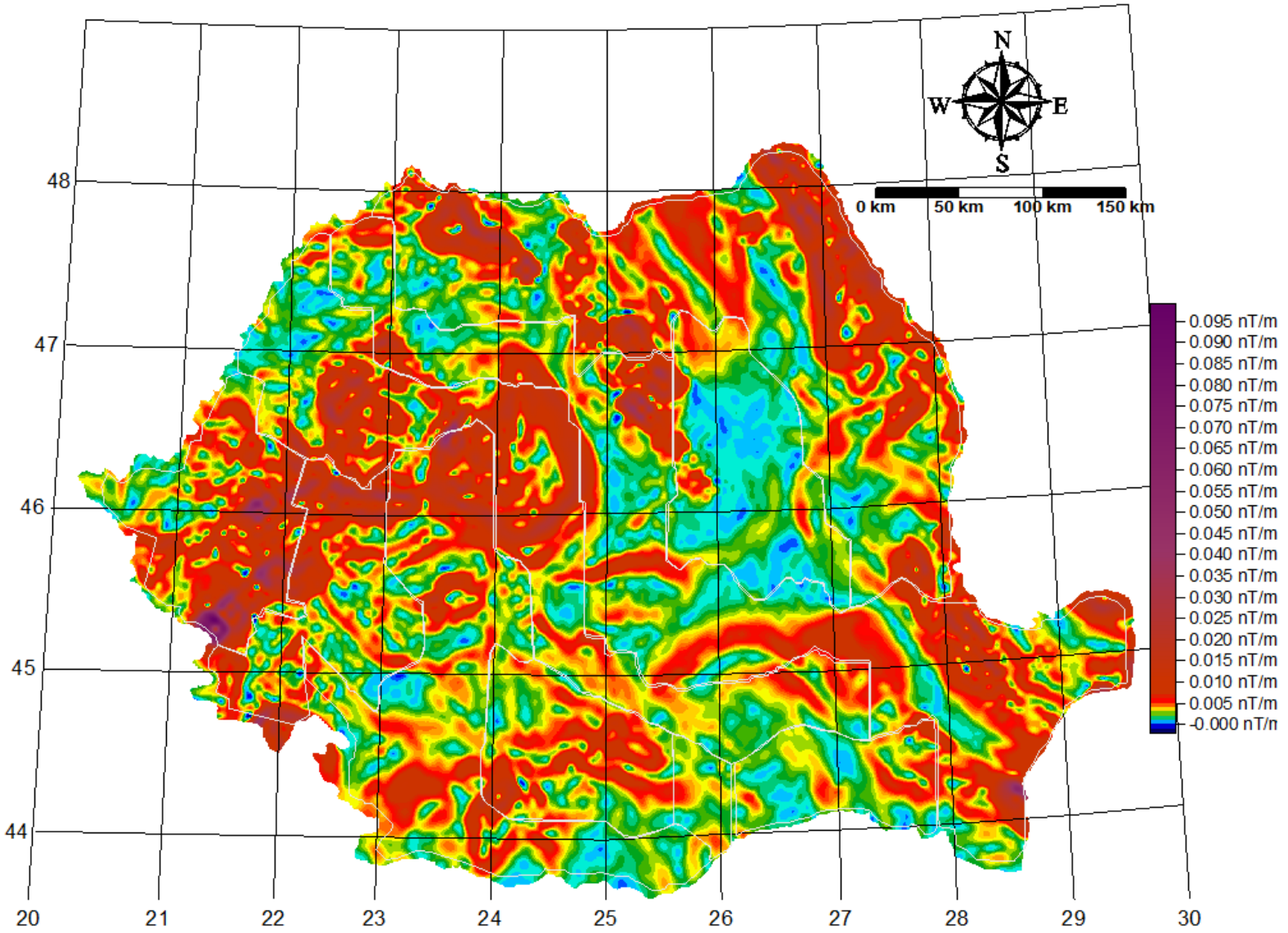
QA: space-time-consistency (1)

