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Interactive comment on "Joint analysis of the magnetic field and Total Gradient Intensity in Central Europe" *by* Maurizio Milano et al.

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Dear Prof. Ebbing thank you for your valuable comments and suggestions. Please note below the answers to the individual comments, the modified version of the manuscript and the attached figure: - page 4, line 7: no ending for sentence:

We have fixed this mistake, by adding part of the sentence that we erroneously deleted. See attached the new version of the manuscript.

- page 4, line 4: KTB was not a deep seismic profile. These were the DEKORP profiles. KTB was the deep drilling for which as well seismic studies have been carried out:

Thank you for noting this mistake: we corrected it. We have modified this part and the relative references according to your comments.

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- Figure 3: I would suggest to delete the decimal points and to use an even spaced colour scale:

Thank you: Figure 3 was modified by using a linear color scale and removing the decimal point.

- page 8, line 20ff: Could you please add the depths at which the sources are placed:

We have added information about depth position of the model sources.

- page 9, line 16: At which depth are the 19 sources placed? And is the regional field a consequence of the orientation of the inducing field or how does t relate to the sources?:

You are right: the 19 sources are placed at different depths ranging between 2 and 10 km. We have added this information in text. The long-wavelength field observed at 350 km altitude is the effect of coalescence between the anomalies of the 19 sources. Total magnetization direction was: ; inducing field direction was: . So, we think that the shape of the coalesced anomaly is dominated by the remanent magnetization, whose intensity is stronger southern. Note that the total gradient intensity map shows clearly a more intense magnetization southern, in accordance with the values selected for the sources.

- page 11, line 9: Maybe show an intermediate model with constant magnetization to demonstrate the effect of geometry only

According to your suggestion, we have added a new model and inserted it in the supplementary material. In this model, the magnetic field and total gradient field of the TESZ model were calculated assuming for both the 'Paleozoic' and the 'Precambrian' synthetic crusts 2 A/m of magnetization. The magnetic field map at 350 km shows a very low-intensity anomaly, this time related to only the variation from the thin southwestern crust to the thicker one to the northeast. Such structure is also imaged in the total gradient map by an extended maximum amplitude along the contact

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line. Therefore, the case of two magnetized crust differing exclusively in the structural features may contribute to the magnetic field but cannot explain completely such magnetic anomaly. The combination of both structural and magnetic property differences, instead, seems the best hypothesis to explain the observed magnetic field above Europe.

- Section 5.1-5.3 I find this discussion to be a bit odd and lengthy. Your main discussion was the origin of the magnetic anomaly over the TESZ , so why here you add a very detailed discussion of (all) European anomalies? I think this part could be shorten for clarity and to increase the appeal of the paper for its readers.

We have reduced the length of section 5.1, removing supplementary information on small-scale magnetic anomalies, that are superfluous and beyond the main topic of this study. However, we point out that our analysis is not exclusively focused on the TESZ area. The joint analysis is performed all over central Europe (say the extension of the CEML). The need for such a study is justified by observing that previous interpretations were based not only on TESZ anomaly but also to the magnetic contributions of sources in Central Europe other than the TESZ structure.

- page 20, line 20: What about differences between EMMP and MF7? I miss a more detailed discussion how the source geometry results in the field and a specific discussion of the spectral content of MF7 vs. EMMP. I think a lot of people use MF7 and here you could demonstrate its pros and cons in interpretation a large scale anomaly as observed in central Europe. I would prefer such a discussion in comparison to the discussion of local anomalies in the text.

The CHAMP MF7 crustal field was the best available satellite derived field at the time of the study. Due to the satellite's orbital height the wavelength resolution of this field was $\sim$150 km. Following Fletcher et al. (2011), the EMMP compilation used all original flight line data down to point ground data available from each county. So, the resolution of many surveys allowed an optimum grid to be generated down to 1km. Technical data

concerning these surveys also allowed the IGRF correction to be applied. With any compilation, merging surveys with a range of spatial survey sizes, ages, instruments, processing methods can and did generate small differences which will not necessarily average out over the compilation. Since the EMMP compilation generally lacked long wavelength control (i.e. $\lambda \geq \sim$150 km) due to limited size of surveys, the final processing step, after gridding at 1km, was to drape it onto the CHAMP's MF7 crustal field (MF7, Maus, 2010).

- Page 20, line 25: data are available from GETECH, not near GETECH.

Thank you, we fixed it.

Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2019-40/se-2019-40-AC2-supplement.pdf

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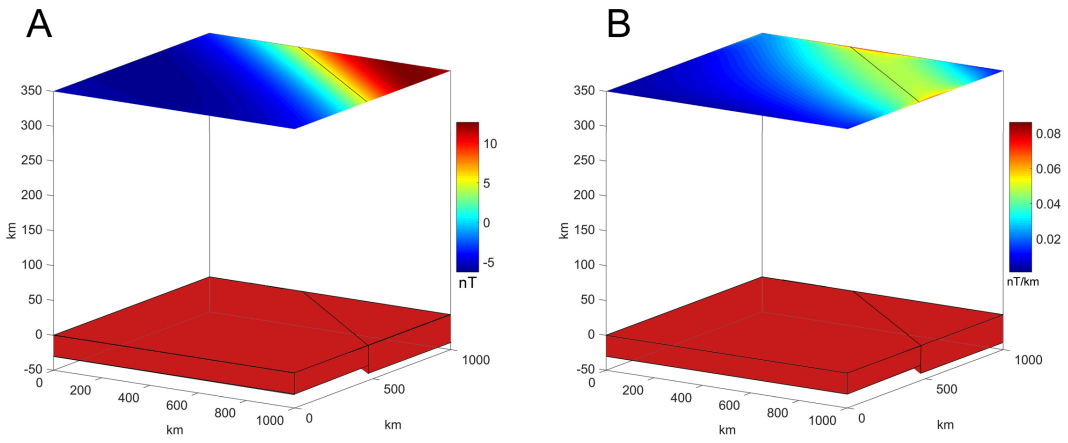

Fig. 1.

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