Review report of manuscript entitle '**The crustal structure of the Lomgmenshan fault zone and its implications for seismogenesis: New insight from aeromagnetic and gravity data (egusphere-2023-1119)**' submitted by Hai Yang, Shengqing Xiong, Qiankun Liu, Fang Li, Zhiye Jia, Xue Yang, Haofei Yan, and Zhaoliang Li

The present manuscript aims to investigate the deep structure of the seismic gap in the Longmenshan fault zone (LFZ) based on 2D forward modeling and 3D inversion of aeromagnetic and Bouguer gravity data. The authors have made significant efforts to establish a correlation between the deep crustal structure and seismic activity. However, I would like to offer some suggestions that could further enhance the manuscript.

- Several previous studies have already investigated the deep structure of the LFZ using seismic data, and authors also briefly mentioned these details in the introduction. It would be valuable to elaborate on the new insights derived from this manuscript and provide a detailed comparison with the findings of these previous studies. This comparative analysis can help readers better understand the novel contributions of the current research

- I failed to understand how authors carried out the magnetic modelling, especially the zig-zag blocks considered with different magnetic susceptibility values. Does it have geological significance, or were they considered only to achieve the best fit? Moreover, I was wondering why the magnetic models weren't extended to the Curie depth.

- Previous studies reveal a low velocities (Vp, & Vs) in the seismic gap region, whereas high low velocities (Vp, & Vs) were imaged below the Lushan and Wenchuan hypocenter. Surprisingly, the crustal density models presented in the manuscript do not exhibits such heterogeneities. I'm curious about the nature of the faults (F1-F3) depicted in the models and why there doesn't appear to be any density variation across them.

- The authors suggest that the aeromagnetic and gravity anomalies reveal significant variations along the LFZ, which is consistent with surface deformation. I agree that magnetic anomaly characteristics differ between the seismic gap and seismicity regions. However, I could not find contrasting gravity signatures across these regions. What I see from Fig. 4 is only an NE-SW trending gravity high running nearly parallel to the LFZ, with some minor variations in amplitudes.

- A detailed description of the aeromagnetic datasets, such as line spacings and sampling intervals, should be included in the manuscript. Otherwise small-scale structures interpreted from magnetic anomaly maps, especially in the seismic gap region have no meaning. I would also suggest that the authors show the location of flight lines on one of the magnetic anomaly maps.

- The paper employs 2D forward modeling based on aeromagnetic and Bouguer gravity data for studying deep crustal structure. However, it would be beneficial to provide more details regarding how the authors have incorporated seismic velocity data to constrain the crustal models. Specifically, for profiles AB and EF, where distinct

bipolar magnetic anomalies are observed, it would be helpful to have a proper justification for how the authors fitted these anomalies.

- Similarly, there is limited information provided about the 3D gravity inversion. It would be helpful to discuss how the regularization parameter (μ) and weighting matrix were selected. Additionally, it's unclear whether in-situ measurements were used to constrain the susceptibility values of the model. To enhance the clarity of the manuscript, consider including contour plots depicting the misfit between the observed and calculated anomalies, as well as the root mean square (RMS) error for each iteration.

Minor comments:

- Although the overall language and presentation of the paper are clear, but some sentences could benefit from rephrasing for improved readability. I quoted a few here:
- Could you please clarify what you mean by 'visible magnetic and density model beneath the LFZ?
- …..structure heterogeneities are widely distributed be-neath the LFZ…. Do you mean to say structure is heterogenous across the LFZ.
- The earthquake epicenters show high magnetic anomalies and the edge of high Bouguer gravity anomalies ……. accumulate stress.. This sentence is difficult to follow and may rephrased. It might be clearer to say that earthquake epicenters are often located in regions with high magnetic anomalies and gravity gradient …..
- The LFZ was attacked by two different earthquakes….Need to be rephrased
- In Figure 1b, it could be beneficial to include seismicity data. Different colors could be used to represent earthquakes at various focal depths. Consider implementing this suggestion in other figures as well.
- Adding seismicity data to the aeromagnetic and gravity anomaly maps (Figures 2 to 4) would provide readers with a more detailed understanding of the correlation between anomalies and seismic activity