horizontal gradient of the total intensity scalar of the geomagnetic field



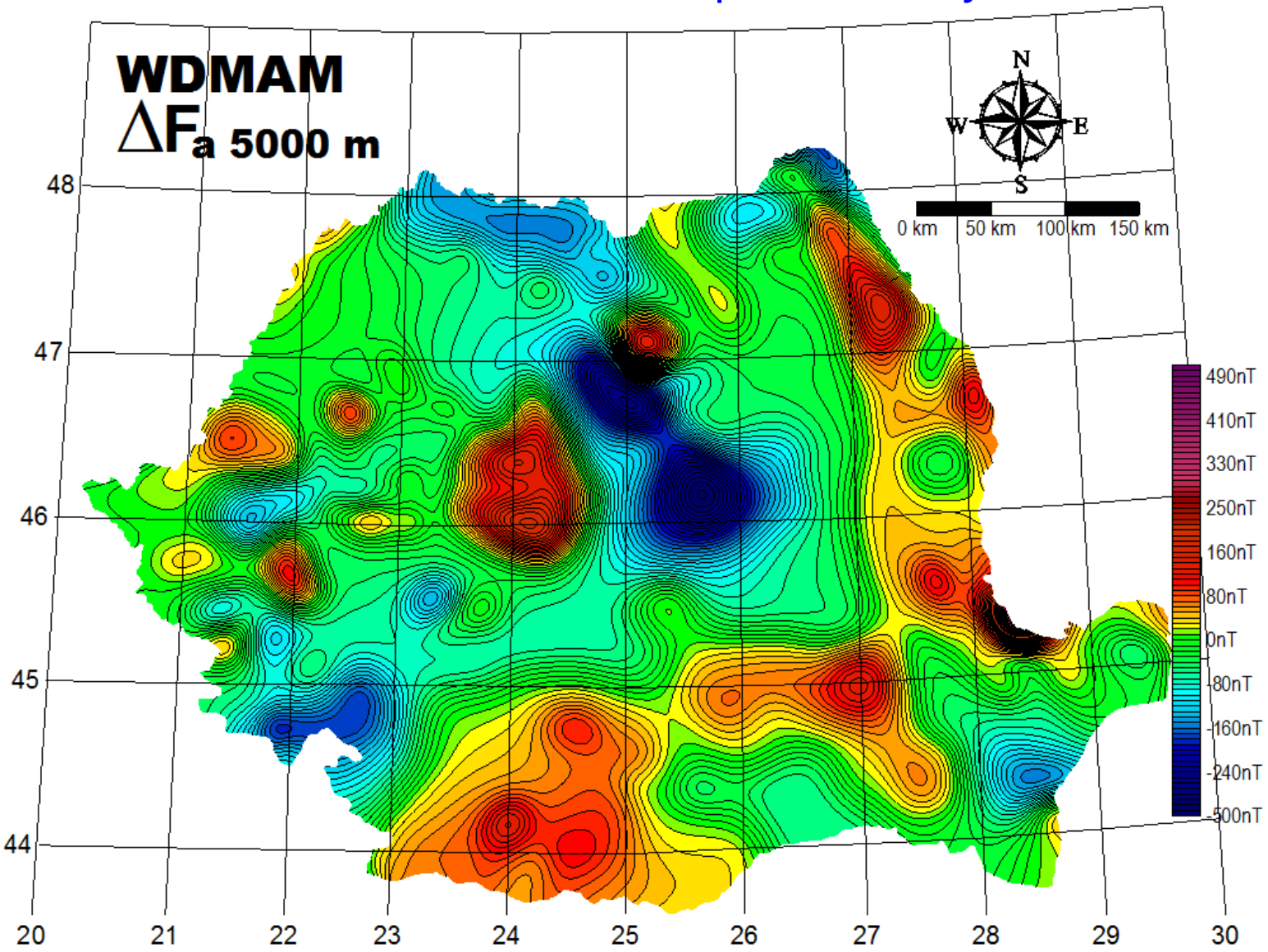
QA: space-time consistency (2)

