TEXT MODIFICATIONS - TRACK CHANGES

RC1: Mara Monica TIBERTI

Main Comments: The topic is interesting and within the scope of SE; the title and abstracts are adequate. The paper presents a deformation model of continental lithosphere adjacent to a retreating subduction zone (the Calabrian subduction in the Mediterranean Sea), trying to explain the observed complex pattern of uplift and subsidence at different wavelengths. The input data are already published; the original part is the model itself.
While the long wavelength behaviour can be easily explained with the combined action of the slab pull and the load of the accretionary wedge, the short wavelength pattern requires more discussion and cannot be completely fitted with the available constraints. The conclusions are, in general, supported by the data, except for one excessively speculative topic that, however, is quite well discussed in the appropriate section (see "Specific comments" below). Finally, I should point out that the faults that justify the short wavelength pattern of uplift and subsidence are very speculative (see the attached file for further comments). This is well stated in the discussion section, but should be better addressed within the results section and in the conclusions as well (that those faults are speculative). The manuscript is clearly written, except for the introduction, which suffers from a few misunderstandings about the cited papers (see "Specific comments" below). The introduction needs a consistent revision. The authors often seem to have misunderstood the contents of the cited papers, and the resulting geological framework is unclear. This may confuse the readers instead of orienting them. See the attached file for suggestions and explanations. The profile along with the calculations are carried out is not accurate. Its location should be shifted towards E. otherwise, it crosses an area of transition between continental and oceanic crust where thicknesses (especially the accretionary wedge thickness) do not correspond to what is represented in Figure 5 and to what is used in the calculations. In addition, the authors use a model of the slab (Hayes et al., 2018) that is good for a global survey but does not take into account local complexities and constraints. This results in a lack of accuracy of the depth of the top of the oceanic crust beneath the accretionary wedge. A 3D model of the subduction interface specifically built for the Calabrian subduction is recommended. See the attached file for suggestions and explanations.

Authors response to RC1's main comments (published on-line the 01 March 2024):

First of all, we would like to thank you for taking the time to review our manuscript. We appreciate your comments and interest in our study.
Before answering your comments and questions, we would like to underline that our study should be seen as a first attempt to explain the current surface deformation and associated seismic cycle of SE Sicily. Our study is, therefore, essentially based on published geological and geophysical data, that we considered of sufficient quality and resolution (even if in some cases just acceptable) to investigate successfully first-order processes. We are aware that further investigations will be needed to go into greater detail and validate some of our interpretations. That is particularly true for the extrado deformation hypothesis (and potentially associated surface faulting/folding). We want to be very careful on this point, and as you suggested, we will be adding dedicated sentences in the Results and Conclusion sections.
One of the main points of your review is that we should use the Maesano et al. (2017) dataset rather than the Hayes et al., 2018 dataset and move eastward the CD profile. You are right, we made a mistake in Figure 5; the CD profile should be located further East. Note that looking at the shapes of the depth iso-contours, won't change the geometry of the top of the Ionian crust. As we are only dealing here with a very long wavelength

signal (>~100km), this also has slight consequences on the AB flexural profile. However, we agree on using the Maesano et al. (2017) dataset and have just started comparing it with the Hayes et al. (2018) one.
Finally, with regard to the introduction of the manuscript, we agree with you that some sentences are unclear or may confuse the readers. This is not because we have misunderstood the cited articles but mainly because we tried to shorten as much as possible a manuscript that is already quite long. We, therefore, recognize that we have sometimes made some unfortunate simplifications. Of course, we will take into account all your specific comments included in your annotated version of our manuscript.

Authors responses to RC1's annotations in the submitted manuscript:

L46+L47-L59 - *Since the Oligocene (~30 Myr), the Alpine Tethys subduction has experienced slab roll-back, causing the drifting of continental micro-blocks, detached from the Iberia plate and the opening of back-arc basins over the Mediterranean realm (e.g., Carminati et al., 2012; Gueguen et al., 1998; Rosenbaum et al., 2002). During the Mio-Pliocene (10-5 Myr), the collision of the retreating Calabrian-Peloritan subduction arc and accretionary wedge with the Northern African passive margin led to the formation of the Sicilian fold-and-thrust belt (e.g., Henriquet et al., 2020). During the Plio-Pleistocene (5-2 Myr), the Calabrian subduction continued strongly interacting with the crustal structure of the African margin, in particular with the thick Pelagian continental lithosphere, the Malta Escarpment, and the Ionian oceanic lithosphere (Wortel and Spakman, 2000) (Figure 1). These three major tectonic domains, which originated during the Triassic period, were shaped by the fragmentation of the Pangea in the early Jurassic, leading to the opening of the Neo-Tethys Ocean (e.g., Stampfli et al., 2002).*

RC1-1: This part is more related to the Alpine chain and is not relevant for the present-day situation (L46). Since at least the Oligocene (Carminati et al., 2012; but, according to Faccenna et al., 2001, since 80 Ma) the Ionian oceanic crust is subducting beneath the Calabrian Arc. The Ionian crust is part of the Africa Plate and it is also the remnant of the Southern branch of the Neotethys (sensu Hardy et al., 2010). An accretionary wedge cannot be retreating (accreting means advancing). The accretionary wedge is always advancing, following the retreat of the slab.

New: L49-L67 - *In the Late Cretaceous ~~(~80 Myr)~~, the Africa/Eurasia plates convergence initiated the subduction of the Alpine Tethys under the Apulia-Adria and Iberia plates (e.g., Handy et al., 2010, 2015; Van Hinsbergen et al., 2020; Jolivet, 2023). During the early Cenozoic, the ~~Alpine Tethys~~ subduction ~~has~~ experienced polarity reversal (e.g., Handy et al., 2010; Almeida et al., 2022) followed by, since at least the Oligocene, long-lasting slab roll-back, causing the drifting of continental micro-blocks, detached from the Iberian margin and the opening of back-arc basins throughout the Mediterranean realm (e.g., Gueguen et al., 1998; Faccenna et al., 2001; Rosenbaum et al., 2002; Carminati et al., 2012; Van Hinsbergen et al., 2020). During the Mio-Pliocene (10-5 Myr), the collision between the southeastward migrating Calabrian-Peloritan Arc, and associated Calabrian Accretionary Prism (CAP), with the Northern African passive margin led to the formation of the Sicilian fold-and-thrust belt (e.g., Gueguen et al., 1998; Henriquet et al., 2020). During the Plio-Pleistocene (5-2 Myr), the Calabrian Arc and the retreating Ionian slab continued strongly* *interacting with the crustal structure of the African margin, particulary with the thick Pelagian continental Platform and the Malta Escarpment (Wortel and Spakman, 2000) (Figure 1). These ~~three~~ major tectonic domains, which originated during the Triassic period, were shaped by the fragmentation of the Pangea in the early Jurassic, leading to the opening of the Neo-Tethys Ocean (e.g., Stampfli et al., 2002).*

Authors: We have chosen to keep the few sentences relating to general pre-Oligocene geodynamic evolution, as this had consequences for the evolution and structuring of the Peloritan-Calabrian Arc. We have complemented the references and added some words to take into account the uncertainty about the age of roll-back initiation. We have clarified the sentence related to the retreat of the Calabrian-Peloritan subduction and southeastward migration of the Calabrian Accretionary Prism.

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L94-L97 - *Main reasons include the complex polyphased geological history of this region and the relatively low present-day horizontal strain rate (< 5 mm/yr), resulting from the slowdown of the Calabrian subduction zone activity in the last million years (Goes et al., 2004)*.

RC1-2: The present-day strain rate in SE Sicily is not the result of the slowdown of the Calabrian subduction zone activity. On the contrary, the slowdown was caused by the arrival of the African continental lithosphere at the trench (Goes et al., 2004).

New: L96-L100 – The m*ain reasons include the complex polyphased geological history of this region and the relatively low present-day horizontal strain rate (< 5 mm/yr), resulting from the culmination of the Calabrian Arc and African Margin collision, and the subsequent slowdown of the Calabrian subduction (roll-back and back-arc extension) ~~zone activity~~ in the last million years (Goes et al., 2004; D'Agostino et al., 2011; Zitellini et al., 2020).*

Authors: To clarify our purpose, we have modified this sentence, and added additional informations and references to evoke causative mechanical processes.

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L196-L902 - *East of the Hyblean Plateau, earthquakes essentially distribute along the Malta Escarpment where a normal fault system, potentially responsible for the 1693 earthquake, has been identified (e.g., Bianca et al., 1999; Gutscher et al., 2016; Gambino et al., 2021, 2022), (Figure 3). The focal mechanisms over the Hyblean Plateau have dominant strike-slip characteristics, contrasting with the extensive deformation characterizing the NE corner of Sicily (Figure 3).*

RC1-3: extensional

New: **L196-L202** - *East of the Hyblean Plateau, earthquakes essentially distribute along the Malta Escarpment where a normal fault system, potentially responsible for the 1693 earthquake, has been identified (e.g., Bianca et al., 1999; Argnani and Bonazzi, 2005 , Gutscher et al., 2016; Gambino et al., 2021, 2022), (Figure 3).*
The focal mechanisms over the Hyblean Plateau have dominant strike-slip characteristics, contrasting with the extensional deformation characterizing the NE corner of Sicily (Figure 3).

