Dear reviewer,

Thank you for your insightful comments that will improve our manuscript. Below are the answers (in black) to your comments (in red).

1) kriging of crustal parameters: did you observe any anisotropy in the variograms estimated along the vertical direction and along the horizontal axis?

There was no anisotropy observed. We observed a linear dependance on depth (the drift) in vertical direction, which has been taken into account during the variogram estimation. We added the following sentence in the Appendix explaining this:

"Besides the drift, we estimated the experimental variogram in several directions, in order to check if it was dependent on the direction (i.e. if there was anisotropy), but we have not observed any anisotropy."

2) how did you choose the width of the gaussian filter applied to the Moho interface?

We added the following explanation in the text:

"The same smoothing was applied for the Moho interface and for the crustal parameters. We observed how it influenced the crustal velocity, particularly in the area of the model for which most data was provided by gravimetric profiles. Given that the gravimetric profiles are interpreted in terms of isotropic sections, and given that the smaller sections interpreted were roughly about 100 km in dimension along the profile, we chose this as the Gaussian width. It was also confirmed by trial and error that below this width we observe some artifacts in the model."

3) It could be interesting to analyze how your model is different from European scale models (e.g. EPCrust).

We added an Appendix comparing some of the features from the regional EPCrust model and our new model.

4) Petrinja earthquake:
a) which hypocenter did you used? You did not report the reference in the text.
b) Fig 9 shows that the use of the 3D model removed the dependency of the residuals on the distance and greatly reduced the residual dispersion; on the other side the mean residual (for Pg and also Pn)ì) is about -0.5s: why did you not re-localize the event with the new velocity model?

(a) We used the Petrinja earthquake mainshock as it was well recorded on all the stations in the region. The location of this earthquake was 45.4188N, 16.2082E, 7.57 km; the information has been added in the text.

(b) We did not deem it necessary to relocate the earthquake, since it was the main shock of the series and was well recorded on a great number of stations. The point of this example was to show that travel times are greatly improved when using the 3D model. Nevertheless, we subsequently relocated the earthquake with the new model and the images below show the location after this. As expected the location stayed basically the same.