horizontal gradient of the total intensity scalar geomagnetic anomaly



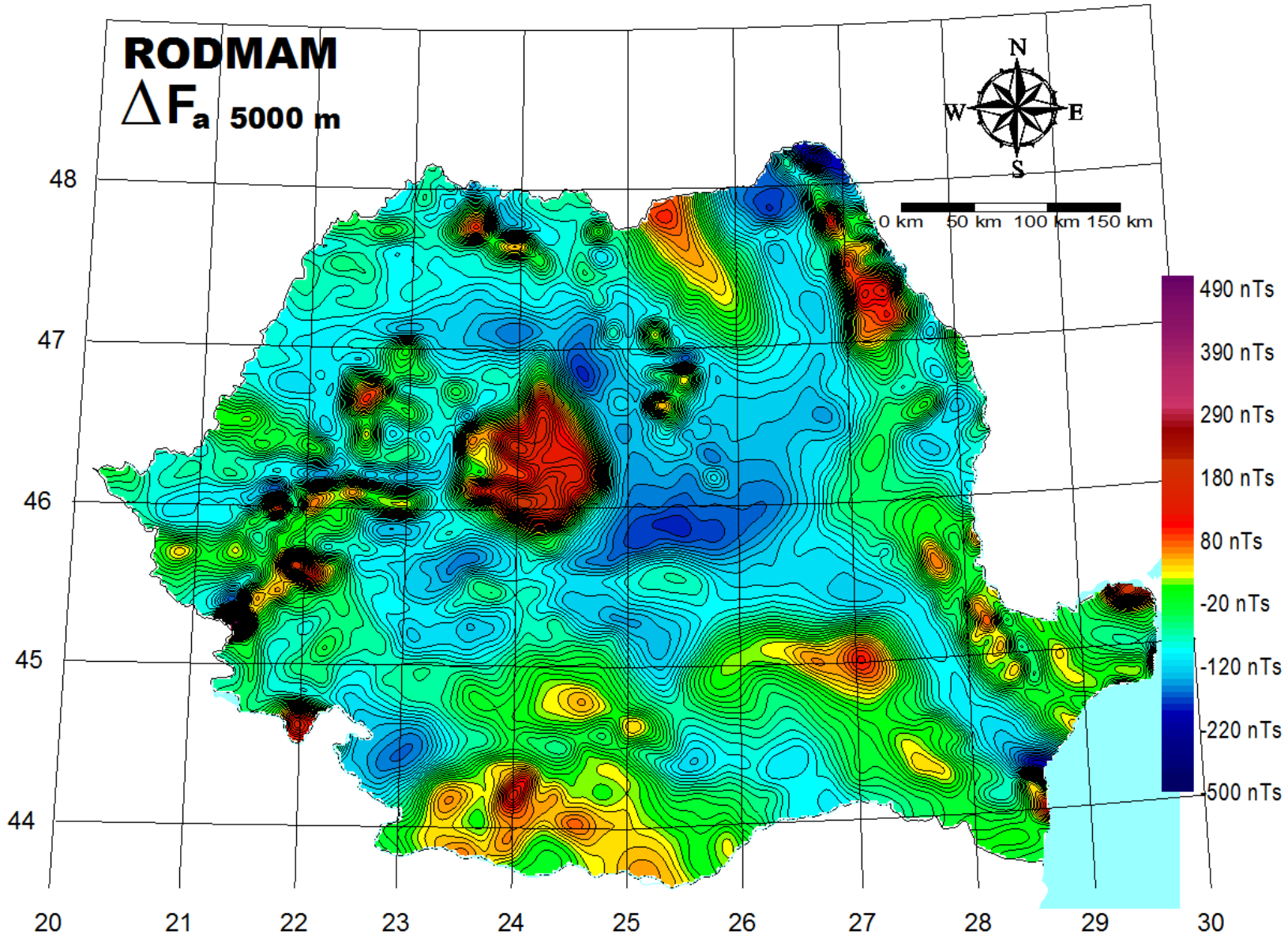
ADDED VALUE

WDMAM as based on the data set provided by the RGVCGM



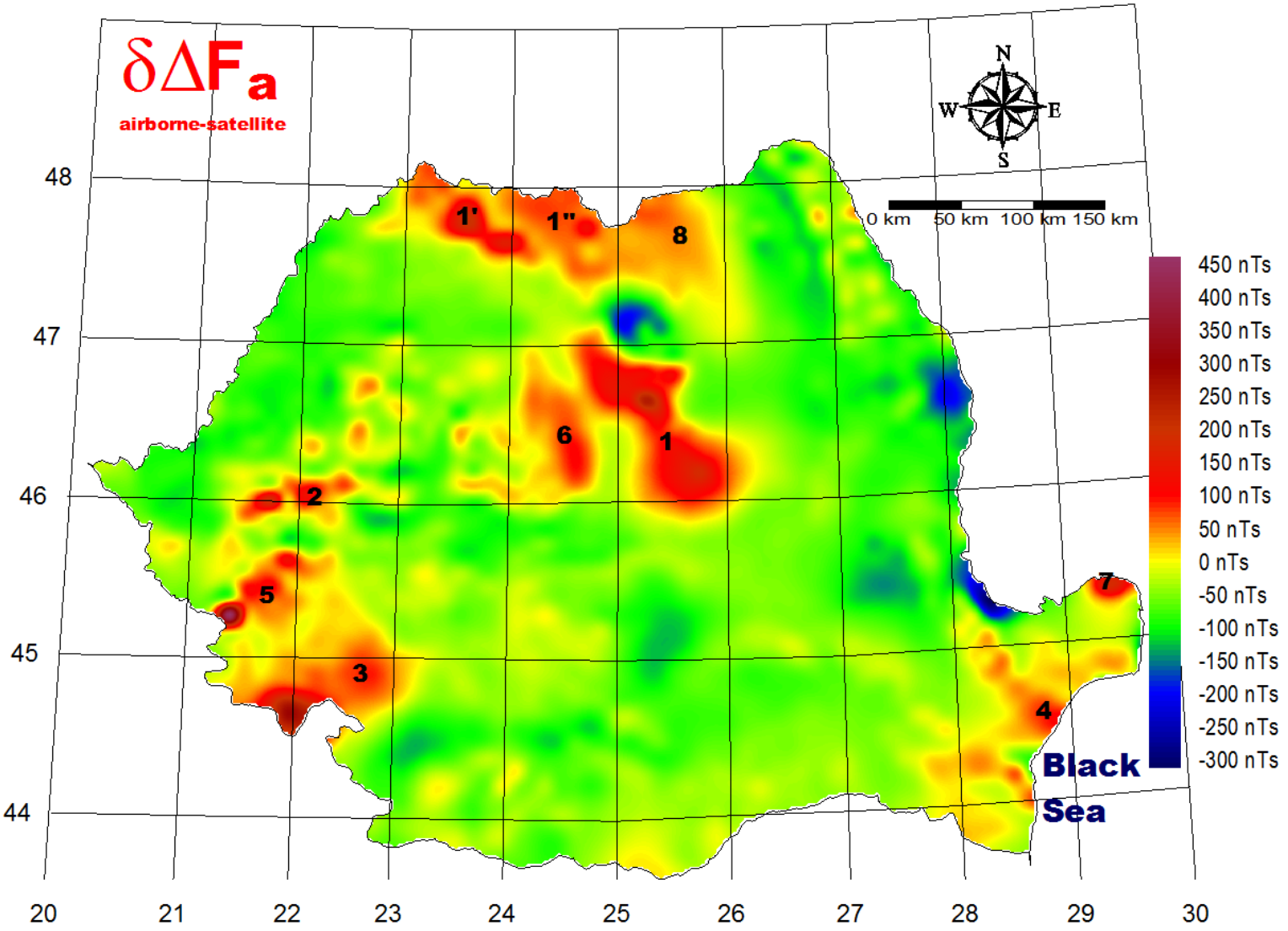
WDMAM for the Romanian territory at 5000m altitude (after Korhoenen et al, 2007)