Authors: Corrected

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L224-L228 - *To better constrain the deep structure and rheology of the studied area, we synthesize the available geological, and geophysical data into a 200 km long simplified crustalscale structural cross-section following the N30°E AB profile crossing the Hyblean Platform, the Malta Escarpment, the western Ionian domain, and the offshore normal faults (Figures 2, 3 and 4).*

RC1-4: What do you mean for "offshore normal faults"? The Alfeo and Ionian?

New: **L216-L221** - *To ~~better~~ constrain the deep structure and rheology of the studied area, we synthesize the available geological and geophysical data into a 200 km long simplified crustal-scale structural cross-section following the N30°E AB profile. This section incorporates part of the Hyblean Platform, the Malta Escarpment, the western Ionian domain, and cut, almost perpendicularly, the offshore normal faults along the Malta Escarpment and the Alfeo/Ionian strike-slip fault systems, extending eastward (Figures 2, 3 and 4).*

Authors: To clarify this point, we slip in two this sentence and added more details.

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L246-L250 - *In the Hyblean domain, geophysical data (e.g., Sgroi et al., 2012; Milano et al., 2020) indicate that the crust has an average thickness of ~30 km. Based on gravity data modeling, Henriquet et al. (2019) evidenced a 100 km-large and 5 km-high lower crustal body below the Hyblean Plateau, locally uplifting the Moho to a depth of about 20-25 km. This feature is supported by tomographic data (ScarfÌ. et al., 2018).*

RC1-5: ~~evidenced~~ Henriquet et al. (2019) hypotesized either a high-density body within the lower crust or an uplift of the Moho in order to explain part of the positive Bouguer anomaly under the Hyblean Plateau.

New: **L230-L236** - *In the Hyblean domain, geophysical data (e.g., Sgroi et al., 2012; Milano et al., 2020) indicate that the crust has an average thickness of ~30-35 km with a notable difference in the Hyblean Plateau region, marked by a huge positive Bouguer anomaly. Based on gravity data modeling, Henriquet et al. (2019) showed that this gravity* *anomaly can be explained by a 100 km-large high density lower crustal body, compatible with a local Moho uplift to a depth of about 20-25 km. This last interpretation seems also supported by recent tomographic data (Scarfì et al., 2018).*

Authors: We have decided to better highlighted the specificity of the Hyblean Plateau region. We've replaced the word "evidenced" with "showed that this anomaly can be explained" and modified this sentence to make it clearer. Finally, we have attenuated our statement about the tomographic data published by Scarfi et al. (2018) to take into account data uncertainties.

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L246-L250 - *Figure 5: a) Map and isobaths of the top of the Ionian slab subducting below the Calabrian Arc (data extracted from Hayes et al., 2018). AB and CD profile locations are indicated, as well as seismic refraction profiles DY-P3 and DY-P1 (Dellong et al., 2018).*

RC1-6: Hayes et al. (2018) present a very good slab model on a global scale. However, it does not have adequate resolution and accuracy at the local scale of your work. For example, it reports a continuous slab from Central Sicily to the Basilicata region, that is not. Also the depth of the subduction interface beneath the accretionary wedge is not well constrained. You should rely on local models specifically built.

New: L333-L334 - *Figure 5: a) Map and isobaths of the top of the Ionian slab subducting below the Calabrian Arc (Hayes et al., 2018) with seismic refraction profiles from Dellong et al. (2018, 2020), also used to constrain the top of the Ionian oceanic crust.*

Authors: We compared the Ionian slab geometries obtained with the Hayes et al. (2018) and Maesano et al. (2017) datasets along the CD profile (Supp. Mat. Figure S10, see here after). If we focus on the long wavelength slab geometry (>=50-100 km), which is the relevant scale for flexural modeling calculations, both datasets give similar results in the northern part of the profile, where the bending of the Ionian slab increase. Note that the Maesano dataset indicates shallower depths (~ -5 km) compared to the Hayes one. The discrepancy could be linked to the parameters of the velocity model used by Maesano et al. (2017).

In the southern part of the CD profile, the Maesano data indicates also shallower depths because, here, the main décollement jump away from the top of the Ionian oceanic crust, to a higher level in the sedimentary cover (Maesano et al., 2017). When comparing in both profiles the depth of the top of the oceanic crust with the Dellong et al., 2018 seismic refraction data, we found a better correlation with the Hayes dataset. We decided, then, to use it in our flexural calculations.

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L509-L515 - *We first simulate slip on the upper portion of the Augusta-Siracusa fault but it this model succeed in producing sufficient uplift east of Augusta it failed to reproduce the observed relative uplift west of Augusta. Based on PSInSAR data, and structural evidences of onshore normal faulting (Gambino et al., 2021), we added to the previous Augusta-Siracusa fault model a 80° dipping onshore normal fault outcropping at the 106 km mark of the AB profile, with a slip rate of 3 mm/yr down to 10 km depth (light blue lines in Figure 7a).*

RC1-7: Based on what?

New: L503-L510 - *We first simulate slip on the upper portion of the Augusta-Siracusa fault but if this model succeeds in producing sufficient uplift east of Augusta, it fails to reproduce the ~~observed~~ relative uplift west of Augusta. Based on PS-InSAR data and structural evidence of regional onshore normal faulting (e.g. Adam et al., 2000; Gambino et al., 2021), we added to the previous Augusta-Siracusa fault model an 80° dipping onshore normal fault outcropping at the 106 km mark of the AB profile (sharp velocity gradient in the PS-InSAR data), with a slip rate of 3 mm/yr down to 10 km depth (light blue lines in Figure 7a).*

Authors: The fault plane geometries tested (strike, dip) are based on published field-trip observations and measurements *(e.g. Gambino et al., 2021)*. Fault locations are based on published geological/structural maps (*e.g. Adam et al., 2000)*, and also on the presence of sharp gradients in the PS-InSar velocity pattern. The imposed fault slip-velocities results from a trial-an-error empirical approach. The objective, essentially, to evaluate if aseismic slip on known, and/or unknown faults, could generate sufficient surface deformation to explain the measured surface deformation pattern.

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L519-L523 - *The triangular patterns of sharp steps and associated lows in the PS-InSAR data could be also fitted by a model involving shallower aseismic creep (up to 5 to 8 km depth) and combining the onshore ENE-dipping fault (106 km mark), creeping at 3-4 mm/yr, an antithetic onshore WSW-dipping fault (110 km mark), creeping at 1 mm/yr, and the Augusta-Siracusa coastal fault (112 km mark), creeping at 3-4 mm/yr (brown lines in Figure 7a).*

RC1-8: Based on what?

New: L515-L520 - *The triangular patterns of sharp steps and associated lows in the PS-InSAR data could be also fitted by a three-fault model, involving shallower aseismic creep (up to 5 to 8 km depth) and combining the onshore ENE-dipping fault (106 km mark), creeping at 3-4 mm/yr, with an antithetic onshore WSW-dipping fault (110 km mark), creeping at 1 mm/yr, and the Augusta-Siracusa coastal fault (112 km mark), creeping at 3-4 mm/yr (brown lines in Figure 7a).*

Authors: Our response is similar to our previous one. We have only tried to answer the following question: Could surface faulting on one or several conjugated creeping faults, sharing geometric and kinematic parameters compatible with the regional tectonic framework, generate the PS-InSar surface deformation pattern. We cannot prove that this deformation mechanism is the real (or the only) one but we can, at least, answer in the affirmative and determine approximately under what kinematic conditions.

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L574-L576 - *This model is based on the assumption that the geodetic data (GNSS and PS-InSAR) measured over a short-period (5-15 years) are representative of the kinematic evolution of the studied region at the scale of a few thousand years.*

RC1-9: Is it this assumption reliable? Please discuss.

New: L591-L598 - *This model is based on the assumption that the geodetic data (GNSS and PS-InSAR), measured over a short period (5-15 years), are representative of the kinematic evolution of the studied region at the scale of a few hundred to a thousand years. In absence of significant seismic events during the period of geodetic data acquisition, and considering that major earthquakes (M>7) in SE Sicily probably have a return period of more than 500 years, geodetic data are mainly recording interseismic elastic deformation and possibly, minor permanent one (fault creep, folding, human-related surface deformation).*

Authors: In absence of significant seismic events during the period of geodetic data acquisition, and considering that major earthquakes (M>7) in SE Sicily have probably a return period of more than 500 years, geodetic data are mainly recording interseismic elastic deformation, and minor permanent one (fault creep, folding). Of course, we are only considering here geological processes, discarding the impacts of human activities or environment changes. We have added these elements in an extra sentence.