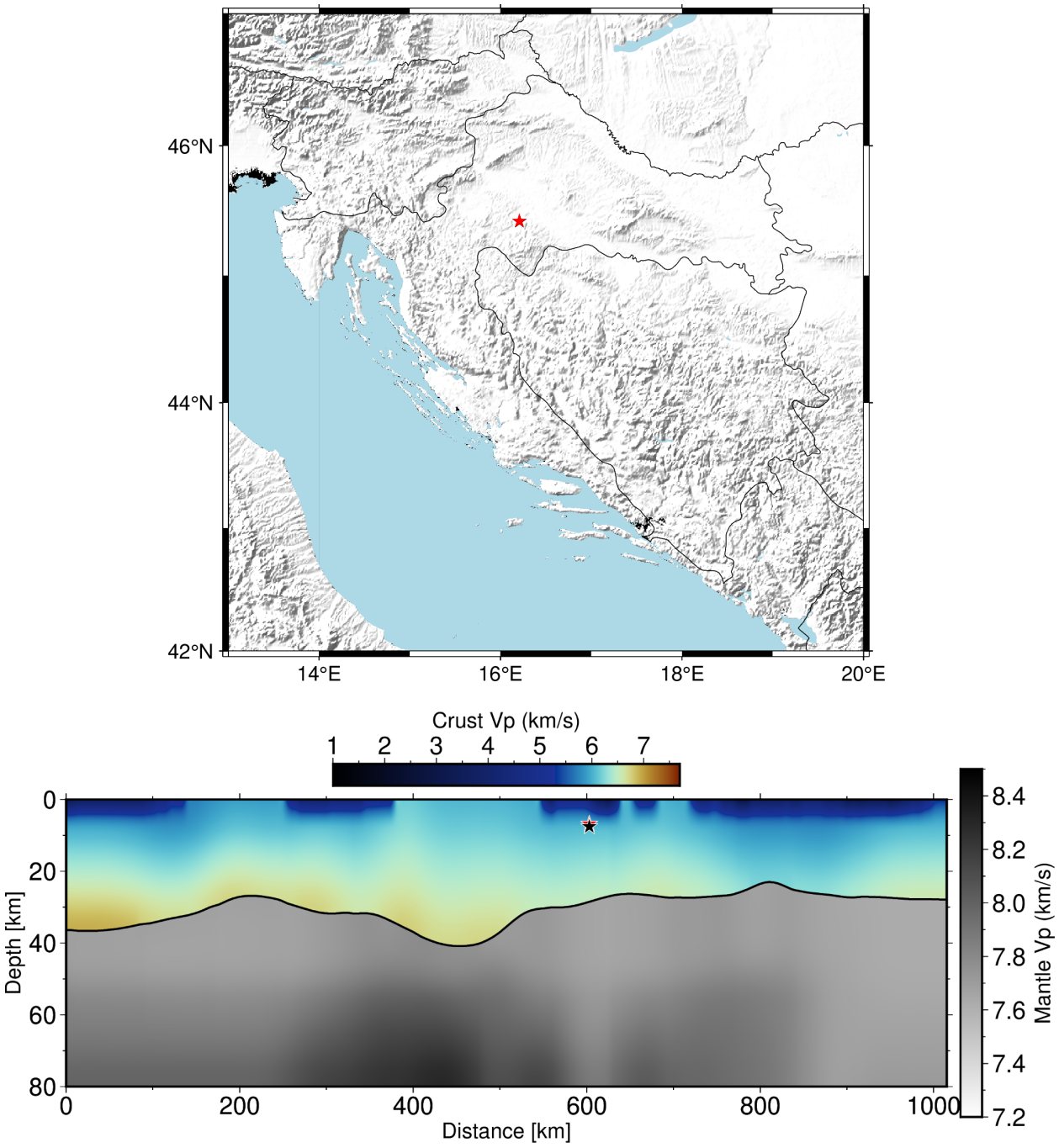

Fig 1. a) Mapview of the Petrinja earthquake used for testing the new model. Red start is the new location and black is the old. **b)** cross-section cutting through hypocenter location showing only minor depth variation between locations.

● lines 255-266: not clear

The explanation about how the thickness of the carbonate layer was acquired laid out in lines 255-266 was rewritten in a (hopefully) more clear and concise way. The new text is the following:
"*The interface with the least data at our disposal was the Carbonate rock complex (CRC) bottom depth. The CRC bottom depth was estimated combining geological and structural data published in available Basic Geological Maps at the 1:100,000 scale with accompanying Explanatory Notes that cover entire Dinaridic area, as well as geological-structural data published in studies of Tišljar et al. (2002), Vlahović et al., (2005) and Balling et al., (2021). Based on the collected data, we determined the spatial extent of the Paleozoic–Paleogene CRC. Since the CRC represents a very distinctive layer in the Dinarides, we additionally estimated its thickness. Assessment of CRC thickness was initially performed at the scale of each of more than 80 geological maps covering the study area, using thicknesses presented in geological columns on each map. Derived values of CRC thickness were further considered in respect to the deformation styles and large-scale structural relations (e.g., Balling et al., 2021). Several regional carbonate nappe systems in the External Dinarides characterized by extensive folding and thrusting could reach a combined stacking thicknesses up to 12000 m, but thicknesses are not evenly spatially distributed. Significant variability of the CRC total thickness in the Dinarides is caused by combination of (1) initial differences in thickness due to significant paleogeographic differences along the Adria Microplate passive margin, since a total thickness of the Adriatic Carbonate Platform and thick underlying and thin overlying carbonates is in the range of 4500–8000 m (Tišljar et al., 2002; Velić et al., 2002; Vlahović et al., 2005), (2) structural position of individual nappe systems in respect to the active collision front, and (3) variable strain rates and stress orientation during the Cretaceous–Paleogene Adria–Europe collision. Nappe stacking systems in the central and southern part of the External Dinarides, where CRC is the thickest (Fig. 3c), locally incorporate up to four thrust sheets composed of different segments of the entire carbonate succession."*

● line 330: "we specified a relatively large area between 10° and 20° east longitude" -> from the maps (fig 3, ...) it seems that the interpolated area reaches 20.5° E longitude
This was a typo which we now corrected it in the text

- lines 798-799: Handy 2010 is in the References but not cited in the text
- lines 813-815: Kennet et al 1995 is in the References but not cited
- lines 816-818: Korbar 2009 is in the References but not cited
- lines 886-888: Tari 1998 is in the References but not cited

We apologize for leaving these references in the list. They were probably left from the first draft. The references which are listed but not cited in the main text are now removed.