ROMANIAN AIRBORNE COMPILATION

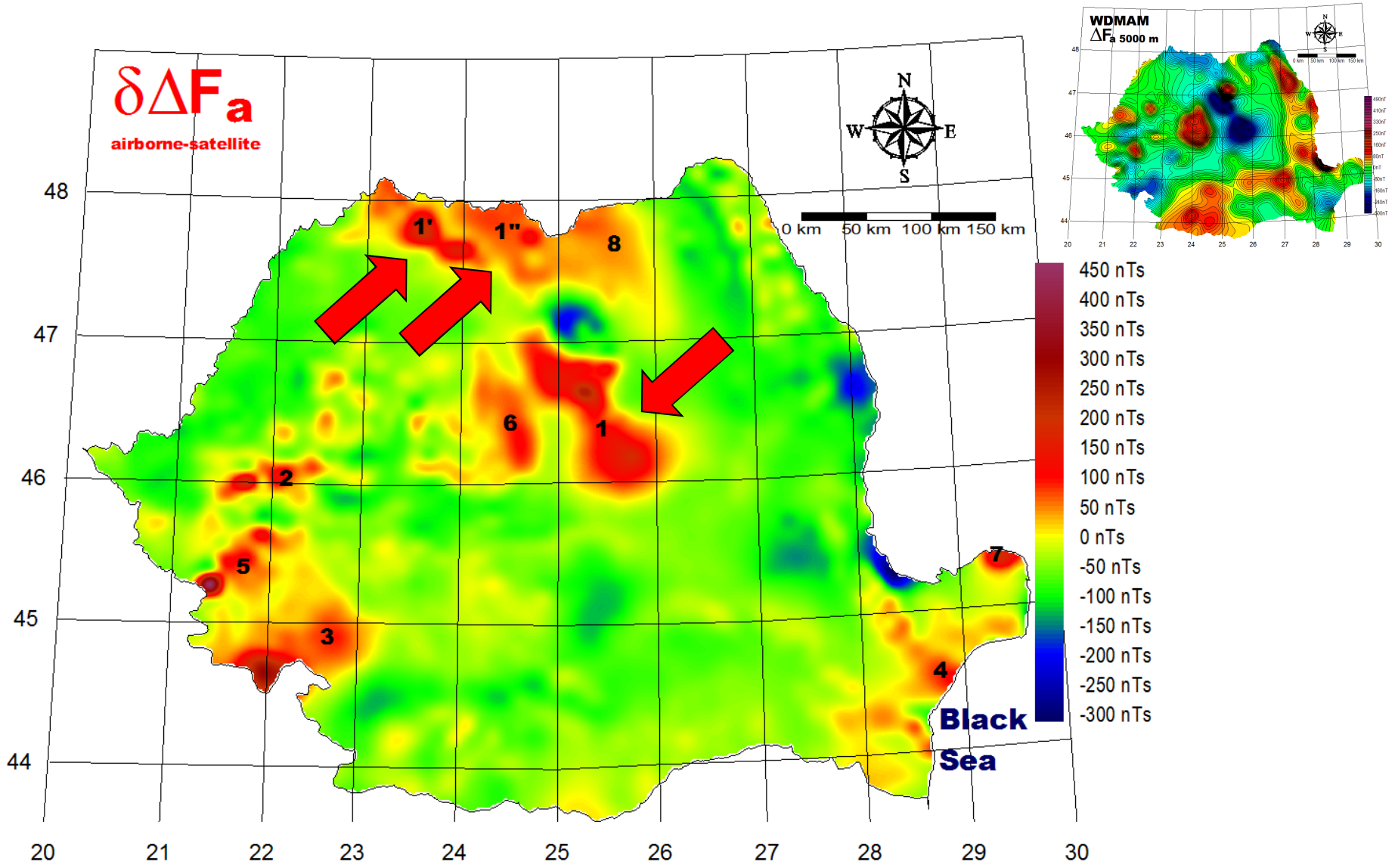


Romanian airborne compilation at the 5000m altitude

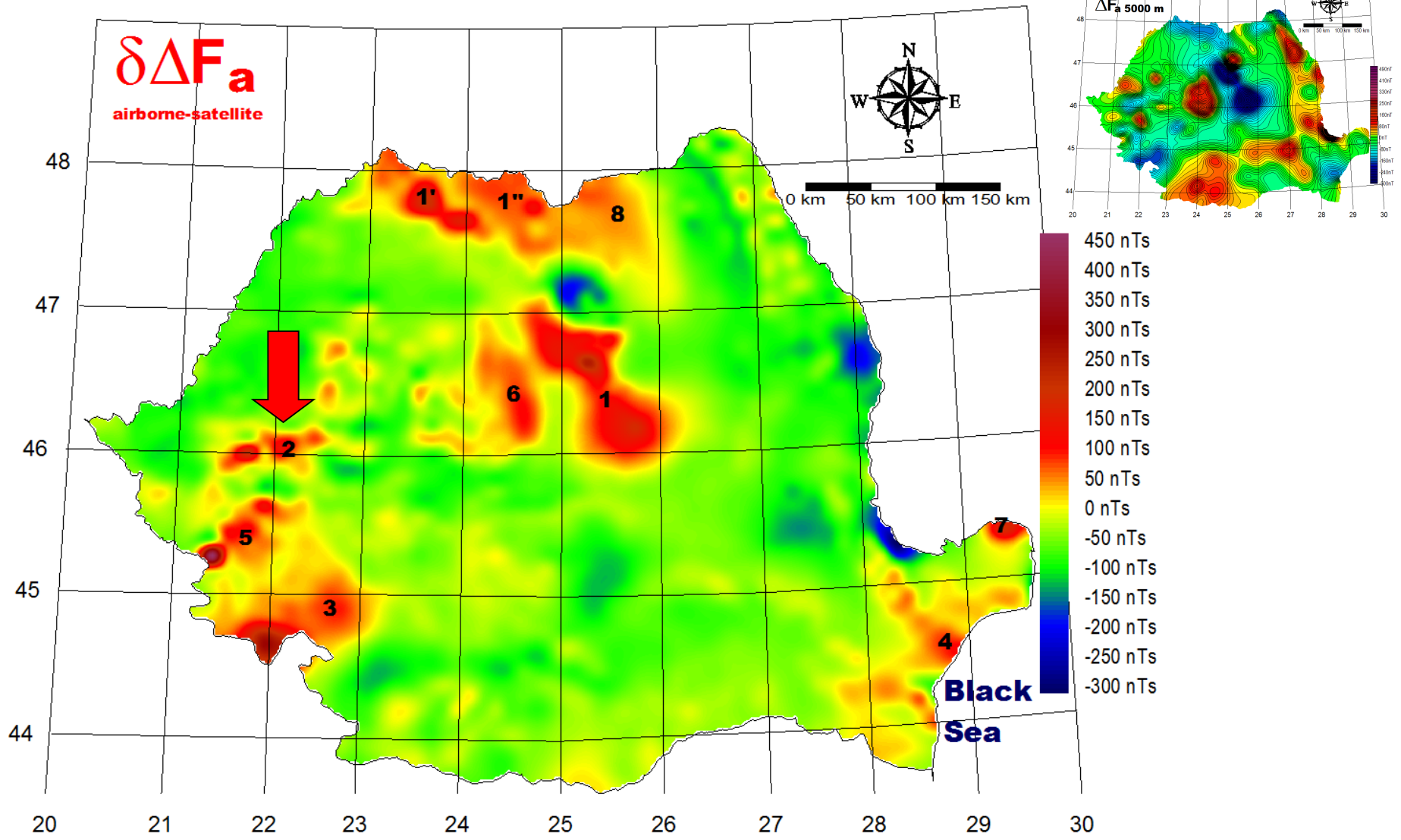
Deviations between the WDMAM model and geomagnetic model provided by the Romanian airborne compilation at 5000m