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L586-L588 - *We used simple 2D elastic model based on parameters determined through analytical modeling of the Ionian oceanic lithosphere flexure using, as a reference, the Ionian slab geometry determined by Hayes et al. (2018).*

RC1-10: You should have used model specifically built with local constraints. As a coauthor, I can recommend Maesano et al. (2017), however the important thing is that it tooks into account the constraints at a local scale.

New: L610-L613 - *We used simple 2D elastic models based on parameters determined through analytical modeling of the Ionian oceanic lithosphere flexure using, as a reference, the Ionian slab geometry determined by Hayes et al. (2018), and data (depth of the top of the Ionian crust) extracted from the refraction profiles published in Dellong et al., (2018).*

Authors: We took into account this suggestion. See our specific response here-above.

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L621-L623 - *These faults could be associated to a Triassic NW-SE graben/horst structure, the Augusta Graben, extending from Augusta to Siracusa (e.g., Grasso and Lentini, 1982).*

RC1-11: Still active? Or reactivated? Are there any indications of recent activity?

New: L640-L644 - *These faults could re-activate inherited Permo-Triassic to Early Jurassic NW-SE extensional structures, leading to the formation of the Augusta Graben, extending up to Siracusa (e.g., Grasso and Lentini, 1982). Even if some seismic activity affects this region (e.g., Adam et al., 2000; Azaro and Barbano, 2000), field evidences of recent (Holocene) tectonic activity has yet to be demonstrated.*

Authors: As far as we know, there is no irrefutable evidence of recent (Holocene) fault slip on the Augusta graben/horst structures, which were formed over the last few millions years. On-land, differential erosion and anthropic surface reworking are significant in this region. However, several studies have proposed that some of the seismic events, located along the Malta escarpement near the coast, could be associated with the Augusta-Syracusa fault system (e.g. Azaro and Barbano, 2000; Adam et al., 2000). Some evidences of syn-tectonic sedimentation have been also reported off-shore, in the Gulf of Augusta, where marine sedimentation represents a more favorable environnement to preserve recent faulting (Adam et al., 2000). Recently, evidence of active faults in the Augusta bay have been discovered by still unpublished sparker lines acquired in the area (G. Barreca, C. Monaco, personal communication).

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L718-L721 - *Finally, the interseismic activity of the inferred extrado onshore faults alone could explain the slow long-term uplift (0.1-0.4 mm/yr) off the eastern coast of the HP. In that case, their activities should be intermittent, alternating between aseismic slip (as presently) and long periods of quiescence.*

RC1-12: Maybe here the source of the uplift is not the activity of the faults, but the mechanism that produces the extrado faults.

New: L733-L738 - *Finally, the inferred interseismic ~~activity of the inferred~~ extrado deformation, affecting the coastal domain, ~~onshore faults alone~~ could explain the slow long-term uplift (0.1-0.4 mm/yr) off the eastern coast of the HP (e.g. Mechis et al., 2020). In that case, extrado deformation activity should be intermittent, alternating between aseismic fault slip/folding (as presently) and long periods of quiescence. Such a scenario remains speculative and need to be mechanically tested.*

Authors: Since we essentially investigated elastic crustal flexure, we focused on what we considered the most probable mechanism capable to generate a localized surface deformation; extrado deformation activating inherited faults. Other sources of uplift have been proposed (Ferranti et al., 2006 and Meschis et al., 2020) but doesn't appear compatible with the satellite geodetic measurements. The relative uplift of the coast remains enigmatic, and further field-work and geophysical studies are certainly needed to better constrain its causes. We reworded this paragraph to clarify our purpose.

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L731-L732 - *We show that the short wavelength coastal signal can be explained by ongoing shallow creep (at 1-4 mm/yr) of ENE trending and steeply dipping normal faults, producing the local relative uplift measured geodetically.*

RC1-13: Very speculative

New: L749-L754 - *We show that the short wavelength relative coastal uplift, measured geodetically, could be explained by ~~ongoing~~ shallow creep (at 1-4 mm/yr) on ENE ~~trending and~~ steeply dipping normal faults, related to extrado deformation. Some morphologic evidence of surface deformation, correlated with leveling data indicating differential surface uplift, seems to corroborate this hypothesis. However, at this stage, the extrado deformation hypothesis has yet to be validated.*

Authors: We have reworded this sentence and added a two new ones to emphasize that this hypothesis is plausible but has yet to be validated.

TEXT MODIFICATIONS - TRACK CHANGES

RC2: Andrea ARGNANI

Authors first response to Dr. Argnani's (RC2) main comments (published on-line the 01 March 2024)**:**

Thank you very much for your availability and your detailed review. We have taken note of your comments and suggestions for corrections. In particular, concerning the need to improve the citations, to better take into account available geological data, and to improve the presentation of some of our less constrained hypotheses. We will also clarify the relevance of our final seismic cycle model, which we consider the most original part of the manuscript, since the process evoked has never been proposed (as far as we know) as a source for elastic loading on major active faults.

Authors response to Dr. Argnani's (RC2) detailed comments:

Please, find hereafter, our responses, as well as the corrections and improvements we have made on the revised version of our manuscript. We believe we have addressed most, if not all, reviewer's suggestions. We have, especially, improved the synthetic cross-section of Figure 4, taking benefits of a recently published paper which synthesized all available drilling data on the Hyblean Plateau (Lipparini et al., nov. 2023). We have also argued better the part of the manuscript dealing with surface deformation modeling in the Augusta-Siracusa region, and we have discussed in more detail the original seismic cycle model we propose. Finally, we have corrected the figures/figure captions, the citations errors and complement missing ones.

TEXT

L40-L41 - *This region also suffered the most powerful and devastating earthquake reported in the Italian seismicity catalog, the 1693 Mw~7.4 Val-di-Noto earthquake, which occurred along the eastern margin of the Hyblean Plateau (e.g., Bianca et al., 1999; Billi et al., 2010; Gutscher et al., 2006; Scicchitano et al., 2022).*

RC2-1: Too many papers cited, and none is properly seismological. The reference Azzaro and Barbano 2000 is sufficient to give a picture of historical seismicity, without citing papers that are not focussed on this issue: Billi et al argued that the 1693 tsunami was caused by a submarine landslide, without implication on the location of the earthquake, and Gutscher et al suggested that the 1693 earthquake originated in the subduction interface, away from the Hyblean Plateau.

New: L40-L45 - *This region also suffered the most powerful and devastating earthquake, the 1693 Mw~7.4 Val-di-Noto earthquake, reported in the Italian seismicity catalog. This earthquake is thought to have occurred offshore the eastern margin of the Hyblean*

Plateau, triggering a widespread tsunami. (e.g., Azzaro and Barbano, 2000; ~~Bianca et al., 1999; Billi et al., 2010;~~ Gutscher et al., 2006; Carafa et al., 2018; Scicchitano et al., 2022).

Authors: We added the *Azzaro and Barbano (2000)* reference and removed the *Bianca et al., 1999; Billi et al., 2010 references*. We have also evoked the tsunami associated to the 1693 earthquake and decided, then, to keep the *Gutscher et al., 2006, and Scicchitano et al., 2022 references.*

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L45-L50 - *In the Late Cretaceous (~80 Myr), the Africa/Eurasia plates convergence initiated the oceanic subduction of the Alpine Tethys under the Apulia-Adria microcontinent (e.g., Handy et al., 2010). Since the Oligocene (~30 Myr), the Alpine Tethys subduction has experienced slab roll-back, causing the drifting of continental micro-blocks, detached from the Iberia plate and the opening of back-arc basins over the Mediterranean realm (e.g., Carminati et al., 2012; Gueguen et al., 1998; Rosenbaum et al., 2002).*

RC2-2: The complexity of the Mediterranean tectonic evolution has been oversimplified: Alpine Tethys subducted under the Apulia-Adria microcontinent (therefore dipping southward). Since the Oligocene the same Alpine Tethys subduction has experienced slab roll-back and the opening of back-arc basins (therefore dipping northward). To avoid unnecessary explanations of how this change of subduction polarity occurred, it would be better to just describe the Oligocene to present evolution.

