

Interactive comment on “Geophysical evidence of pre-sag rifting and post-rifting fault reactivation in the Parnaíba basin, Brazil” by D. L. de Castro et al.

Anonymous Referee #1

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De Castro et al. interpret different geophysical observations, i.e. gravity, magnetic, seismic and borehole data, to study the tectonic mechanisms connected to the Parnaíba basin, a large intracratonic basin in the South American platform.

Although outside my main field of expertise, I found the paper well written and clearly exposing the geodynamic context and open questions about the formation and evolution of this, as well as of others intracratonic basins. In any case, I will mostly comment on the methodological aspects of data processing and interpretation. All the methodologies used are appropriate and their integrated geological interpretation is also done with critical reasoning. There are, however, few points where I think the authors should pay more attention (see detailed comments below).

Detailed review

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Previous studies based on magnetic and gravity interpretation by same authors (De Castro et al. 2014) have been carried out. The outcome of that study was the inference of concealed grabens. In view of the limited resolving power of potential field data, here the authors add new geophysical observations to better constrain their interpretation. Specifically, seismic and well data have been used.

The pre-processing of geophysical data, partly done by the Brazilian Petroleum Agency (ANP), is appropriate and well explained.

Regional anomalies have been filtered out and pseudogravity conversion of magnetic map has been obtained. The authors mention the difference between the pseudogravity map obtained in this study and the one by their previous work (De Castro et al. 2014) and discuss possible reasons for it.

The comparison of gravity and pseudogravity maps in Fig. 5 is, in my opinion, a bit confusing. The two maps reflect, of course, two different physical properties and have different wavelength content. More comment on the possibility of long-wavelength artifacts in the pseudo-gravity map should be added. What kind of assumption has been made outside the survey area?

About the seismic lines used, I have a bit of perplexity on the identification of three different tectonic regimes based solely on the sections here presented. In particular, it is hard to compare the L507 and L304 seismic lines with the Ferreira's one (Line 303, bottom panel in Fig. 9 and Fig. 10c) (by the way link to Ferreira's study is missing). In particular, the quality of the interpreted seismic sections in Fig. 10c and 9 is low and I feel that reliability of the interpretation rely more on trust than in a real assessment of data. Some words of caution and more critical assessment of seismic sections, corroborated by better illustrations and proper references, should help the readers to build their own opinion.

My main concern regards, however, the joint gravity and magnetic inversion along the seismic sections. I am not sure about the added value of this analysis. The authors

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should explain if the performed inversion is 2-D or 3-D, describe what kind of relationship between physical properties and what ranges of parameters (beside the basement) have been tested, and test (and discuss) trade-off with uncertainties of seismic horizons. This way, the authors should have a better assessment of the outcome and limitations of the inversion.

Minors

Page 10, row 18-19. Based only on interpretation of seismic sections, this sentence sounds a bit too strong. I advise to modify it.

Page 10, row 21 and row 24: It is Fig. 9b and not 8b.

References: Ferreira 2013 is missing.

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