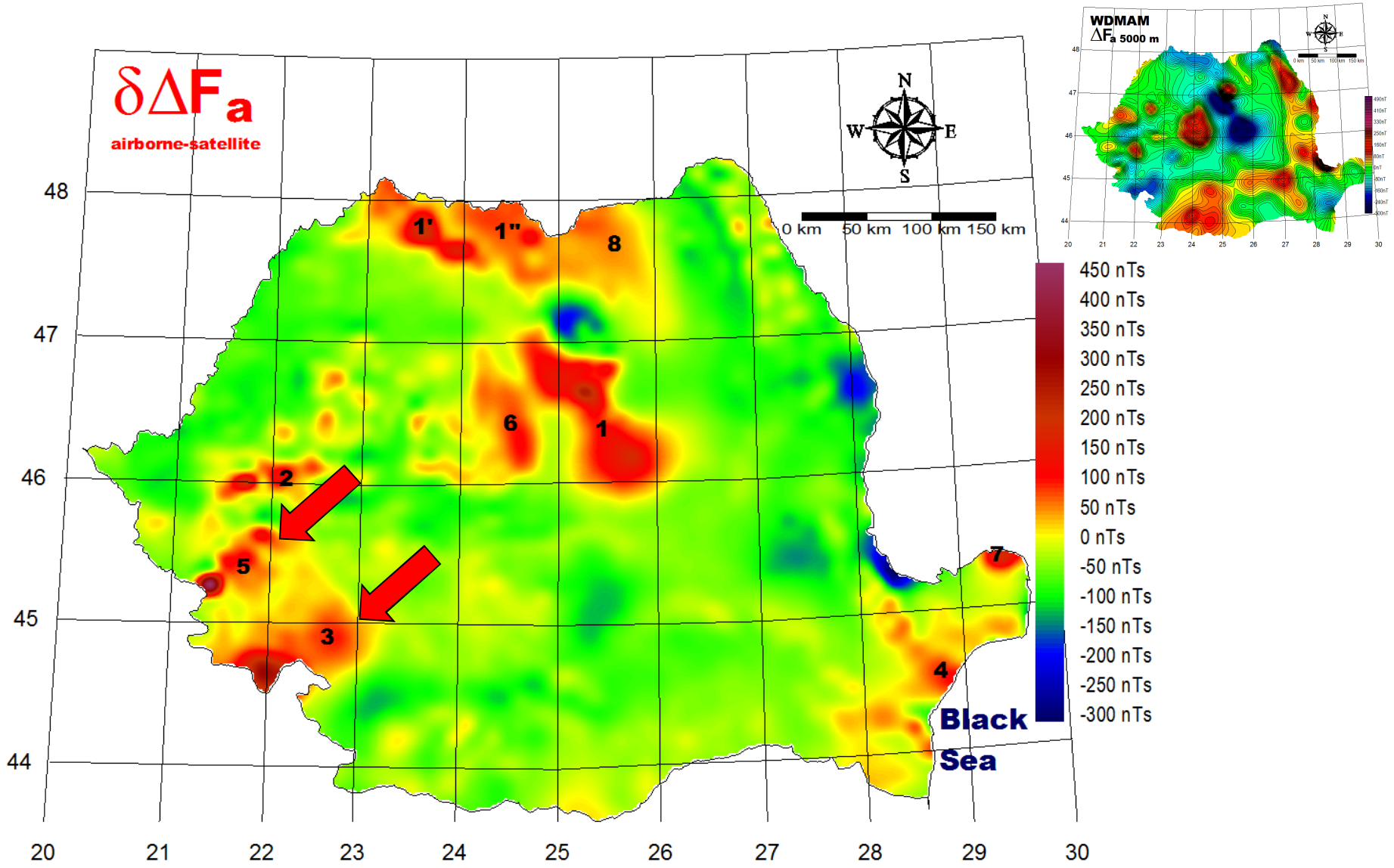
ADDED VALUE: 1) removing topography effect within Neogene volcanism area