New: L49-L57 - *In the Late Cretaceous ~~(~80 Myr)~~, the Africa/Eurasia plates convergence initiated the subduction of the Alpine Tethys under the Apulia-Adria and Iberia plates, giving rise to the Alpine orogeny (e.g., Handy et al., 2010, 2015; Van Hinsbergen et al., 2020; Jolivet, 2023). During the early Cenozoic, the ~~Alpine Tethys~~ subduction ~~has~~ experienced polarity reversal (e.g., Handy et al., 2010; Almeida et al., 2022) followed by, since at least the Oligocene, long-lasting slab roll-back, causing the drifting of continental micro-blocks, detached from the Iberian margin and the opening of back-arc basins throughout the Mediterranean realm (e.g., Gueguen et al., 1998; Faccenna et al., 2001; Rosenbaum et al., 2002; Carminati et al., 2012; Van Hinsbergen et al., 2020).*

Authors: We agree that synthesizing 50 Myr of geodynamic evolution in one sentence was somewhat too challenging. Instead of removing it, we have decided to rephrase it to keep a trace of the general framework of the Central Mediterranean geodynamic evolution which was dominated by the Apulia/Adria micro-plate collision with Eurasia, and subduction polarity reversal in its western domain. Note that, on that same portion of the text, we have performed other slight corrections in response to RC1 comments, and reorganized the references in chronological order.

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L120-L122 - *Major faults of the Hyblean Plateau and Malta Escarpment (M.E) including the offshore normal faults identified by Gutscher et al. (2016) and analyzed by Gambino et al. (2021), respectively.*

RC2-3: In the captions of Fig 2 (panel a) and Fig 7 (panel b), the so called "Turbiditic Valley faults" are indicated as identified by Gutscher et al 2016. This fault system however, is the same previously mapped by Argnani and Bonazzi 2005. Gutscher et al 2016, mapped the morphological unit called "turbidite valley", but did not name the faults, seen on just one profile, within this domain. Previous works should be acknowledged properly.

New: L122-L123 - *Major faults of the Hyblean Plateau and Malta Escarpment (M.E) including the offshore normal faults identified by Argnani and Bonazzi (2005) and recently analyzed by Gambino et al. (2021).*

Authors: We have completed the references by adding *Bianca et al. (1999),* Argnani and Bonazzi (2005), and we have clarified the contributions of each author.

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L91-L94 - *The kinematics and active tectonics in the SE Sicily are still a matter of debate, with major evolutions in the last decade (e.g., Argnani et al., 2012; Bianca et al., 1999), in particular with the acquisition of high-resolution bathymetry and seismic profiles in the adjacent Ionian domain (Dellong et al., 2020; Gambino et al., 2021, 2022; Gutscher et al., 2016; Ridente et al., 2014).*

RC2-4: The paper of Argnani and Bonazzi 2005 is a more appropriate reference because they mapped the active fault system after interpreting ca. 2500 km of seismic profiles, purposely acquired over the Malta Escarpment. It is true that the acquisition of new data helped improving the comprehension of active tectonics along the Malta Escarpment; however, strictly speaking, Gambino et al 2021 did not contribute to any acquisition of geophysical data, but used previously published data.

New: L91-L95 - *The kinematics and active tectonics in ~~the~~ SE Sicily are still a matter of debate, with major evolutions in the last decade (e.g., Bianca et al., 1999; Argnani et al., 2012), in particular with the acquisition of high-resolution bathymetry and seismic reflection/refraction profiles in the adjacent Ionian domain (Argnani and Bonazzi 2005; ~~Ridente et al., 2014;~~ Gutscher et al., 2016; Dellong et al., 2020), and seismotectonic analysis (e.g. Gambino et al., 2021, 2022b).*

Authors: We added the *Argnani and Bonazzi (2005)* reference, and deleted the *Ridente et al., 2014* reference (located outside our region of interest). We have sightly rephrased the sentence to clarify the contribution of *Gambino et al. (2021)*, and reorganized the references in chronological order.

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L198-L199 - *(e.g., Bianca et al., 1999; Gutscher et al., 2016; Gambino et al., 2021, 2022)*

RC2-5: Bianca et al offer an incomplete picture of the faults because of limited data coverage, and the fault system in Gambino et al is the same as Argnani and Bonazzi 2005 that should be cited.

New: L198-L199 - *(e.g., Bianca et al., 1999; Argnani and Bonazzi 2005; ~~Gutscher et al., 2016;~~ Gambino et al., 2021, 2022)*

Authors: We have added the *Argnani and Bonazzi (2005) reference*.

#####

L263-L266 - *As documented by Gutscher et al. (2016), and Gambino et al. (2021, 2022), the seismic reflection profiles (CIR-01, MESC-08 and MESC-09) shows several normal faults bounding and crossing the Turbiditic Valley, extending along the base of the Malta Escarpment (Gutscher et al., 2016). This Turbiditic Valley fault system is constituted by three major parallel normal faults, 60 km long and dipping 35-50° (Figures 4a and 4b), producing a strong morphological offset of the Ionian seafloor from the latitudes of Catania to Siracusa (cf. MESC-08 and MESC-09 seismic reflection profiles in Gambino et al., 2021).*

RC2-6: Not necessarily several faults in the Turbidite Valley; for other authors (Argnani and Bonazzi, 2005) there is just one fault with a splay. The three "major parallel faults" of Gambino et al 2021 are too close to be independent faults at crustal scale (e.g., Argnani 2021 Frontiers Earth Sci.).

New: L255-L264 - *As documented in Argnani and Bonazzi (2005), Gutscher et al. (2016), and Gambino et al. (2021, 2022), the seismic reflection profiles (MESC-06, MESC-11,CIR-01, MESC-08, and MESC-09) shows several normal faults bounding and crossing the Turbiditic Valley, extending along the base of the Malta Escarpment (Gutscher et al., 2016). The Turbiditic Valley fault system is constituted by three ~~major~~ parallel normal faults, ~60 km long, producing a marked morphological offset of the Ionian seafloor from the latitudes of Catania to Siracusa (Figures 4a and 4b). These faults dip 35-50° to the East and most probably merge at depth into a single major fault plane (Argnani and Bonazzi, 2005; Argnani, 2021; cf. MESC-08 and MESC-09 seismic reflection profiles in Gambino et al., 2021;).*

Authors: We have added a sentence to clarify this point, and added the Argnani and Bonazzi (2005); Argnani (2021) references. Here, for clarity, is what is stated in Gambino et al. (2021): « However, the simultaneous activity observed with the fault displacement analysis leads to interpret such faults as merging down-dip into a single tectonic structure even if depth penetration of seismic data does not resolve its deeper trajectory”

#####

L268-L269 - *We interpret these offshore normal faults as potentially related to recent reactivation of the shallow prolongation of the inferred Mesozoic tilted blocks (Figures 4a and 4b).*

RC2-7: "potentially related to recent re-activation of the shallow propagation of the inferred Mesozoic tilted blocks" It is difficult to grasp the meaning of this statement, which appears very speculative.

New: L264-L266 - These offshore normal faults could be linked to the recent re-activation of crustal faults at the Ocean-Continent Transition, inherited from the Early Mesozoic rifting phase (Figures 4a and 4b).

Authors: We've reworded this sentence to make our point clearer.

#####

L296-L296 - *In addition, we test interseismic loading models on several onshore and offshore east-dipping normal faults, such as the Augusta-Siracusa fault, the Malta Escarpment, and the active faults documented by Gutscher et al. (2016) and Gambino et al. (2021, 2022)*

RC2-8: As above, the offshore active fault system have been first described by Argnani and Bonazzi 2005.

New: L291-L295 - *In addition, we test interseismic loading models on several onshore and offshore east-dipping normal faults, such as the Augusta-Siracusa fault, the Malta Escarpment, and the active faults documented by Bianca et al. (1999), Argnani and Bonazzi 2005; Gutscher et al. (2016) and Gambino et al. (2021, 2022b)*

Authors: We have modified the sentence to reflect the contributions of *Bianca et al. (1999)*, and *Argnani and Bonazzi (2005)*.

#####

L308-L310 - *The Ionian oceanic lithosphere is modeled assuming an effective elastic thickness (Te) ranging from 25 to 37 km (Figure 5b and Supplementary Figure S9), compatible with its Permo-Triassic age (e.g., Catalano et al., 2001; Speranza et al., 2012) and consistent with other publications (e.g., Watts and Zhong, 2000; Tesauro et al., 2012; Cloetingh et al., 2015).*

RC2-9: A Permo-Triassic age is attributed to the Ionian oceanic lithosphere. This issue is debated; however, whereas Speranza et al. agree with this age, for Catalano et al. the oceanic spreading is Jurassic, following a Permo-Triassic rifting. It should be noted that a Permo-Triassic age of the Ionian ocean contrasts with what stated in lines 259-261, where a Triassic-Jurassic rifting is assumed.

New: L318-L322 - *The Ionian oceanic lithosphere is modeled assuming an effective elastic thickness (Te) ranging from 25 to 37 km (Figure 5b and Supplementary Figure S11), compatible with its Triassic to early Jurassic age (e.g., Catalano et al., 2001; Speranza et* *al., 2012) and consistent with other publications (e.g., Watts and Zhong, 2000; Tesauro et al., 2012; Cloetingh et al., 2015).*

Authors: We have corrected the sentence to take into account this point (and correct, then, our statement in lines 249-250, see below).