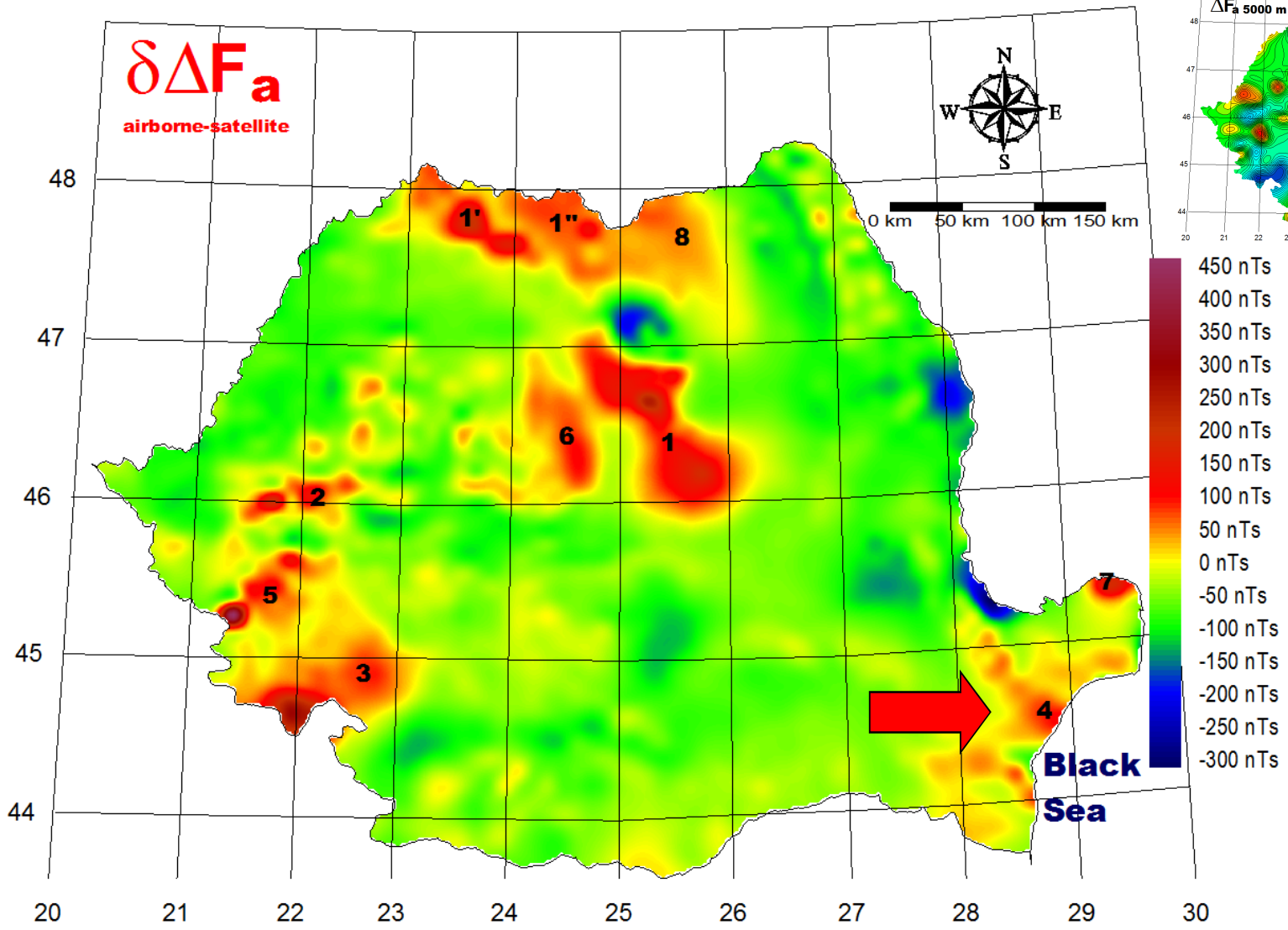
ADDED VALUE: 2) magnetic anomaly over ophiolitic scar within S Apuseni Mts

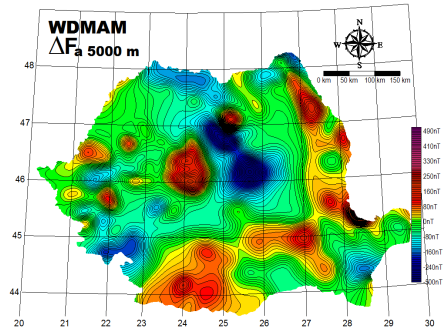


ADDED VALUE: **(3 & 5) the presence of Cretaceous intrusions (banatites)**

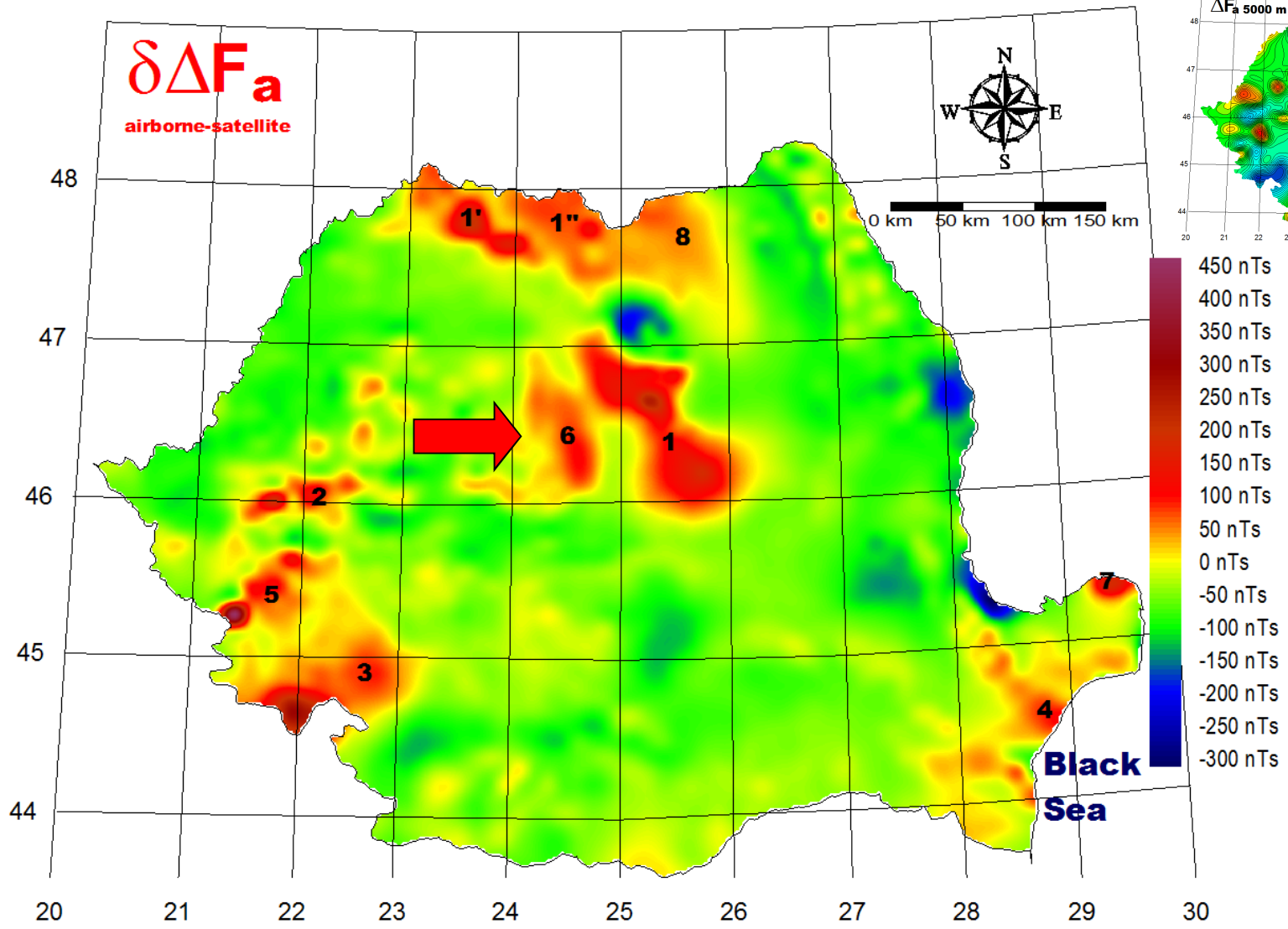


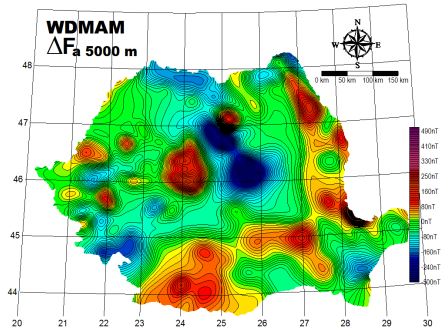
ADDED VALUE: (4) Proterozoic Green Schist Series within Dobrogea