L259-260 - New L249-L250: … potentially related to tilted blocks of thinned continental crust formed during the Permo-Triassic/Early Jurassic rifting phase (see section 1) …

#####

L350 - *… with a sediment density (ρ) of 2800 kg/m2 (profile 2D) according to Dellong et al. (2020),*

RC2-10: A density of 2800 kg/m3 is used for the sediments, with reference to Dellong et al 2020, which, however, attribute this density to the Ionian oceanic crust.

New: L341 - … *with a sediment density (ρ) of 2500-2800 kg/m^2 (profile 2D) using Dellong et al. (2020),*

Authors: In Dellong et al. (2020), the authors attribute a density of 2.8 to the oceanic crust (Figure 8d), which is rather low (the average density of the oceanic crust is generally closer to 3.0, e.g., Carlson and Raskin, 1984). In the same figure, for the layer just above, which certainly includes the southern termination of the Calabrian backstop, the authors used an average density of ~2.9. Since our CD profile mainly cuts the Calabrian accretionary wedge, we agree that we have slightly overestimated its mean density by using 2.8. We, therefore, also calculated the CAP load using an end-member density of 2.5 (see new figure 5), which resulted in a variation in flexure amplitude of a few percent, thus not affecting our conclusions.

#####

L538 - *Faccenna, 2005*

RC2-11: Faccenna et al. 2005 instead of Faccenna 2005

New: L540-L541 – *(Trua et al., 2003; Civello and Margheriti, 2004; Faccenna, et al., 2005; Scarfì et al., 2018)*

Authors: Done

#####

L581-585 - *However, we obtained this result considering that the Hyblean crust/lithosphere, the continent-ocean transition (COT), and the Ionian crust/lithosphere have similar mechanical properties.*

RC2-12: Similar mechanical properties are assumed from the Hyblean continental to the Ionian oceanic lithosphere: how is this compatible with the occurrence of the Alfeo lithospheric fault crossing the AB profile?

New: L603-L608 - *However, we obtained this result considering that the Hyblean crust/lithosphere, the Continent-Ocean Transition (COT), and the Ionian crust/lithosphere have similar mechanical properties.* The Alfeo-Etna fault system, in particular, was considered not mature enough offshore SE Sicily to alter significantly the mechanical properties of the above-mentioned crustal/lithospheric blocks (*Gambino et al., 2022a*).

Authors: In our opinion, the Alfeo-Etna fault is an incipient lithospheric fault, as demonstrated by its relation with Mt. Etna volcanism that mostly developed in the last 200 ka. Consequently, we have considered that it has not yet altered the mechanical properties of the two juxtaposed blocks. About this, see the below mentioned paper:

Gambino, S.; Barreca, G.; Bruno, V.; De Guidi, G.; Ferlito, C.; Gross, F.; Mattia, M.; Scarfì, L.; Monaco, C. Transtension at the Northern Termination of the Alfeo–Etna Fault System (Western Ionian Sea, Italy): Seismotectonic Implications and Relation with Mt. Etna Volcanism. Geosciences 2022, 12, 128. https://doi.org/10.3390/geosciences12030128
We've added a new sentence, with the above reference, to address this point.

#####

L631-633 - *Figure 9: 1970-1991 leveling profile from Spampinato et al. (2013) performed along the Siracusa-Augusta coastal domain. a) Morpho-structural map of the Augusta-Siracusa region showing fluvial incision networks and morphological scarps. The location of leveling benchmarks with their reference numbers and potential tectonic fault/fold scarps. c) 1970-1991 leveling profile showing a first velocity step (~4 mm/yr) between benchmark 107 and 113, and a second one (~2 mm/yr), between benchmark 119 and 120 (potential fault zone locations appear in the background in red).*

RC2-13: the N-S topographic step is not obvious and should be indicated in the figure. It is suggested (lines 647-650) that the step could be the expression of a creeping fault, although the Onshore fault, used for modelling the InSAR velocities, is located farther eastward. Moreover, GPS velocities at the northern border of the Hyblean Plateau suggest a contractional regime (Mastrolembo Ventura et al., 2014) which could be responsible for the relative uplift recorded by the geodetic transect. The point in this section is not clear, and the authors should explain it further.

New: L657-L658 - *Figure 9: a) 3D view of a shaded DEM of 2 m resolution from S.I.T.R. regione Siciliana (2013) showing the morphology of the NE part of the Hyblean Plateau. b) Morphological map of the Augusta-Siracusa region showing fluvial incision networks and morphological scarps. The location of leveling benchmarks appears in yellow circles. c) Simplified morpho-structural map highlighting the location of potential tectonic fault/fold scarps in red, and the know fault in thick red dashed line with cross-section (Supplementary Figure S15). d) 19070-1991 leveling profile (Spampinato et al., 2013) showing a first* *velocity step (~4 mm/yr) between benchmark 107 and 113, and a second one (~2 mm/yr), between benchmark 119 and 120 (potential fault zone locations appear in the background in red).*

Authors: We have significantly improved Figure 9 to take account of the reviewer's comments and suggestions (see the section of our reply dedicated to figure corrections). Concerning GNSS data, Mastrolembo Ventura et al. (2014) suggested 2.4 mm/yr of N160 shortening followed immediately by 2.5 mm/yr of N160 extension. This is based on limited GPS data and was not well constrained. An alternative interpretation is no detectable deformation rates within the uncertainty and dispersion of the geodetic data. In any case, these data say nothing of the E-W deformation gradient. Ventura et al. (2014) block model only puts ~1 mm/yr of strike-slip on the Malta Escarpment.

#####

L661 - *(2) the aseismic activity on the Augusta-Siracusa fault and offshore fault bordering the eastern coast of the Hyblean Plateau*

RC2-14: perhaps "Augusta-Syracusa fault and onshore fault" instead of "Augusta-Syracusa fault and offshore fault »

New: L677-L680 - *(2) the aseismic activity of the Augusta-Siracusa system, potentially extending onshore an inferred tectonic structures, explaining the short-wavelength deformation signal affecting the Augusta/Siracusa region (Figure 10).*

Authors: Corrected. This is a previously identified spelling error that survived our last review of the submitted manuscript.

#####

RC2-15a: Interseismic loading and aseismic creep. This section is highly speculative and is penalized by many assumptions and lack of constraints. The faults addressed by Viger et al are shown in Fig 2 and consist of the Malta Escarpment and the Turbidite Valley faults, both located offshore. Whereas the latter corresponds to the fault mapped by Argnani and Bonazzi 2005 and subsequently by Gambino et al 2021, the Malta Escarpment fault has not been documented. It was drawn by Gutscher et al from a morpho-bathymetry, marking the base of a scarp; however, on seismic profiles this scarp appears just a morphological feature passively onlapped by sedimentary strata (Argnani and Bonazzi 2005 and Gambino et al., 2021). The Augusta-Syracusa Fault and the Onshore Fault are also poorly constrained, and seem too short to account for the short-wavelength subsidence anomaly observed in the entire eastern Hyblean plateau. Summing up, out of the four fault systems considered by the authors only the easternmost one seems properly documented (Argnani and Bonazzi 2005). This undermines the use of the Augusta-Syracusa and Onshore faults in the interseismic elastic modelling of Fig. 7.

Authors: The seismic profiles across the main slope of the M.E. are very rough and not penetrating because of the steep sloping of the escarpment. We chose to test the Malta

Escarpment because it is closest to the eastern coast of H.P and could be active with a long inter-seismic period. Moreover, evidence of active faults in the Augusta bay are documented by still unpublished sparker lines acquired in the area (*G. Barreca, C. Monaco, personal communication*). We have clarified these points L487-491.

#####

RC2-15b: Fault modelling has been carried out without constraints on fault geometry, particularly for the two faults that can explain the short-wavelength surface deformation, i.e., the Onshore and the Augusta-Syracusa Faults. The fault parameters have been chosen ad hoc in order to fit the data, but the lack of geological constraints on the faults, and even on the occurrence on these faults, undermines this part of the modelling.

Authors: We propose the same response as for RC1 to a similar comment -> The fault plane geometries tested (strike, dip) are based on published field-trip observations and measurements *(e.g., Gambino et al., 2021)*. Fault locations are based on published geological/structural maps (*e.g., Adam et al., 2000)*, and also on the presence of sharp gradients in the PS-InSar velocity pattern. The imposed fault slip-velocities results from a trial-and-error empirical approach. The objective, essentially, is to evaluate if aseismic slip on known, and unknown faults, could generate sufficient surface deformation to explain the measured surface deformation pattern. We have added these statements L462-L468.

#####

RC2-16: Alternative hypotheses. The authors explore three hypotheses that could account for the InSAR observation. However, two of them are not realistic: in the Hyblean region published modelling of mantle flow upwelling shows no effects, and no recent volcanic activity has been reported. The hydrologic loading could possible contribute to the subsidence, but the authors reject this hypothesis saying that the data required to test it are out of the scope of the paper..... which means hypothesis not tested. Considering that the pattern of InSAR-derived subsidence is fairly consistent over the entire Hyblean Plateau, the effect of glacial isostatic adjustment (GIA) should perhaps be taken into account. The modelling of the GIA in the Mediterranean region predicts some subsidence in the Hyblean region (Spada and Melini 2022); the order of magnitude of the subsidence rate is comparable to the subsidence observed by InSAR.

Authors: Concerning the effect of GIA: Spada and Melini (2022) deal with changes in sea level due to GIA. They use Peltier most recent GIA model (ICE-6G_C VM5a) to estimate present-day deformation rates. This model predicts a regional subsidence rate of 0.4-0.5 mm/yr, with a gradient across southern Sicily of about 0.1 mm/yr. This GIA effect is about an order of magnitude smaller than the differential vertical rate observed with InSAR (1-3 mm/yr). We therefore consider that there is no need to take the GIA into account.

Concerning hydrologic effects: Hydrology loading / unloading cycles can have a significant impact on vertical deformation observed by geodesy, up to a few 10s of mm on an annual cycle (cf. review in White et al., 2022). The effects of hydrology variation on pluri-annual trends are more difficult to assess. Here we consider velocities over 5 yrs from InSAR and GNSS. The regional subsidence rate of 1-3 mm/yr and associated east-side-down tilt would require an increase of the water level by ~10-20 cm over 5 years at the scale of the southeastern Sicily reservoir. This seems incompatible with the absence of similar effect over Central and Western Sicily, and with the drought periods that have affected Sicily in recent decades. We have added these details to the text (L571-L579), and also modified the Anzidei et al. (2021) reference to cite the article in Remote Sensing journal:

Anzidei, M.; Scicchitano, G.; Scardino, G.; Bignami, C.; Tolomei, C.; Vecchio, A.; Serpelloni, E.; De Santis, V.; Monaco, C.; Milella, M.; et al., 2021. Relative Sea-Level Rise Scenario for 2100 along the Coast of South Eastern Sicily (Italy) by InSAR Data, Satellite Images and High-Resolution Topography. Remote Sensing, 13, 1108. https://doi.org/10.3390/rs13061108

#####

RC2-17a: Combined long-term tectonics and seismic cycle model. InSAR data show that the eastern Hyblean Plateau is undergoing subsidence, though with variable rates; the pattern describes an overall, long-wavelength eastward increase of subsidence with a slower subsidence near the coast, with a shorter wavelength. The two signals coexist in what the authors consider an interseismic period. The lithospheric flexure, caused mainly by slab pull, can explain, according to the authors the eastward increasing subsidence, whereas the short wavelength relative uplift is considered as due to two creeping faults located onshore. However, Late Quaternary marine terraces testify an overall slow uplift of the Hyblean Plateau and this is explained as produced during the coseismic-postseismic period, when the offshore faults (more likely the only one which is documented as active) rupture. However, Meschis et al have shown that the footwall uplift of the offshore fault is much less of what required to account for the uplift of marine terraces; this invalidates the logic of the seismic cycle proposed by the authors.

Authors: Meschis et al. have used simple Okada type elastic modeling to estimate the amount of co-seismic coastal surface uplift associated with a major earthquake Mw=7. If this approach provides interesting metrics, it does not quantify, in particular, the post-seismic deformation. In such context, normal faulting, long-wavelength post-seismic deformation is often measured. In addition, the seismic cycle contains other earthquakes contributing to surface deformation than a single M=7 event. We have added this details in the text L695-L702.

#####

RC2-17b: The possible causes of additional uplift proposed by the authors are extremely speculative. Even more doubtful is their connection with earthquakes in the coseismic period. The effect of a lithospheric tear decoupling the Ionian from the Hyblean lithosphere would likely be to switch off the slab pull, and the resulting subsidence. The onshore creeping faults are considered as extrados faults, though the extremely bland arching shown in the cross section without vertical exaggeration (Fig 4b) is not really supporting this interpretation.

Authors: In the paper Meschis et al., we modeled the fault assuming different parameters («The model shows a simulated earthquake of Mw7.05, produced if the entire length of the Western Fault (50 km) is ruptured with a slip at depth of 5.5 m, with a dip angle of 70°. (b) Assuming a recurrence interval of 500 yr,….»). This is only one of the possible models. The modeling was performed just for a final discussion of new data reported in the paper that allowed a more precise dating of the terraces with respect to the paper Bianca et al., 1999. Moreover, we stated that «…the footwall uplift rate is <0.1 mm/yr, which does not explain the total uplift rate implied by our determinations based on the elevations of Late Quaternary palaeo-shorelines. The discrepancy between uplift rates produced by footwall uplift and the total measured uplift rate is indicated (double-headed black arrow), and this may reveal the magnitudes of uplift rate produced by other processes.». So, we did not exclude the rôle of the offshore fault as responsible of the cumulative uplift, but we affirmed the possibility of the co-existence of a regional process. However, the sources of uplift proposed by Meschis et al. for the long-term deformation doesn't appear compatible with the very short-term satellite geodetic measurements.

FIGURES corrections

RC2-18: The figure 1 is taken, with only minor changes, from Henriquet et al 2020. It is fine to cite the source of the focal mechanisms and GNSS data, but the rest of the geological citations could be avoided. These citations repeat the caption of Henriquet et al where the figure covered a larger area and are not really relevant for the present study. For instance, the study area of Lymer et al does not overlap the map in Fig 1. The map of Corti et al was not original but was taken from Tricart et al 1994. Chamote-Rooke et al. is only relevant to the part east of 18°E, and Rabaude and Chamote-Rooke is just an extended abstract focussed on the Algerian margin and, only marginally, on the northern Sicily margin.

L63-69 (now L70-71) Figure 1: Geodynamic and tectonic map of Central Mediterranean (modified from Henriquet et al., 2020). Geological and structural data were synthetized from previous publications (e.g., Funiciello et al., 1981; Bigi et al., 1991; APAT, 2005; Finetti et al., 2005; Lentini and Carbone, 2014; Prada et al., 2014). ~~Structural data were synthetized from previous publications (e.g., Finetti et al., 2005; Chamot-Rooke et al., 2005; Corti et al., 2006; Prada et al., 2014; Lymer et al., 2018; Rabaute and Chamot-Rooke, 2019~~). Present-day Centroid Moment Tensors (Mw > 4.5) and GNSS data were retrieved from https://www.globalcmt.org/CMTsearch.html and https://www.unavco.org/data/gps-gnss/gpsgnss.html websites, respectively.

Authors: Corrected. We have modified the figure caption accordingly.

#####

RC2-19: In Fig 2, the panels (a) and (b) are not mentioned in the caption.

L117-127 (now L122-123) Figure 2: Geodetic data across the Hyblean Plateau region (see location in Figure 3). a) ~~The~~ Permanent-Scatterer (PS-InSAR 2015-2020) pseudo-3D Up velocities in map view from Henriquet et al. (2022) ~~and are measured during the 2015-2020 period~~. GNSS 3D surface velocities are derived from a reanalysis of the Nevada Geodetic Laboratory (NGL) data (Horizontal components reference: fixed Nubia; Up components reference: ITRF2014). Major faults of the Hyblean Plateau and Malta Escarpment (M.E) including the offshore normal faults identified by Argnani and Bonazzi (2005), ~~Gutscher et al. (2016)~~ and recently analyzed by Gambino et al. (2021) (red: active fault; red dashed: inferred active fault; black: inferred aseismic slip from Spampinato et al., 2013)~~)~~. b) SW-NE trending velocity profile showing surface velocity (Up) derived from PS-InSAR and GNSS stations vertical velocities. PS-InSAR data are stacked across a 5 km width on both sides of the AB profile (in blue). GNSS data are stacked using 20 km (in black) and 40 km (in gray) widths on both sides of the AB profile. Topographic and bathymetric profiles are presented without vertical exaggeration (V.E.x1).

Authors: Corrected. We have also added the Argnani and Bonazzi 2005 reference.

#####

RC2-21: In Fig 5d, perhaps in panel (d) it should be dashed lines Te = 27 km and continuous lines Te = 30 km.

Authors: Done

#####

RC2-22: In Fig 9, It could be useful to show on the shaded relief map the marine terraces mentioned in the text. In panel (b) the potential fault/fold scarps (thin, dashed black line?) should be better indicated.

Authors: We have reworked this figure to better highlight potential morphological evidences of active deformation west of Augusta (see the new version of Figure 9 here after). We have also modified the figure caption accordingly and added a new figure (S15), in the supplementary material section, showing the marine terraces mentioned in the text.