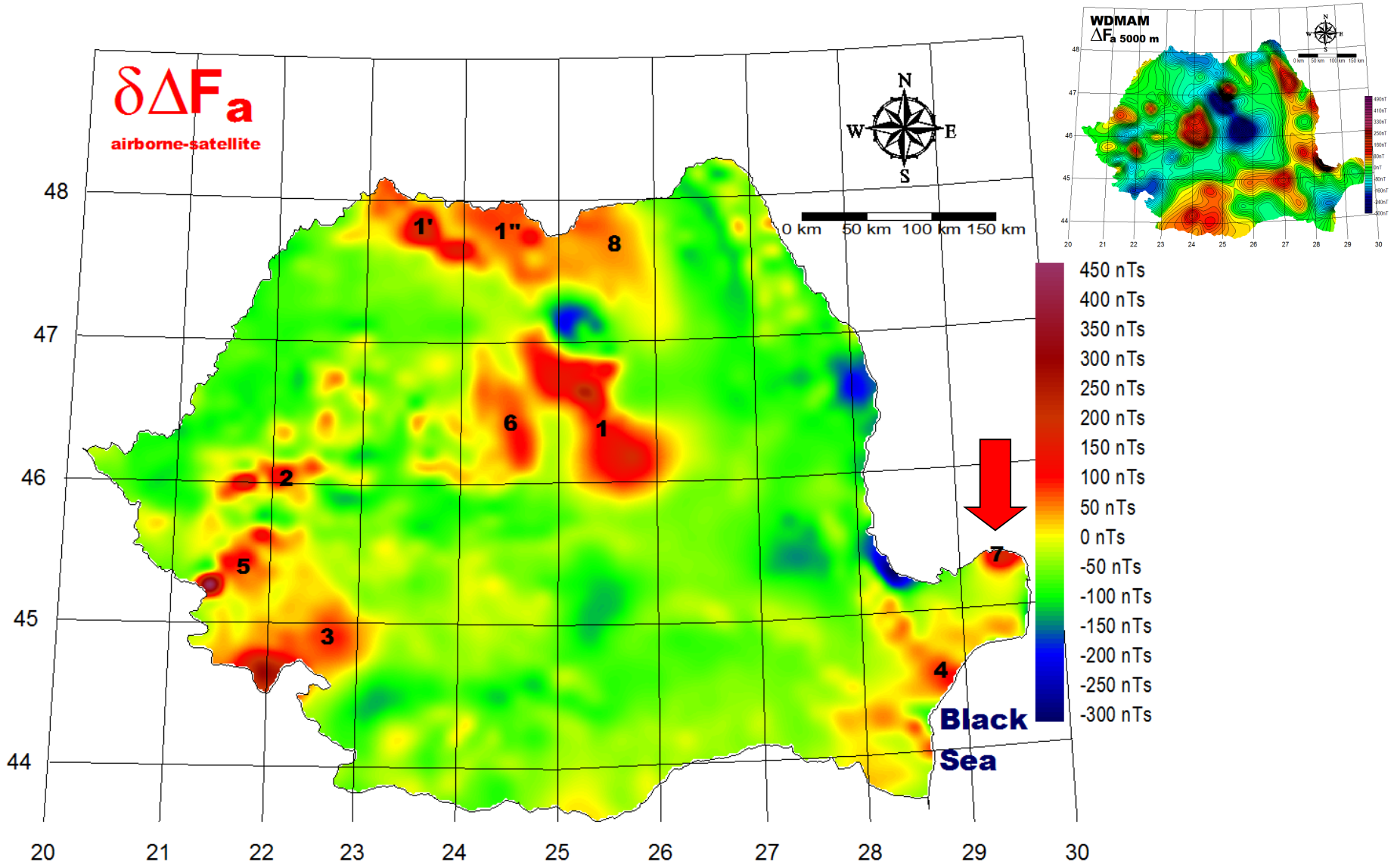


ADDED VALUE: **(6) accurate shape & amplitude of anomaly within central TD**

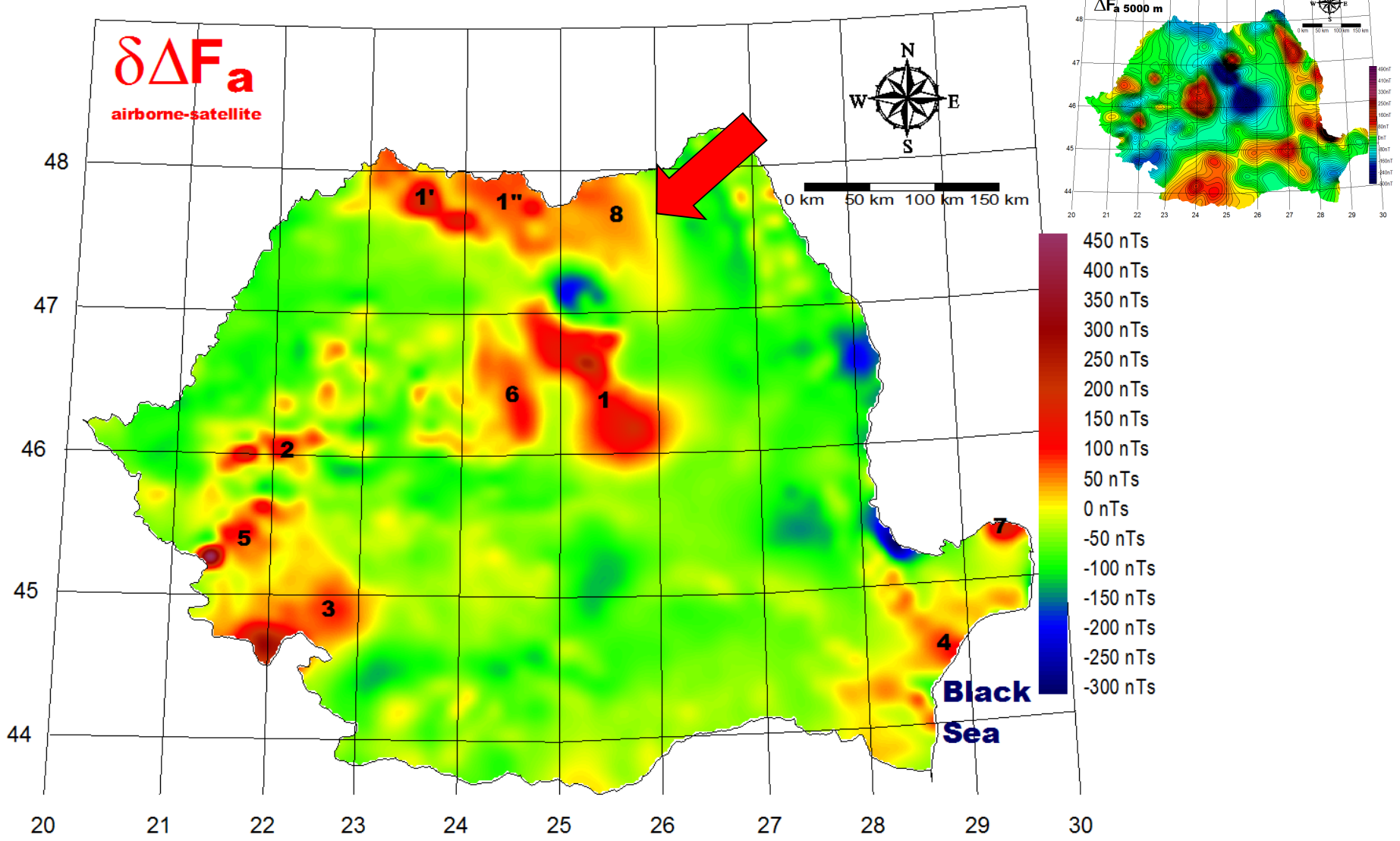




ADDED VALUE: (7) Triassic magmatism within N Danube Delta



ADDED VALUE **8) better outlining the effect of the accretion prism within EC**



CONCLUDING REMARKS

- The 2007 WDMAM release was strongly affected over Romania by the shortcomings of the Romanian ground vertical component geomagnetic map, which it was based on.
- The former raw data provided by the Romanian airborne geomagnetic survey proved to be fully inappropriate to be implemented within WDMAM due to the large space-time inconsistencies.
- Following the decision to contribute to the WDMAM the DYGEF project was conducted in order to provide a space-time consistent geomagnetic model for the whole Romanian territory.
- The space-time consistent grid (10 km x 10 km) of total intensity scalar of the geomagnetic field valid for 2007.5 geomagnetic epoch at 3000 m above the sea level that Romania contributed to the WDMAM will significantly improve its quality over Romanian territory.

Thank you for your patience!