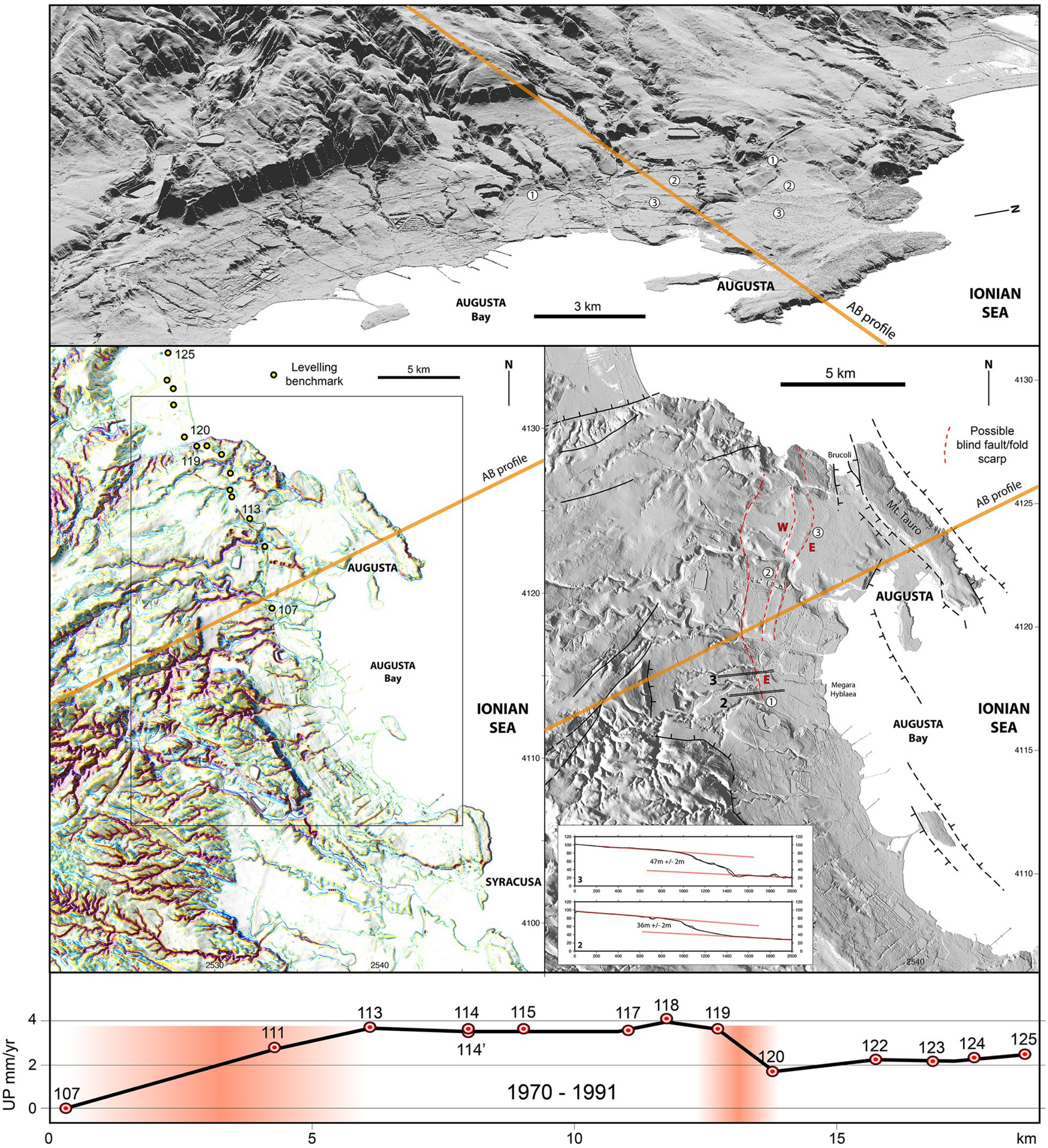


Figure 9: a) 3D view of a shaded DEM of 2 m resolution from S.I.T.R. regione Siciliana (2013) showing the morphology of the NE part of the Hyblean Plateau b) Morphological map of the Augusta-Siracusa region showing fluvial incision networks and morphological scarps. The location of leveling benchmarks appears in yellow circles. c) Simplified morpho-structural map highlighting the location of potential tectonic fault/fold scarps in red, and the know fault in tick red dashed line with cross-sections (Supplementary Figure S15). d) 1970-1991 leveling profile (Spampinato et al., 2013) showing a first velocity step (~4 mm/yr) between benchmark 107 and 113, and a second one (~2 mm/yr), between benchmark 119 and 120 (potential fault zone locations appear in the background in red).

#####

FIGURE 4 Specific Corrections (see the new version of Figure 4 here after)

RC2-23: The crustal-scale cross section has many critical points that deserve some attention.

Authors: We agree, find hereafter the new version of our synthetic crustal-scale cross section together with our answers to reviewer's questions and comments.

#####

RC2-20: In Fig 4, the map in panel (c) and the text (lower right) are too small to read. The map needs to be enlarged, whereas a larger version of panels (a) and (b), with the legend of the horizons, should go in the supplementary materials .

Authors: Done. We have also moved the legends of the horizons and wells to a supplementary figure (S09). We removed the Cavallaro et al., 2017 reference, and added Lipparani et al. (2023), and Lentini and Carbone (2014).

#####

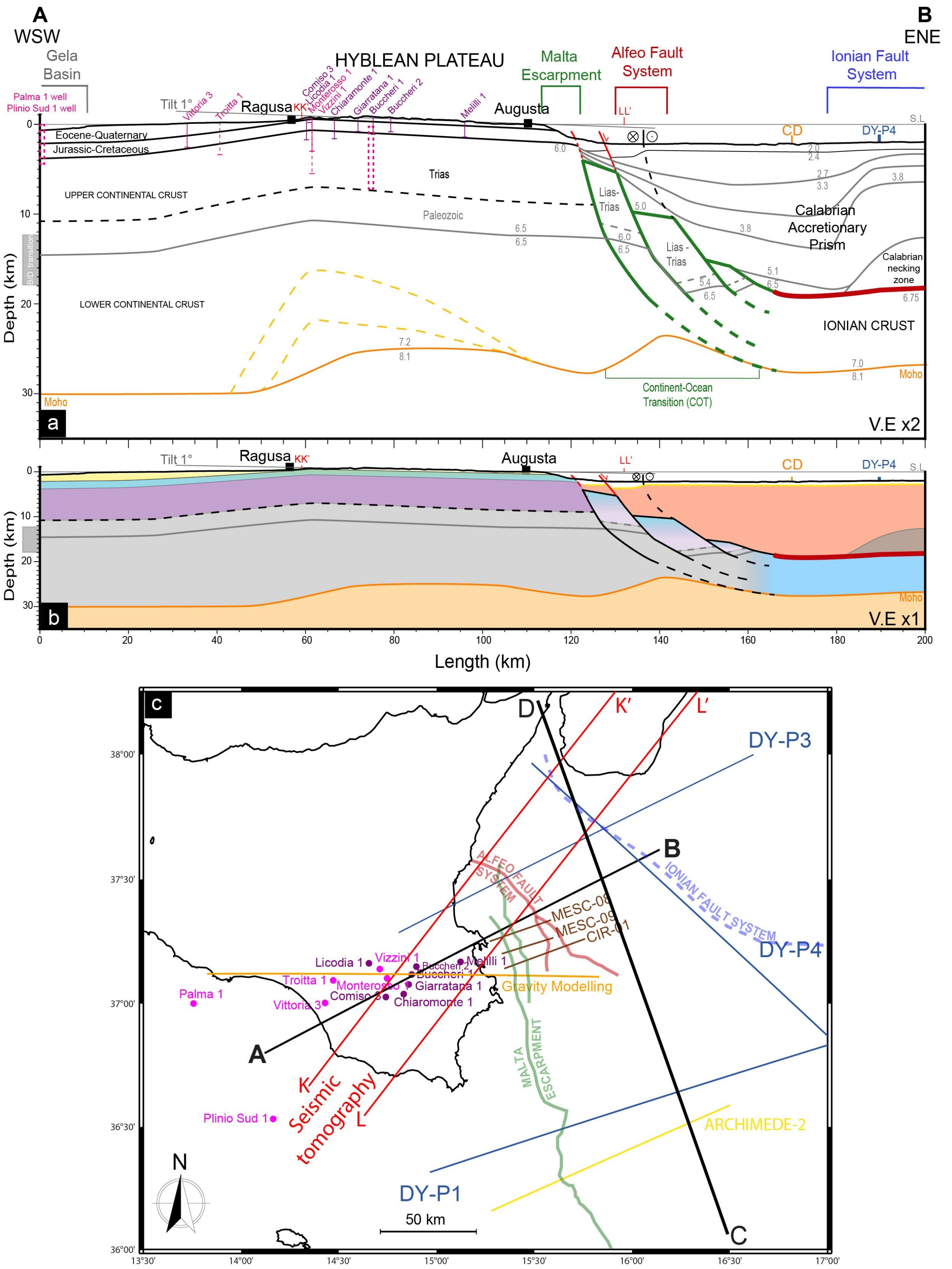
RC2-24: i) The choice of using the well Palma1 does not make much sense: the well is ca. 40 km away from the cross section, whereas other wells, much closer, are available in the VIDEPI repository, like Plinio Sud1. By the way, Palma1 reaches the Triassic, unlike what is represented in Fig. 4.

Authors: In addressing this point, we came across a recent publication by Lipparani et al. (Nov.2023) synthesizing all available data on wells across the Hyblean Plateau. We used the result of this study to correct the geometry of the H.P. Meso-Cenozoic sedimentary cover.

#####

RC2-25a: ii) The refraction profile DY-P3 is located at the northern end of the Malta Escarpment. The authors have arbitrarily drawn similar velocity contours on their crustal cross section (Fig. 4), which is located ca. 20 km farther south. It should be noted that in doing so the the values at the crossing with DY-P4 have not been respected. The uncontrolled isovelocity contours have then been used to draw two extensional faults that reach the base of the crust. In the authors interpretation these two faults are intended to correspond to the Malta Escarpment fault and the "Turbiditic Valley" fault. But the line of reasoning is too speculative and has no supporting evidence.

Authors: Refraction data are only available along 3, significantly spaced, crossing profiles, and it is, then, challenging to propose a 3D velocity structure across our AB profile. Fortunately, the DY-P3 is trending parallel to the AB profile, at close distance. We interpolated its velocity structure taking into account the southward evolution of the main velocity interfaces between the DY-P3 and DY-P1 profiles.


A
WSW
Gela
Basin
HYBLEAN PLATEAU
Malta
Escarpment
Alfeo Fault
System
B
ENE
Ionian Fault
System
Palma 1 well
Plinio Sud 1 well
Tilt 1°
Vittoria 3
Troitta 1
Ragusa
KK'
Comiso 3
Licodia 1
Monterosso 1
Vizzini 1
Chiaramonte 1
Giarratana 1
Buccheri 1
Buccheri 2
Melilli 1
Augusta
LL'
CD
DY-P4
S.L
Eocene-Quaternary
Jurassic-Cretaceous
Trias
UPPER CONTINENTAL CRUST
Paleozoic
Lias-
Trias
Lias -
Trias
Calabrian
Accretionary
Prism
Calabrian
necking
zone
LOWER CONTINENTAL CRUST
IONIAN CRUST
B/D transition
Depth (km)
Continent-Ocean
Transition (COT)
Moho
a
V.E x2
b
V.E x1
Length (km)
c
D
K'
L'
DY-P3
B
ALFEO FAULT
SYSTEM
IONIAN FAULT SYSTEM
MESC-08
MESC-09
CIR-01
DY-P4
Licodia 1
Vizzini 1
Buccheri 2
Melilli 1
Buccheri 1
Troitta 1
Monterosso
Giarratana 1
Gravity Modelling
Palma 1
Comiso 3
Vittoria 3
Chiaramonte 1
A
K
Seismic
tomography
L
MALTA
ESCARPMENT
Plinio Sud 1
ARCHIMEDE-2
N
DY-P1
50 km
C
38°00'
37°30'
37°00'
36°30'
36°00'
13°30'
14°00'
14°30'
15°00'
15°30'
16°00'
16°30'
17°00'

RC2-25b: The uncontrolled isovelocity contours have then been used to draw two extensional faults that reach the base of the crust. In the authors interpretation these two faults are intended to correspond to the Malta Escarpment fault and the "Turbiditic Valley" fault. But the line of reasoning is too speculative and has no supporting evidence.

Authors : We believe that our interpretation of tilted blocks at the Continent-Ocean Transition is in line with similar considerations done by authors analyzing seismic refraction/reflexion profiles (e.g. Afilhado et al., 2015; Sapin et al., 2021; Klingelhoefer et al., 2022). We have added a new sentence with these references to better justify our point of view in L251-254.

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RC2-26: iii) Inconsistent match with Dellong profile DY-P4: in profile AB the thickness of the CAP (interval 4.9 to 5.1 km/s) is by far too thick at the crossing. It should be noted that Dellong et al 2020 (G3-Rep), in their reply to Argnani 2020 (G3), interpret the unit bounded by the isovelocities 4.9-5.1 km/s as non-sedimentary, and belonging to the Calabrian basement. However, in the profile in panel (b) the subduction decollement is located between the lower and upper crust, and the CAP is indicated above the upper crust; this creates some ambiguity: is the subduction decollement different from the base of the CAP? And if so, where is the base of the CAP? Dellong et al 2020 (G3-rep) (Fig 1) mark the lower and upper oceanic crust, however, at the crossing with profile AB part of the upper-plate crust should be present as well. The authors should better describe the interpretation of the structural relationships in this sector of the profile.

Authors: Velocities of ~5 km/s can be attributed to deformed sediment of the CAP. When looking at the DY-P4 profile, such velocities can be observed over most of the profile length, especially, in its southward half where the Calabrian basement is surely absent and where the profile is only crossing, then, the sedimentary CAP. Indicating « Upper crust » and « Lower crust » in the eastern end of the AB profile in panel (b) was clearly a mistake. Only « Oceanic crust » should be indicated below the thick blue line corresponding to the main décollement/plate interface. We have corrected the synthetic cross-section accordingly. As we have slightly moved eastward our CD profile, in response to reviewer RC1 suggestion, we have also reconsidered the relations with the DY-P4 profile.

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RC2-27: iv) The crossing with the Ionian Fault (IF) is marked on the profile, but its position cannot be right: according to Dellong et al. 2020a the IF is located east of profile DY-P4, likely outside the AB cross section. In some literature the Alfeo Fault System has no expression on the cross section, although it is considered a lithospheric fault. None of these two fault systems are mentioned in the text. A mechanical connection between the Hyblean and Ionian lithosphere is inferred. Perhaps the authors should comment on how this assumption fits with the occurrence of the Alfeo lithospheric fault?

Authors: The Ionian Fault and Alfeo Fault systems are still debated features. The lithospheric nature of the later generates divergent opinions among the scientific community, and it's a point that we prefer not to address in the present manuscript (see our previous reply on this subject). We have made some corrections to our drawing in the AB cross-section.

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RC2-28: v) The Triassic units are represented as ca. 8 km thick and the lower crust is indicated as Palaeozoic. Is there any evidence for these attributions? These details, which are not relevant to the adopted modelling, should be omitted, nulles they are based on some evidence.

Authors: We agree that it was not necessary or even relevant to assign an age to the lower part of the profile's continental crust. We have corrected this error and removed this indication.

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RC2-29: vi) A up to 10 km-thick succession of Jurassic-Cretaceous and Eocene-Quaternary is represented in the cross section (130-170 km). These units are connected to the Mesozoic units of the Hyblean Plateau and are overlying the CAP. These relationships do not make much sense: the CAP originated in Cenozoic time so it cannot be covered by Jurassic-Cretaceous sediments. Note that Dellong et al 2020rep consider this lower velocity domain as a "basin" filled by "accretionary wedge sediments". Though I do not agree with their definition of basin, the evidence from seismic reflection profiles (Argnani and Bonazzi 2005) supports the presence of an accretionary prism, as in Argnani 2020 (G3). Also note that Triassic rocks have been dredged at the base of the Malta Escarpment (Scandone et al 1981), just to undermine the stratigraphic correlation between the Hyblean and the Ionian regions presented in the cross section of Fig 4.

Authors: Part of the inconsistencies affecting our synthetic cross-section (Figure 4) comes from confusion between the general age indications and seismic velocity contours. They are, of course, not directly correlated since marked velocity gradients could have various origins and indicated chronological/stratigraphic, rheological or tectonic boundaries. We have corrected this. We have also benefited a lot from a recently published article by Lipparini et al. (2023) to improve our drawing of the Meso-Cenozoic sedimentary cover across the Hyblean Plateau. We have also improved the Figure 8 of the article.

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RC2-30: Summing up, some of the domains drawn in the cross section, particularly on the Malta Escarpment-Ionian sector do not respect the existing data, whereas others are based on unproven or unlikely assumptions.

Authors: We agree with most of the reviewer's comments and have corrected the simplified structural cross-section (Figure 4) accordingly. Finally, we would like to stress that this cross-section is not intended to synthesize all available geological and geophysical data, which would go far beyond the scope of our study, but to constrain, to first order, the general geometries of the main rheological interfaces and tectonic structures useful for flexural modeling calculations.